epiphan video

Epiphan Pearl
Pearl Rackmount
Pearl Rackmount Twin

Release 4.12
June 30, 2020

UG100-36

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Gather as much information about your problem as you can before you contact us so we can help you better, including:

- A description of the problem
- Details about your video or audio source (type, connection, resolution, refresh rate, etc.)
- Product serial number
- Product firmware version (using the admin interface)
- Product LED lights

What's new in release 4.12?

In Firmware 4.12, we've future-proofed Pearl and added new streaming protocols to ensure Pearl stays on the leading edge of streaming technology advances well into the future. Other enhancements in this release include adding pre-existing recordings to an AFU queue and multiple multicast publisher support.

IMPORTANT NOTICE: Release 4.12 is Pearl's final firmware update. No future development is planned for Pearl after release 4.12.

Firmware 4.12

Secure Reliable Transport (SRT) streaming protocol

Get low-latency streaming to CDNs and other SRT enabled decoders across unreliable Internet connections using SRT. Pearl can also ingest an SRT stream as an input. Secure your streams with up to 256 bits AES encryption and enjoy easy firewall traversal with little to no IT involvement.

HTTP Live Streaming (HLS)

Pearl can push HLS streams over HTTP-based networks to CDNs. HLS is a highly reliable protocol that is bandwidth efficient and economical to deploy. For greater security, streaming over HTTPS and digest authentication using the MD5 hashing algorithm is supported.

MPEG-DASH

Pearl can push MPEG-DASH, or Dynamic Adaptive Streaming over HTTP, streams reliably and economically over HTTP-based networks to CDNs. MPEG-DASH is a highly reliable protocol that is bandwidth efficient and economical to deploy. For greater security, streaming over HTTPS and digest authentication using the MD5 hashing algorithm is supported.

HLS (pull)

We've updated how HLS (pull) is set up on Pearl using the Admin panel and added options to configure the segment size and playlist duration.

Multiple multicast publishers

You can now add mutliple multicast publishers in the same Pearl channel. You can also start and stop the publishers.

Add files to an AFU queue

Pre-existing recordings can now be added to an Automatic File Upload (AFU) queue.

Info page enhancements

We changed some of the status fields on the Admin Panel's Info page and changed the bitrate status, which now shows the total combined bitrate of the video plus audio. We also improved the streaming error messages in the Admin panel and on the touch screen.

Table of contents

Start here

Welcome, and thank you for buying Epiphan Pearl™, Pearl Rackmount™ or Pearl Rackmount Twin™. You'll find information on how to set up and use all three models in this user guide. When you see the name Pearl used in this guide, it means that the content applies to all three models. Differences are explicitly called out. For a product description, see What is Pearl?.

See the Quick start for basic steps to get a single video source (and optional audio) set up so you can stream and record some output right away. The rest of the guide shows you how to tweak the system exactly how you want it so you can take advantage of the many advanced features. The Integration section provides API information and administrative tasks related to third party integrations, including Kaltura and Panopto.

About this Guide

After the introductory section and quick start, the next chapter describes the main user interfaces that are used to operate and configure Pearl. You'll find everything that you need to use these interfaces and to successfully access Pearl locally as well as remotely:

- Touch screen
- Admin Panel
- Epiphan Live

The rest of the user guide covers setting up and operating your system for a successful video switching, recording, and live streaming experience. The chapters are organized in to these five categories: Setup, Capture, Stream, Record, Integration, and Maintenance.
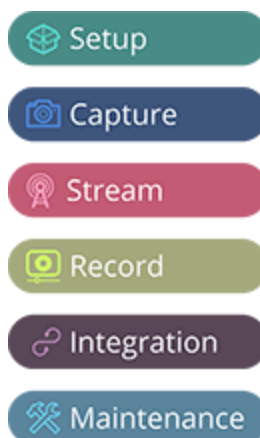
What is Pearl?

Pearl is a versatile live video production device that's a video encoder, video streamer, live switcher, and video recorder all in one. Pearl comes in three models.

Pearl	**Pearl Rackmount**	**Pearl Rackmount Twin**
A small, silent, portable system that comes with a hard-shell carry case.	A 2U rackmount system with all the same functionality as the portable Pearl, but designed for installation and operation in a rack.	A high density 2U rack mount variation that contains two complete (and independent) Pearl systems.

With Pearl, you can capture, record and stream computer monitors, radar displays, or anything with a wide variety of supported video input signals, including:

- SDI
- HDMI™
- VGA
- DVI-I (single link)
- USB
- SRT and RTSP

Capture audio via TRS, USB, SDI, HDMI, and network sources (SRT and RTSP).

Simultaneously capture four audio visual sources and choose how you want to record and stream them. Have separate ISOs or create custom layouts with multiple video sources for live switching. You can do all that using Pearl.

Stream to Content Distribution Networks (CDNs) using modern protocols SRT, HLS, and MPEG-DASH. At the same time, stream to other destinations using RTMP/RTMPS or RSTP.

Easily multistream directly to viewers on your LAN so they can watch the live channel broadcast using a web browser or media player on smart devices connected to the same private network as Pearl.
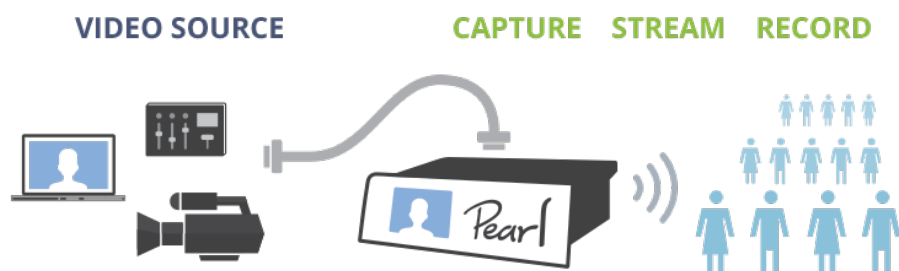
Recordings can be downloaded via FTP or set to automatically upload over FTP, RSYNC, or CIFS and can be integrated into your Content Management System (CMS). Pearl is also fully integrated with Kaltura and Panopto Content Management Systems (CMSs) and can be registered as a video remote recorder resource for seamless lecture capture plus user authentication directly from Pearl's touch screen.

Network security compliance with 802.1x protocols, passwords, and certificate authentication means an easier setup for IT friendly live streaming over enterprise networks. HTTPS enabled for secure administration and control over the LAN, and RTMPS support for secure, encrypted live streaming.

> Pearl does not capture from HDCP encrypted sources.

Front and back view Pearl

Table 1 Pearl front panel descriptions

Label	Name	Description
1	Touch screen front panel display	Used for confidence monitoring and simple configuration, obtaining system information, and starting/stopping recordings and streams. Users can also authenticate with one of the integrated Content Management Systems (CMSs) to create unscheduled ad hoc recordings and webcasts.
2	3.5 mm audio jack	For audio confidence monitoring. Plays the audio for the currently visible channel.
3	Power light	Glows when the system is powered on.
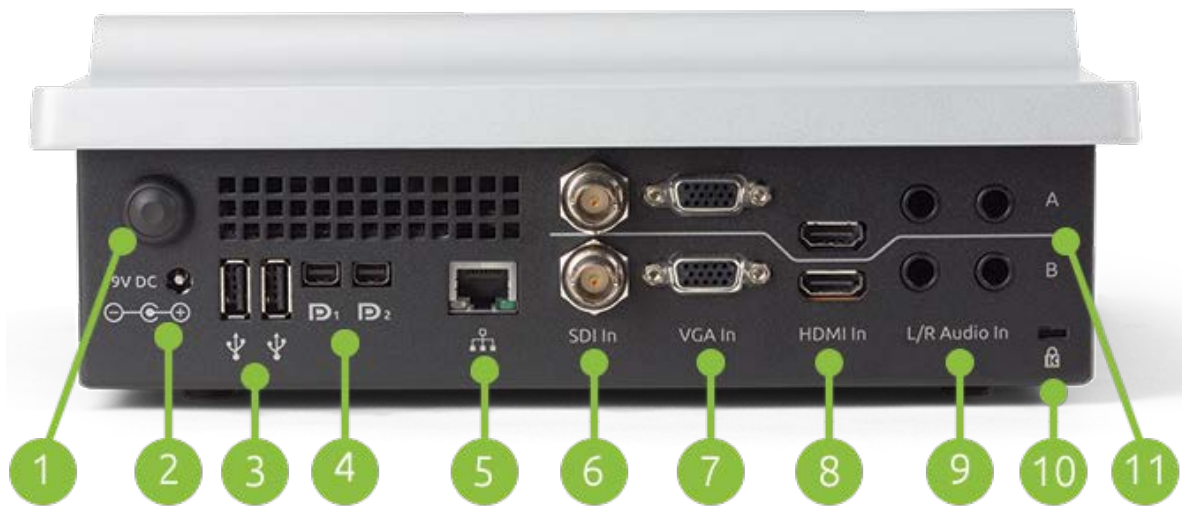
Table 2 *Pearl back panel descriptions*

Label	Name	Description
1	Power button	Press once to power on. Double-press to initiate a graceful system shutdown.
2	Power jack	Plug the power supply in here. The port requires a 19 V DC power source (center-positive). Always use the provided power supply.
3	USB 2.0 ports	For connection of external hard drives, flash drives, a single USB webcamera or USB microphone, or control interfaces, see AFU or copy to USB. Also used to connect a USB mouse or keyboard when the local console feature is enabled.
4	DisplayPort ports	Video output ports, see Video output ports.
5	RJ-45 Ethernet	Auto-sensing gigabit Ethernet 10/100/1000 Base-T network port. See Configure network settings for setup instructions.
6	SDI in	Connect up to 3G-SDI signals to Pearl.
7	VGA in	Connects VGA and other analog video signals to Pearl.
8	HDMI in	Connects HDMI and DVI signals to Pearl.

Label	Name	Description
9	L/R Audio In	The four ¼" TRS analog audio ports can function as two, professional line level left/right stereo pairs (TRS A pair and TRS B pair) or as four mono inputs. The TRS audio inputs are for use with professional line-level signals up to 0.707 V RMS, and are + 4.0 dBu up to 12.3 V (RMS), (+24 dBu) (balanced/unbalanced)
10	Lock	Allows Pearl to be locked to a desk or surface using a laptop lock cable.
11	Row A/Row B divider	Ports above the line belong to Row A and ports below the line belong to Row B.

Pearl Rackmount and Pearl Rackmount Twin

Pearl Rackmount Twin consists of two completely independent Pearl systems, each with identical sets of controls and ports.

Table 3 *Pearl Rackmount and Pearl Rackmount Twin front panel descriptions*

Label	Name	Description
1	Touch screen front panel display	Used for confidence monitoring and simple configuration, obtaining system information, and starting/stopping recordings and streams. User can also authenticate with one of the integrated Content Management Systems (CMSs) to create unscheduled ad hoc recordings and webcasts.
2	USB port	Two other USB ports are located on the back. See Record for information about recording to USB drives. Also used to connect a USB mouse or keyboard when the local console feature is enabled.
3	3.5 mm audio jack	For audio confidence monitoring. Plays the audio for the currently visible channel.
4	Power button and LED	Press once to power on. Double-press to initiate a graceful system shutdown.
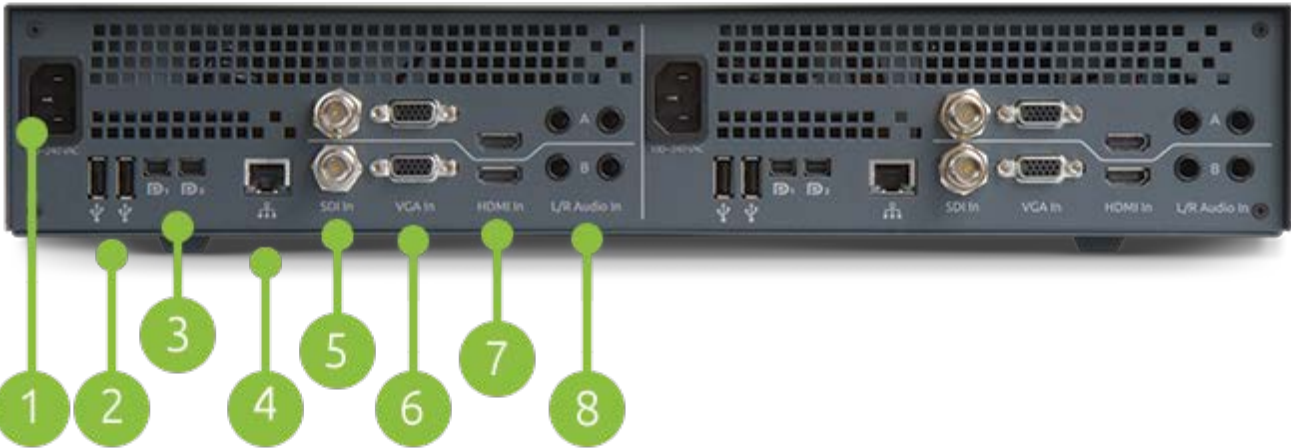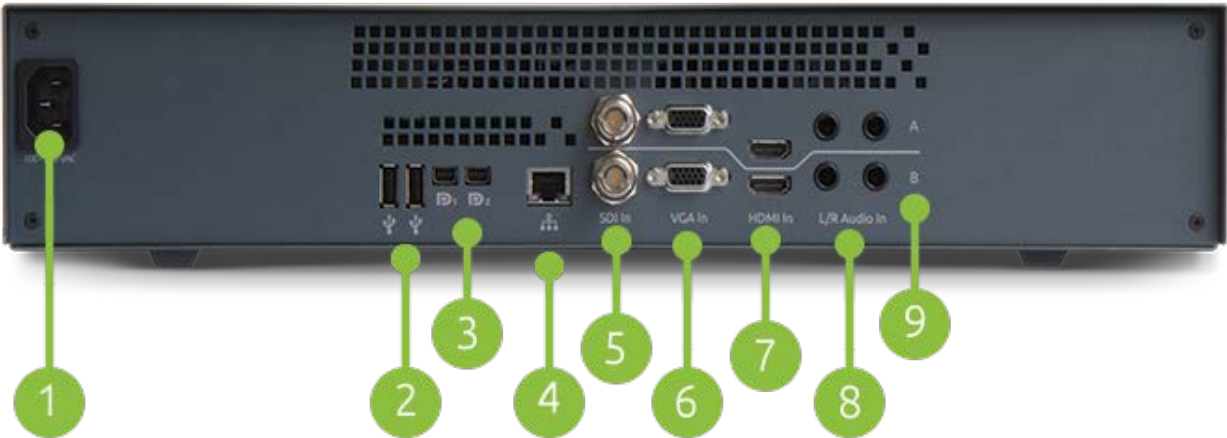
Pearl Rackmount Twin is comprised of two completely independent Pearl systems, each with identical sets of controls and ports.

Table 4 *Pearl Rackmount and Pearl Rackmount Twin back panel descriptions*

Label	Name	Description
1	Power jack	Plug the power supply in here. Always use the provided power supply.
2	USB 2.0 ports	For connection of external hard drives, flash drives, a single USB webcamera or USB microphone, or control interfaces. See AFU or

Label	Name	Description
		copy to USB for copying data to a USB drive. Also used to connect a USB mouse or keyboard when the local console feature is enabled.
3	DisplayPort ports	Video output ports. See Video output ports for more details.
4	RJ-45 Ethernet	Auto-sensing gigabit Ethernet 10/100/1000 Base-T network port. See Configure network settings for setup instructions.
5	SDI in	Connects up to 3G-SDI signals to Pearl.
6	VGA in	Connects VGA and other analog video signals to Pearl.
7	HDMI in	Connects HDMI and DVI signals to Pearl.
8	L/R Audio In	The four ¼" TRS analog audio ports can function as two, line level left/right stereo pairs (TRS A pair and TRS B pair) or as four mono inputs. The TRS audio inputs are for use with professional line-level signals up to 0.707 V RMS with the audio attenuator disengaged or 12.3 V RMS with the attenuator engaged.
9	Row A/B designators	Ports above the line belong to Row A and ports below the line belong to Row B.

What's in the Box?

Pearl

Pearl Rackmount

Pearl Rackmount Twin

The standalone portable Pearl model is shipped in a hard shell case that you can re-use for storing or moving Pearl between jobs. Cable storage is under the custom foam tray holding Pearl in the case.

Inside the box with your Pearl system, you'll find the power cable and the following items. Pearl Rackmount Twin comes with two sets of these cables:

1. One SDI cable (3 feet / 1 meter in length)

2. One HDMI cable (3 feet / 1 meter in length)

3. One VGA cable (3 feet / 1 meter in length)

4. One DVI (male) to HDMI (female) adapter

5. One Ethernet cable

6. Two analog audio attenuators (XLR to ¼" TRS) - included only with the portable Pearl model

7. One power supply cable (6 feet / 1.8 meters in lengths) and power supply brick with the standard Pearl model

Table 5 *Cables (power cable not shown)*

Image	Name	Description
	SDI cable	Connect SDI sources to the SDI ports (3G-SDI capable).
	HDMI cable	Connect HDMI or DVI (using adapter) sources to the HDMI ports.
	VGA cable	Connects VGA (or component if used with a converter) signals to Pearl.
	DVI (male) to HDMI (female) adapter	Connect DVI sources to the HDMI port.
	RJ-45 Ethernet cable	Connect Pearl-2 to your network.

Image	Name	Description
	XLR to TRS attenuator cables (portable Pearl model only)	Use the two cables to apply 25 dB of audio attenuation to your analog audio inputs (left and right) before connecting to the TRS ports on Pearl.

Quick start

This quick start uses the default settings where possible so you can quickly start using your Pearl. The instructions apply to all Pearl models; however, rackmount installation is not included here, see Rackmount installation.

> For the Pearl Rackmount Twin, you cannot plug a source into one system and use it from the other.

Before you begin, make sure you have:

- A video source such as a camera or a computer and cables to connect them to Pearl. For HDMI, the source must not be HDCP protected.

- An audio source coming from either your SDI , USB videoor HDMI video source (must not be encrypted). Optionally, audio from a different source, such as an audio mixer that you connect to the audio input ports can be used. For VGA sources, connect your audio source to the ¼" TRS ports.

- Local area network that uses Dynamic Host Configuration Protocol (DHCP) is preferable.

- Computer with a web browser connected to the same network. We'll call it the "admin" computer.

Starting up!

Pearl is pre-configured with two plug and play channels: Auto A and Auto B. Auto channels are used for this quick start. They have automatic video sensing, which detects the video signal you connect to the video input ports on Pearl.

The first video source you connect while Pearl is powered on is automatically assigned to the Auto channel (either Auto A or Auto B, depending in which row you connect the video source). For example, when you first start Pearl, the video sources you connect to the HDMI-A and HDMI-B input ports appear automatically in Auto A and Auto B channels (respectively). If no video source is connected, a standard No Signal screen displays.

With auto channels, audio from the connected SDI, HDMI, or USB video source is automatically applied to the channel without needing any additional configuration. For SDI or HDMI audio, make sure it's unencrypted.

The Auto channel's frame size is set to match the video source by default and the best bit rate for the default frame rate of 30 fps is applied automatically.

For details about Auto channels defaults, behavior, and audio source priorities, see About automatic channels Auto A and Auto B.

To get started quickly with auto channels:

1. Turn on your camera or video source and connect the output to one of the video input ports labeled "A" on the back panel of Pearl.

2. (Optional) Connect a second video source to one of the video input ports labeled "B".

3. (Optional) For VGA sources, connect your audio source to the ¼ TRS left/right stereo pair audio input ports on the same row as your VGA source (row A or row B) on the rear panel of Pearl.

4. Connect the Ethernet cable to Pearl and to your network.

5. Press the power button on the front panel to turn on the system. Wait for the power-up cycle to complete.

   The Grid view showing both channels appears on the touch screen. The video source you connected to the "A" row appears in the Auto A channel, and the video source connected to the "B" row appears in the Auto B channel.

6. Use the touch screen on Pearl for confidence monitoring. To display the single Channel view, simply tap on one of the channels that you see in the Grid view. From the Channel view, you can do things like stop and start recording for the channel.

7. (Optional) Plug headphones or speakers into the 3.5 mm stereo audio jack at the front of Pearl to monitor the audio.

My network IP address and channel monitoring

You can get the network IP address of your Pearl from the touch screen so that you can do things like view the channels using a web browser or access the configuration Admin panel. Just make sure that your admin computer is connected to the same network as Pearl.

1. To find the IP address using the touch screen, tap the **gear** icon in the bottom right corner of the screen and select **System Status**.

2. Using a browser on the admin computer, go to one of the following URLs to preview the channel.

> **For Auto A:** http://*<IP Address for Pearl>*/preview.cgi?channel=1
> **For Auto B:** http://*<IP Address for Pearl>*/preview.cgi?channel=2
>
> **For example:**http://192.1.10.100/preview.cgi?channel=2

3. (Optional) Open a new tab in your browser and enter the URL to login to the Admin panel.

> http://*<IP Address for Pearl>*/admin
>
> **For example:**http://192.1.10.100/admin

The default user name **admin** has no password set by default. If a password has been set, consult with your system administrator for the login credentials, see What is streaming?

Record the Channel

Once the channel is set up, it's simple to record the channel. You can do that using either the touch screen or the Admin panel.

To start and stop recording using the touch screen:

1. From the Grid view, tap the channel you want to record. The Channel view appears.

2. Tap the red dot to start recording. The record timer starts and continues for as long as the system is recording. Tap the red dot again to stop recording. If the control icons aren't visible, tap the screen once.

To control recording using the Admin panel:

1. From the Channels menu in the Admin panel, click **Recording** for your channel. The Recording page opens.

2. Click **Start** to start recording the channel and click **Stop** to stop recording.
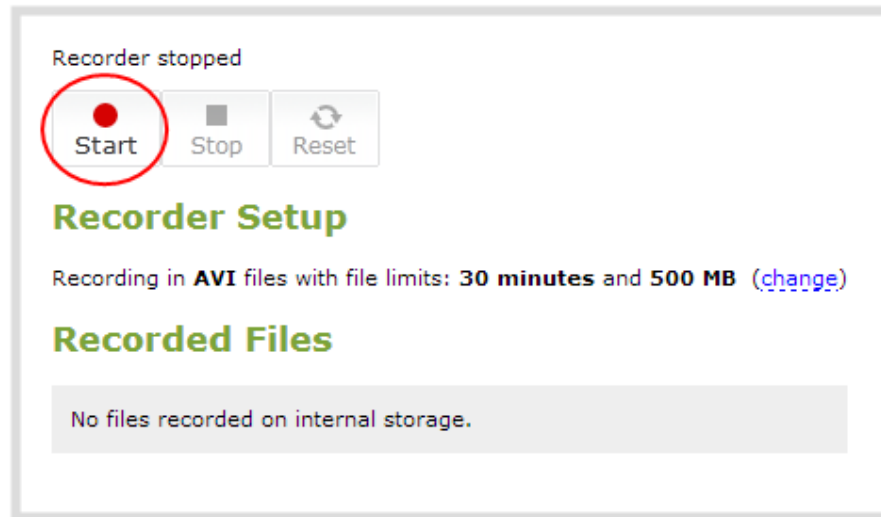
3. Refresh the page. Click **Recording** again in the Channels menu or reload the browser page. The page reloads and a file list appears that shows your newly recorded content.

4. Click the file name to download and view your recording.

What's Next?

Now that you have a source setup and are ready to stream, you can fine-tune the system to your exact requirements. Take a look at topics such as:

- What is a channel?
- Live video mixing / switching
- Custom layout configuration
- What is streaming?
- Selecting an audio source
- Video output ports
- FTP and automatic file transfers

> For higher security, we recommend setting admin, operator and viewer-level passwords on Pearl, see **Set or change user passwords**.

When you're done setting up your Pearl, make sure to back up the system configuration using the procedure described in Create a configuration preset.

Register Pearl to get firmware updates

Keep Pearl up-to-date and get all the latest features and firmware updates. Registering your Pearl is free and only needs to be done once. You can register anytime from the Firmware update page using the Admin panel, see Register your device

Live video mixing / switching

Create dynamic content for your viewers to watch while you record and stream your program using Pearl. Using the custom layout editor, you can create different layouts, like picture in picture or side-by-side views of a camera and slides, then easily switch between layouts with either a tap on the touch screen, using Epiphan Live on a mobile device, or from the Admin panel.

Your program stream with switched layouts could look like this:

To create a program channel with custom layouts using the custom layout editor that you can switch, see What is a channel?

For instructions on how to live switch, see:

- Switching / mixing using the touch screen
- Switching / mixing using Epiphan Live
- Switching / mixing using the Admin panel

Monitoring audio

Pearl's front panel includes a 3.5 mm audio jack for monitoring audio. You can plug external speakers or headphones into the 3.5 mm audio jack. To monitor the audio for a channel, just select the channel using the touch screen. The audio you hear depends on which layout is currently live because different layouts can have different audio sources configured.

Adjust the volume

Tap the headphones icon on the touch screen to adjust the volume. Each tap increases the volume by 25% to a maximum volume of 100%. Tapping the headphones icon when the volume is at 100% mutes the volume. You can also long press the headphones icon to mute and unmute the volume.

Volume is muted.	25% volume.	50% volume.	75% volume.	100% volume.

At 75% volume, what you hear corresponds to the nominal audio level in the VU meter at approximately where the green bars change to yellow. Increasing the volume to 100% may cause you to hear distortion that is not actually present in the audio signal being recorded and streamed.

Audio VU meter

A VU meter on the touch screen shows the audio levels for the selected channel. The value is displayed in dBFS (decibels relative to full scale). Colored bars represent the audio level.

Channels that have stereo audio display two bars. The top bar is the left audio channel and the bottom bar is the right audio channel.

VU meter (mono)	
VU meter (stereo)	

Table 6 *Audio VU meter levels*

Color	Decibel range
Red	0 to -9 dBFS
Yellow	-9 to -18 dBFS
Green	-18 dBFS and lower

The VU meter appears in several different places so you can visually check audio levels:

- **Touch screen**: On the individual channel view and the grid view. If the audio meter isn't showing, tap anywhere on the touch screen to turn on the control icons.

- **Admin Panel**: On the audio input source's configuration page when you select the input source from the Inputs menu. You can also add the VU meter to appear on the video output ports, see Disable or enable audio and output port volume.

- **Epiphan Live**: See Monitor video and audio input sources

Selecting an audio source

You can choose the audio source for a channel using the Admin panel and can have a mix of several different audio sources. Select your audio sources from connected video sources (SDI, HDMI, USB video UVC, SRT, and RTSP), as well as the ¼" TRS analog audio input ports. The USB (UVC/UAC) ports on the rear panel of Pearl will accept a USB microphone (UAC).

Dedicated analog audio inputs ports are:

- Four ¼" TRS professional line-level inputs + 4.0 dBu up to 12.3 V RMS, (+24 dBu) support balanced and unbalanced signals.

- Two USB video/audio ports

- Two HDMI ports

- Two SDI ports

- Two VGA ports

The four ¼" TRS audio input ports are configured as two stereo pairs by default: TRS A (left/right) and TRS B (left/right), see Configure audio ports for stereo or mono.

This table offers some guidelines for adjusting the gain of the ¼" TRS and RCA analog audio input ports, as well as the USB ports. Add the suggested gain to the audio input to get an average signal to register at a nominal level in the VU meter (i.e. where the green bars change to yellow). The actual amount of gain needed depends on the strength of the original audio signal. See Adjust audio gain and delay for details.

Table 7 *Audio input port gain guidelines*

Audio source	Input port	Gain
Mobile phone or other consumer line level device	TRS	Add +6 to +12 dB gain to the audio input port.
Professional mixer	TRS	Nominal
USB microphone	USB	Nominal

> Pearl also comes with two XLR to TRS audio attenuator cables, which provide 25 dB of attenuation to the input audio signal before the audio input ports on Pearl.

To choose a different audio device for the channel:

1. Using a web browser on the admin computer, go to the IP address of your Pearl and log in, see Connect to Admin panel.

2. From the Channels menu, select your channel (i.e. Auto A or Auto B) and click **Layouts**. The custom channel layout editor page opens.

> Audio for Auto channels are selected automatically.

3. Check the audio source that you want to use for the layout and click **Save**.

Audio sources:

Audio inputs
- 🎤 Analog-A Audio
- 🎤 Analog-B Audio
- 🎤 HDMI-A Audio
- 🎤 HDMI-B Audio
- 🎤 SDI-A Audio
- 🎤 SDI-B Audio
- 🎤 USB-A
- 🎤 USB-B
- ☑ 🎤 Auto A
- 🎤 Auto B

Channels
- 🖥 Auto B

4. (Optional) Adjust the gain for an audio input source, select the input port from the Inputs menu and adjust the amount of gain on the configuration page for the audio input port. Click **Save** when you're done. For more details, see Adjust audio gain and delay.

Specifications

Topics include:

- AV inputs

- Tech specs

- Optimum CPU performance

- International character support

AV inputs

For best performance, we recommend using a maximum of four 1920×1080@30 fps video input sources used in up to six full HD channels simultaneously. Up to three of those video sources can be from SRT sources, or up to two can be from RTSP sources.

Pearl supports the use of common signal converters and input adapters. Only content that is not HDCP-protected is captured from HDMI and USB video sources.

> Pearl Rackmount Twin has two complete sets of these inputs.

Table 8 *Pearl input ports*

Input port	Qty	Details
SDI[1]	2	Linear PCM audio/video input. Supports up to 3G-SDI signals.
HDMI™	2	Linear PCM audio/video input accepts non-HDCP protected content. DVI-I (using an adapter) is single link.
USB 2.0	2	Linear PCM audio/video input accepts non-HDCP protected content. Use to connect only a single UAC device (i.e. USB microphone) or UVC device (i.e. web camera). Can also connect to external hard drives, flash drives, and control interfaces.
VGA (HD-15)	2	Connect VGA and other analog video signals.
RJ-45[2]	1	Up to three SRT sources over Ethernet at 1920×1080@30 fps.
		Up to two RTSP sources over Ethernet at 1920×1080@30 fps.
¼" TRS	4	The ¼" TRS inputs accept balanced and unbalanced, pro line level signals (+4.0 dBu) up to to 12.3 V$_{RMS}$, +24 dBu.

Input port	Qty	Details
		By default, the four ¼" TRS ports operate as two stereo left/right audio pairs (TRS A pair and TRS B pair). You can configure the ports to operate as independent mono inputs using the Admin panel, see Configure audio ports for stereo or mono.

[1] SD-SDI audio is not supported.

[2] A mix of video over Ethernet sources are supported. Just ensure that total system loading is within acceptable levels, see Optimum CPU performance.

> If you are using DVI2PCIe cards with your Pearl, DVI2PCIe cards do not support audio over HDMI.

Tech specs

The input and output connectors are listed for Pearl and Pearl Rackmount. Pearl Rackmount Twin is made up of two completely independent Pearl systems, therefore it has double the number of inputs and outputs that are listed in this table.

Table 9 *Specifications for Pearl*

Video Inputs	Connectors	(2) SDI (2) HDMI™ / DVI[1] (2) VGA (1) USB video[2]
	Resolutions	VESA modes: 640×480 to 2048×2048 (or 2650×1600); Custom HDMI/VGA/DVI/SDI/USB modes up to 1920×1200
	HD Video Format Options	3G-SDI; HD-SDI; SD-SDI; DVI single link; HDMI; USB video R, G, B plus separate HSync and VSync signals; R, G, B plus CSYNC signal; R, G, B with Sync-on-Green synchronization
	Video over Ethernet[3]	RTSP[4] SRT (push)[5]

Audio Input	Connectors	(4) ¼" TRS commercial line level (or 2 stereo pairs left/right) accept balanced or unbalanced analog signals (2) SDI audio[6] (2) HDMI audio (1) USB audio (a single UAC or UVC device only)[2]
	Analog audio sensitivity	Max signal (without attenuator pad): 0.707 V *RMS* (-1 dBu)
		Max signal (with -25 dB pad): 12.3 V *RMS* (+24 dBu)
Video Output	Connectors	(2) DisplayPort (software selectable content) with audio for local video display or larger confidence monitoring (1) RJ-45 (female)
	Streaming protocols	MPEG-TS and FLV
		RTSP over TCP/UDP
		SRT (push) over UDP
		HLS (push) over HTTP/HTTPS
		MPEG-DASH (push) over HTTP/HTTPS
		Multi-publish to streaming server / CDN (SRT, RTSP, RTMP, RTMPS)
		HLS (pull) - Native Apple HTTP/HTTPS stream for iPad, iPhone and iPod Touch
	Multicast Streams	RTP/UDP, MPEG-TS & RTP and MPEG-TS over UDP
	Network traffic shaping (multicast streams)	4 Mbps to 95 Mbps (configurable)
Audio Output	3.5 mm audio	Front-mounted jack for confidence monitoring
Built-in Display	Front touch screen display for live switching, confidence monitoring, quick configuration, system information, recording control and streaming control	

Video Encoding	Video Codecs	H.264, Motion JPEG		
	Video Bit Rates	100 - 9,999 kbit/sec		
	Key Frame Intervals	Programmable		
	Color Resolution	4:2:0		
	Output Frame Size	Configurable up to 3840x2160		
	Frame Rates (per output stream)	60 fps at 1920×1080 capturing and streaming 2 sources simultaneously 30 fps at 1920×1080 capturing and streaming 4 sources simultaneously		
Audio Encoding	Audio Codecs	Encoder	Bitrate	Sample Frequencies
		MP3	64-192 kbps	22 kHz, 44 kHz, 48 kHz
		PCM	-	22 kHz, 44 kHz, 48 kHz
		AAC	64-192 kbps	16 kHz, 22 kHz, 44 kHz, 48 kHz
IP Network Interfaces	Connector	10/100/1000 Ethernet RJ45		
	Network Discovery / Announce	UPnP, SAP		
	Network security	802.1x EAP methods: PEAP, EAP-TLS, EAP-TTLS		
Video / Audio Recording and File Management	Internal Storage[7]	Portable model: 1 TB HDD Rackmount models: 512 GB SSD		
		Automatically removes oldest recordings from internal storage as space is required.		
		File maintenance through admin interface (Web UI)		
	Local USB 2.0	Automatic or manual copy to local USB drives via the (2) USB 2.0 ports		
	Network Storage	FTP server and FTP client capabilities (automatic and manual)		

	Playback and Recorded Formats	Download recorded videos (AVI, MOV, MP4 or MPEG-TS) using the Web UI and playback through any compatible player.
Administration	Web UI for full administration. On-screen display and mobile UI for confidence monitoring and simple administration and control.	
	Local Admin panel access using a USB mouse, keyboard, and monitor connected directly to Pearl with built-in virtual keyboard and touch-screen monitor support.	
	Multiple user accounts/passwords.	
	HTTPS for secure Admin panel and Epiphan Live access, as well as local network access to the live channel broadcast.	
	Included API for integration into existing environments (executed via HTTP/HTTPS or RS-232). RS-232 API integration requires a USB to RS-232 adapter (not included).	
Integrations	Content Management Systems	Kaltura Panopto
	Cloud-based video production	AV Studio
Time Synchronization	NTP, TIME (RFC 868), PTP v1 (IEEE-1588-2002 V1)	
Product Dimensions	Pearl: 10⅝" × 3¼" × 7⅜" (270mm x 82mm x 187mm) Pearl Rackmount: 19⅝" × 3½" × 10⅝" (498 mm × 89 mm × 270 mm) Pearl Rackmount Twin: 19⅝" × 3½" × 10⅝" (498 mm × 89 mm × 270 mm)	
Product Weight	Pearl: 3.4 lbs (1.54 kg) Pearl Rackmount: 12.1 lbs (5.5 kg) Pearl Rackmount Twin: 14.6 lbs (6.6 kg)	
Country of Origin	Made in North America (Canada)	

[1] Using HDMI port with the supplied adapter
[2]The USB 2.0 ports support connection of a single UVC or UAC device only.
[3]A mix of video over Ethernet sources are supported. Just ensure that total system loading is within acceptable levels, see Optimum CPU performance.
[4]Up to two RTSP sources over Ethernet at 1920×1080@30 fps.
[5]Up to three SRT sources over Ethernet at 1920×1080@30 fps.
[6]SD-SDI audio is not supported.

[7]A portion of the hard drive space (approximately 100 MB) is reserved for system use. Recording space can be virtually unlimited with offload to networked storage.

Optimum CPU performance

Pearl, Pearl Rackmount and Pearl Rackmount Twin are powerful live video production systems; however, there's a limit to the number of concurrent tasks the onboard CPU can perform efficiently.

The number of concurrent tasks depends on many factors, like: how many channels you have, how many layouts you have per channel, how often you switch layouts, is the system resizing (scaling) video sources, what frame rate and bitrate is used per channel, are the video output ports used, etc. Keep in mind that connecting a live monitor to the HDMI output port consumes about the equivalent of an encoded 1920×1080@30 fps channel.

For best results, we recommend keeping Pearl's CPU usage under 70%.

You can check the **Overall system load** from the **Info** page using the Admin panel.

To check the CPU usage from the touch screen, tap the gear icon and select **System Status**.

If the system load is higher than recommended, you can:

- Disable the video output port (if unused).
- Remove unused channels or layouts.
- Reduce the number of channels created.
- Ensure video sources come in at the right resolution so that Pearl doesn't have to up scale or down scale the video source.

International character support

You can include certain international characters in channel names, layout names, video and audio input names, text overlays, and in the name of recorded files. Common character sets for the following languages are approved:

- **Western European/Nordic languages**: Danish, Dutch, English, French, German, Icelandic, Italian, Norwegian, Portuguese, Spanish, and Swedish.
- **Central/Eastern European languages**: Bosnian, Croatian, Czech, Hungarian, Polish, Romanian, Slovak, and Russian.

Important considerations

- Use only alphanumeric and diacritic characters in metadata descriptions. The whole metadata string is refused if any special currency or mathematical symbol appears in the description. You must remove the offending characters before Pearl will accept the description, see Add or remove channel metadata.
- Do not include any special currency, mathematical symbols, and other special characters such as slashes or spaces in the channel name. Pearl replaces special characters with an underscore.

User interfaces and remote access

Pearl has three user interfaces:

- **Touch screen**: Easily accessible on the front panel of Pearl, the touch screen is primarily used for confidence monitoring, live switching, and one-touch recording and streaming control, see About the touch screen. For instructions to use the touch screen to start/stop scheduled events or to authenticate with a Content Management System (CMS) and create unscheduled ad hoc recordings and webcasts, see CMS event controls using the touch screen.

- **Admin Panel**: A web-based user interface that's primarily used to perform system set up and administrative tasks for your Pearl. You can access the Admin Panel using an internet browser on a computer or tablet that's connected to the same local Ethernet network as your Pearl, or locally using a USB mouse, keyboard, and monitor connected directly to Pearl. See About the Admin panel.

- **Epiphan Live**: A web-based user interface that's primarily used for confidence monitoring, statistics, live switching, and recording control, see Epiphan Live.

You can remotely login and access your Pearl using cloud versions of the Admin panel and Epiphan Live. Start and stop recording, perform rescue troubleshooting and more over the Internet when you use the cloud versions. All you need is a free AV Studio account to start remotely accessing your Pearl right away. To learn how, see Access cloud versions of the Admin panel and Epiphan Live.

Remotely controlling recording on your Pearl directly in AV Studio is also possible. You can even set the encoding settings for a channel on Pearl Pearl using AV Studio. When you upload recordings to AV Studio, you can use the AV Studio Scene Editor to do low-touch editing and post processing for quick, cloud delivery of your video assets, see Using AV Studio to control Pearl.

The touch screen

Use the touch screen to switch layouts, start and stop recording and streaming, configure network settings, load configuration presets, and to view configured channels, audio meters, and system information.

Topics include:

- About the touch screen
- Record a channel using the touch screen
- Stream a channel using the touch screen
- Switching / mixing using the touch screen
- One Touch streaming and recording control
- CMS event controls using the touch screen
- Configure the touch screen

To view system information using the touch screen, see View system information using the touch screen

To select the video source for the output port using the touch screen when local console is enabled, see Select the video output source using the touch screen.

About the touch screen

Pearl's front panel includes a touch screen display that's used for confidence monitoring, basic configuration, one-touch streaming and recording control, as well as to start/stop scheduled events and authenticate with a Content Management System (CMS) to create unscheduled ad hoc recordings and webcasts.

> **STOP** The touch screen is capacitive. Use your finger or a specially designed soft-tipped capacitive stylus with firm but gentle pressure. Pressing too hard or using something other than a fingertip or capacitive stylus can result in damage to the screen.

When you power on Pearl, a grid view appears. The grid view displays all channels that are configured for your system. If you haven't created any channels yet, the grid view shows only the two default auto channels: Auto-A and Auto-B.

In this example, the grid view shows two video sources, which are plugged into video input ports A and B on Pearl and are displayed in auto channels Auto-A and Auto-B, respectively.
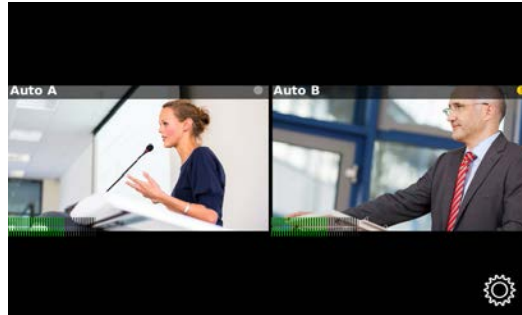
> If no video sources are connected, or your sources aren't sending a signal, the grid view shows no signal images. See **About automatic channels Auto A and Auto B** for more details about auto channels.

Tap a channel on the grid view to select it and go to that channel's view. You can tap the grid icon to return to the grid view. Tap the **gear** icon at any time to go to system settings.

Grid icon

A No Channels screen appears if there are no channels configured on your Pearl and the automatic channels **Auto A** and **Auto B** have been deleted. Tap anywhere on this screen to go to the system settings screen.
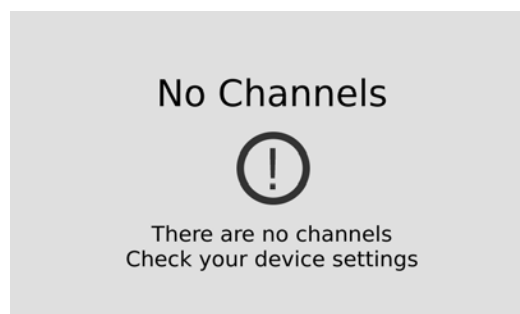
By default, the touch screen and all features except viewing the CMS Events screen are enabled. You can disable the touch screen and define which features are enabled on the touch screen. If the touch screen is

configured to not show channel previews, tap anywhere on the screen to go to the system settings screen. See Configure the touch screen for details. To see the CMS Events screen and icon, see .
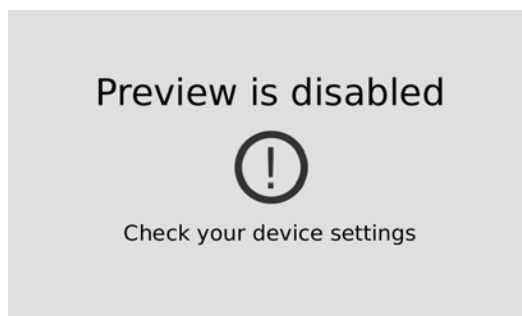
The Channel view

Each channel you configure on Pearl can be monitored and controlled using the touch screen. After you power on Pearl and the grid view opens, you can select a channel and open the channel view. Just tap the channel you want in the grid view and the channel view opens.

Table 10 *Parts of the touch screen for the individual channel view*

Item	Description
1	Channel name.
2	Streaming status. Gray means streaming is stopped, flashing blue means streaming is in progress.

Item	Description
3	The streaming timer shows the length of time that streaming has been in progress.
4	Recording status. Bright red and flashing means recording is in progress.
5	The recording timer shows the length of time that recording has been in progress.
6 and 7	Controls to switch between channels. Tap the arrow to view the next (or previous) channel. The arrow icons fade when the touch screen is idle (i.e. untouched) for several seconds. Tap the touch screen and the icons reappear.
8	Audio VU meter uses quasi-peak ballistics with samples averaged every 10 ms. The maximum average audio level in each 100 ms period is displayed using colored bars. • RED = 0 to -9 dBFS • Yellow = -9 to -18 dBFS • Green = -18 dBFS and lower
9	Audio monitoring volume control icon. Tap to change volume level. See Monitoring audio for more information.
10	Live Switcher view icon. Tap to view the live switcher, which lets you live switch between different custom layouts that are configured for the channel.
11	CMS Events screen icon. Tap to view the status of scheduled Kaltura or Panopto CMS events or to authenticate with your CMS and create an unscheduled ad hoc event, see Create ad hoc events using the Admin panel.
12	Grid view icon. Tap to view all the configured channels in a grid.
13	Single touch streaming and recording control icon. See One Touch streaming and recording control
14	System settings icon. See View system information using the touch screen.

Record a channel using the touch screen

Use Pearl's touch screen to easily start and stop recording of a channel. Simply tap the recording control button that appears in the channel view.

> If the red Record icon doesn't appear in the top right corner of the screen, recording is disabled. See **Disable or enable recording, streaming and switching from the touch screen** to enable recording.

To start and stop recording a channel using the touch screen:

1. From the grid view, select the channel you want to record. The channel view opens. If necessary, tap the screen once to display the controls.

2. Tap the red Record icon at the top right of the screen to start recording. The red dot flashes and the record timer increments when recording is in progress.
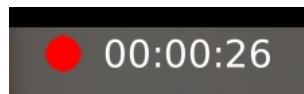
3. Tap the red Record icon again to stop recording. The dot stops flashing and the record timer resets to 00:00:00.

Pearl also features **One Touch**, which lets you control recording and streaming of multiple channels and recorders at the same time with the touch of a button. See **One Touch streaming and recording control** for more information.

Stream a channel using the touch screen

Use Pearl's touch screen to easily start and stop streaming a channel. Simply tap the streaming control button that appears in the channel view.

> If the gray (or blue) Stream icon doesn't appear in the top left corner of the screen, streaming is disabled. See **Disable or enable recording, streaming and switching from the touch screen** to enable streaming.

To start and stop streaming a channel using the touch screen:

1. From the grid view, select the channel you want to record. The channel view opens. If necessary, tap the screen once to display the controls.

2. Tap the gray Stream icon at the top left of the screen to start streaming. The Stream icon turns blue and the timer increments when streaming is in progress.
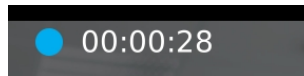
3. Tap the Stream icon again to stop streaming. The dot turns gray and the timer resets to 00:00:00.

> If an error occurs when you start streaming, a yellow circle with an exclamation mark appears in the left top corner of the touch screen. Check your networking and streaming settings.

Pearl also features **One Touch**, which lets you control recording and streaming of multiple channels and recorders at the same time with the touch of a button. See **One Touch streaming and recording control** for more information.

Switching / mixing using the touch screen

Switching live video inputs, or video mixing, is simple and intuitive using Pearl's touch screen.

After you select the channel you want to live switch, tap the Live Switcher icon along the bottom of the touch screen to open the live switcher. All custom layouts that are configured for the channel display in the carousel. Simply tap a layout to load it in to the standby panel and you're ready to start live switching.

> Performing live switching using one interface, like the touch screen, does not dynamically update the visuals in the other interfaces (e.g. the Admin panel and Epiphan Live). The other interfaces must be manually refreshed to accurately reflect the current live switching layout information.

If the live switching controls don't appear on the touch screen, they may have been disabled, see Disable or enable recording, streaming and switching from the touch screen.

To switch custom layouts for a channel using the touch screen:

1. Tap the Live Switcher icon to open the live switcher view for the channel. If the control icons aren't showing, tap anywhere on the touch screen.
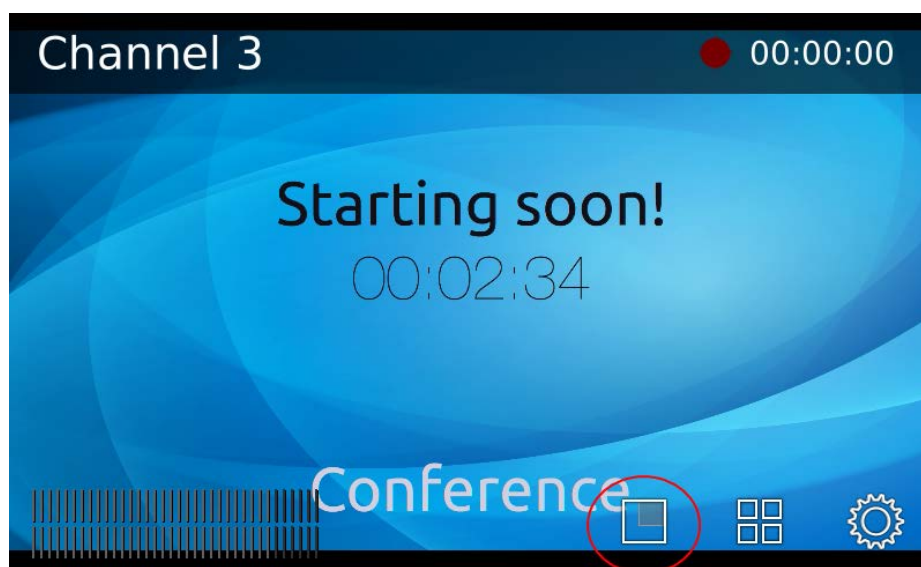
2. The Live Switcher view opens.
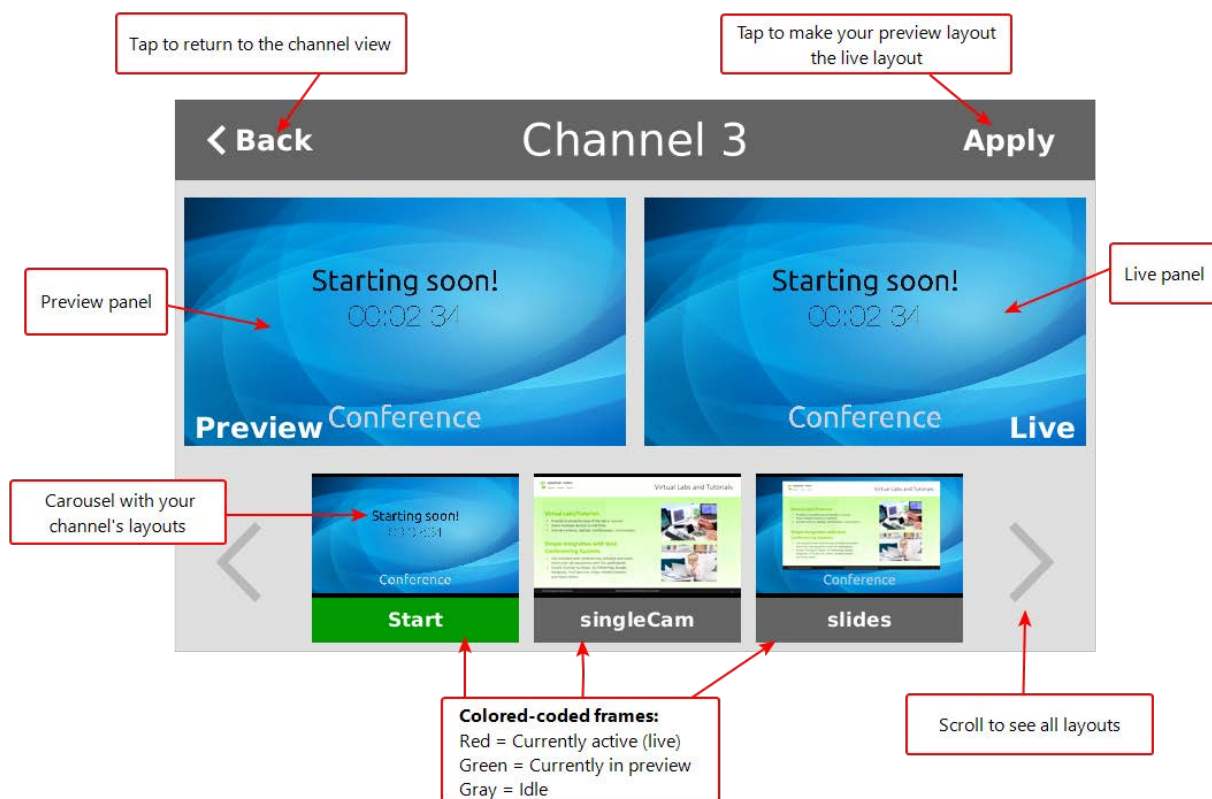
3. Tap any layout that appears in the carousel to load it in to the Preview panel.

4. Tap **Apply** or double tap inside the Preview panel to switch that layout to the Live panel. The layout that was in the Live panel moves to the Preview panel so that it's ready for the next time you switch.

5. To load a different layout into the Preview panel, tap another layout in the carousel.

6. Tap **Back** to exit the Live Switcher view.

One Touch streaming and recording control

You can easily control streaming and recording from the touch screen on Pearl with the press of a single button.

Topics include:

- About One Touch streaming and recording

- Specify channels and recorders for One Touch recording

- Specify channels for One Touch streaming

- Customize the One Touch control display

About One Touch streaming and recording

The One Touch feature lets you control the recording and streaming of multiple channels and recorders with the touch of a single button on the touch screen of Pearl. You simply specify which channels and recorders to include for One Touch control using the Admin panel.

To open the One Touch control screen from the touch screen on Pearl, simply tap the **One Touch control** icon.

Table 11 One Touch control screen components

Label	Description
1	**Start/stop button**: Press the One Touch control button to start or stop streaming and recording for all specified channels and recorders.
2	The number of recorders and/or channels that are actively recording (the first number) over the total number of channels that are configured for One Touch recording (the second number).
3	The number of channels that are actively streaming (the first number) over the total number of channels that are configured for One Touch streaming (the second number).

When you press the start button to activate One Touch recording and streaming, a blue **Stop** button appears, the Recording values update to show the number of channels and recorders that are actively recording, and the Streaming values update to show the number of channels that are actively streaming.
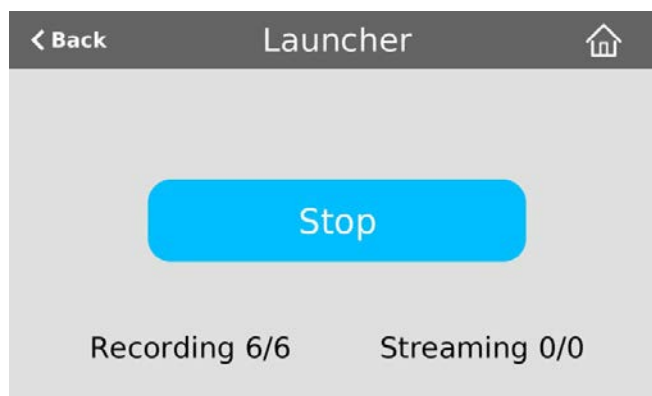
In the example above, One Touch control has been activated and all six out of the six total channels and/or recorders are recording successfully. There is no streaming activity because there are no channels configured for One Touch streaming.

An error icon displays if there's a problem with the streaming and/or recording settings for one or more of the channels and recorders. All other channels and recorders that are working correctly continue to stream and record normally.
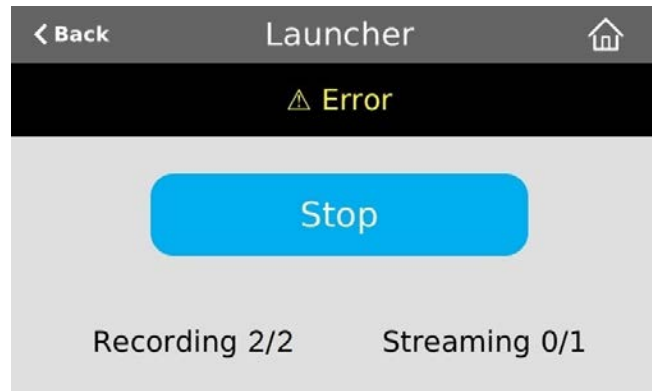
In this example, after pressing **Start**, both recorders/channels are recording properly but the one channel configured for streaming is not streaming correctly.

To troubleshoot, investigate each channel's streaming configuration page using the Admin panel and identify which channel isn't streaming. Then correct any streaming configuration errors.

See Specify channels for One Touch streaming and Specify channels and recorders for One Touch recording for more information about configuring channels and recorders for One Touch control.

Customize the One Touch control display

You can use the Admin panel to customize how One Touch Control is displayed on the touch screen of Pearl:

- **Default**: The One Touch control screen is accessed by tapping the **One Touch control icon** at the bottom of the touch screen.

- **Start Screen**: The One Touch control screen displays automatically on the touch screen when you power on Pearl. Operators can still navigate to other screens from the One Touch control screen.

- **Locked**: The One Touch control screen is the only screen that displays on the touch screen of Pearl. Operators cannot navigate to other screens from the One Touch control screen.

To configure how the One Touch control screen displays on the touch screen:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, click **Touch Screen**. The Touch screen configuration page opens.
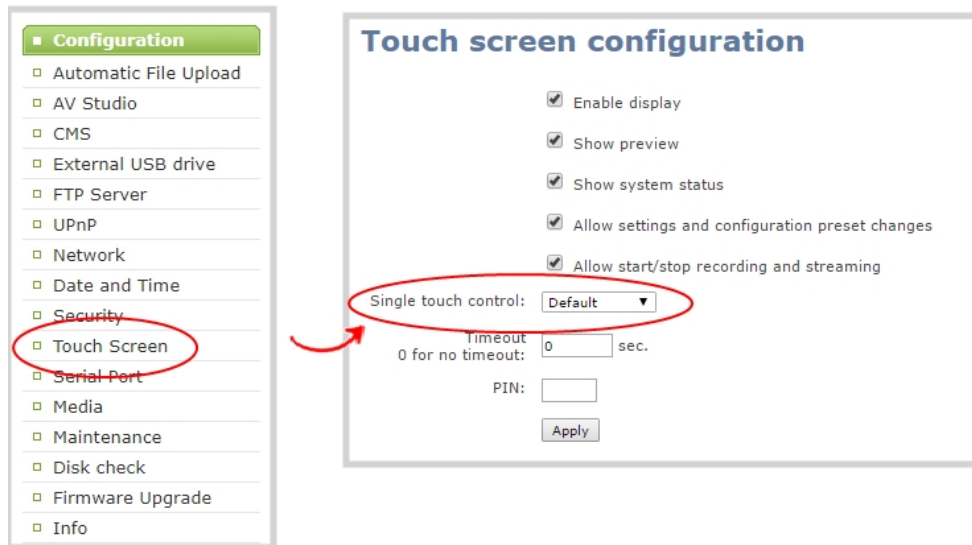
3. Click **Single touch control** and select either **Default**, **Start Screen** or **Locked**.

4. Click **Apply**.

> If you chose **Start Screen** or **Locked**, the touch screen automatically refreshes to display the One Touch control screen.

Specify channels and recorders for One Touch recording

All channels and recorders are enabled for One Touch recording by default. You can enable and disable One Touch recording control for individual channels and recorders using the Admin panel.

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. To enable or disable **Single touch control** for a channel.

    a. From the Channels menu, select the channel you want and click **Recording**. The Recording page opens.
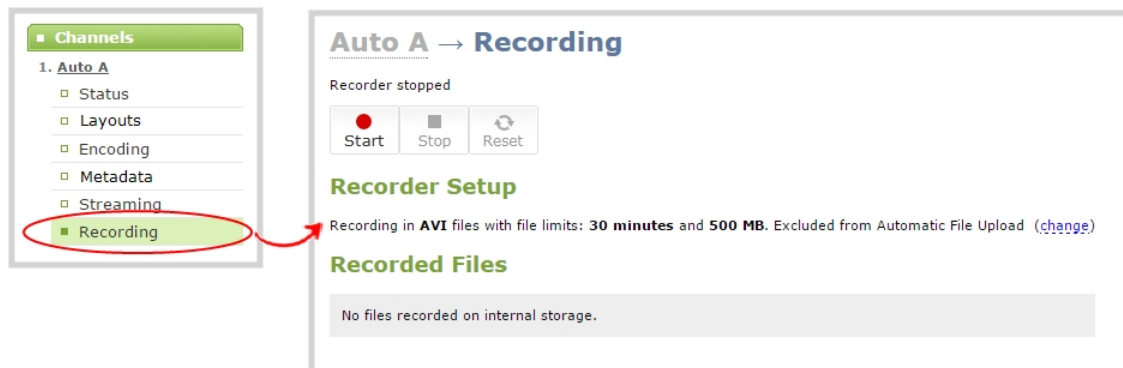
b. Click **change**, and then check **Single touch control** on the options page to enable the channel
    for One Touch control. Uncheck the check box if you don't want to include that channel for One
    Touch control.
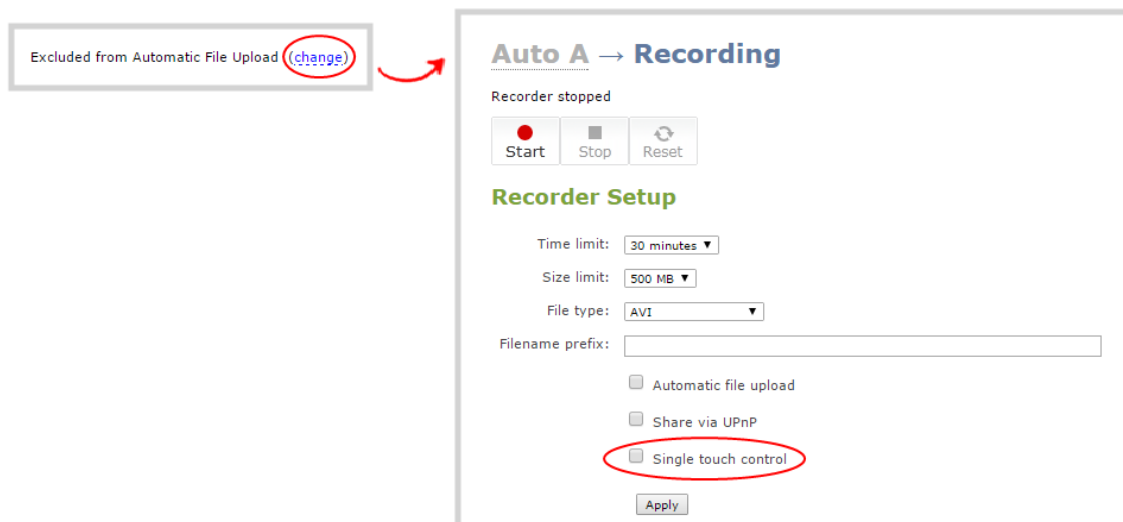
c. Click **Apply**.

3. To enable or disable **Single touch control** for a recorder.

a. From the Recorders menu, select the recorder you want. The Recorder Setup page opens.
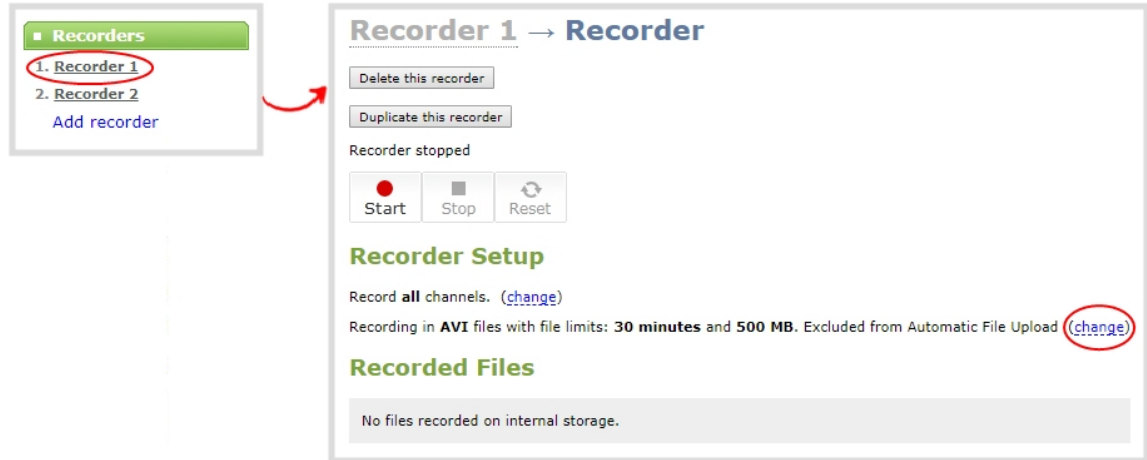
b. Click **change**, and then check **Single touch control** on the options page to enable the recorder for One Touch control. Uncheck **Single touch control** if you don't want to include that recorder for One Touch control.
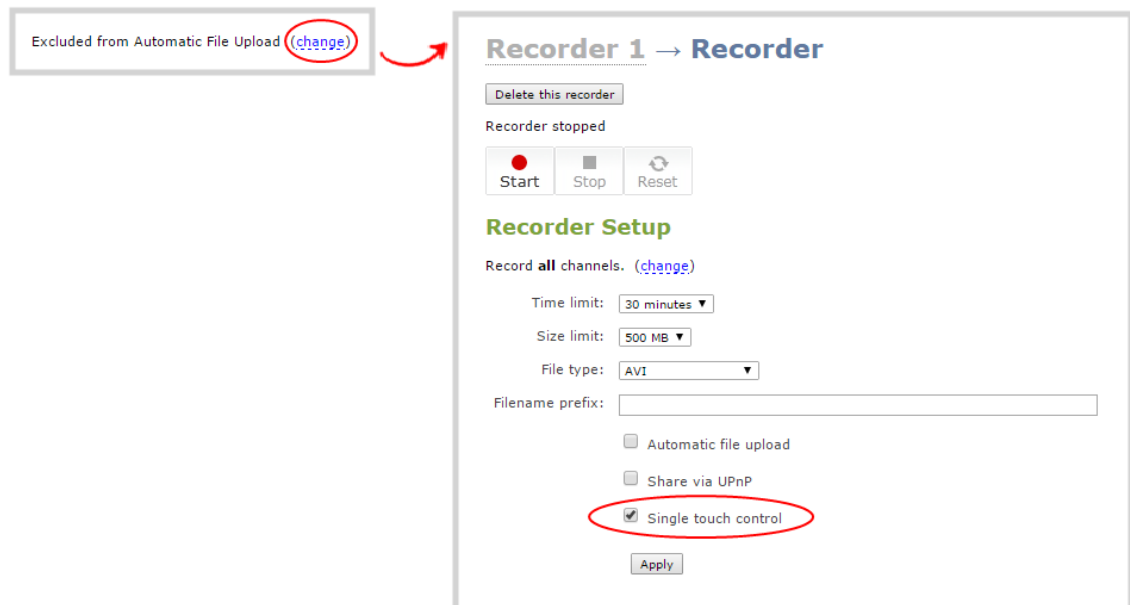
c. Click **Apply**.

> To learn how to configure your channels for recording, see **Record**. To learn how to configure recorders, see **Recorders**

Specify channels for One Touch streaming

Channels are not enabled for One Touch streaming by default. You can enable and disable One Touch streaming control for individual channels using the Admin panel.

To specify channels for One Touch streaming:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Channels menu, select the channel you want and click **Streaming**. The Streaming page opens.
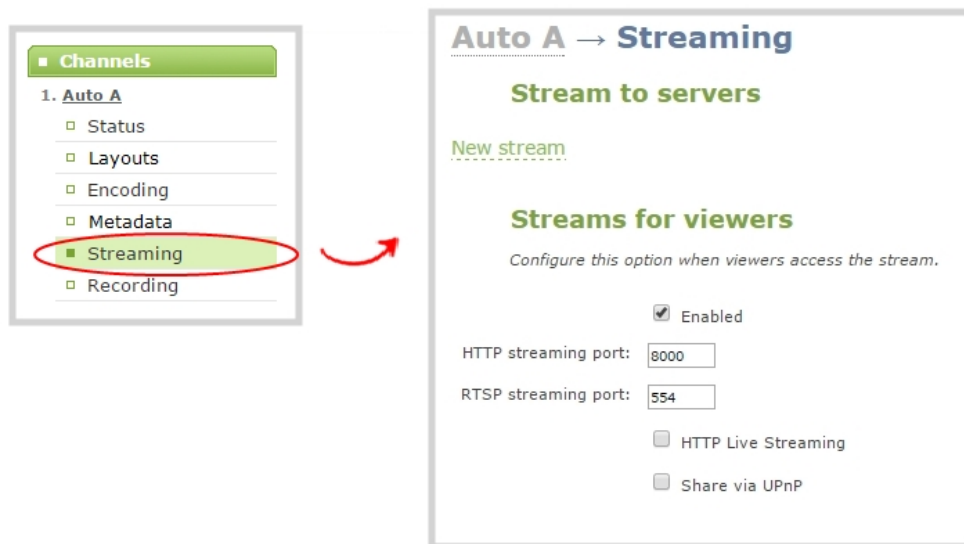
3. Click **New stream** and select a publishing method, for example, RTMP push.

4. Check **Single touch control** to enable this channel's stream for One Touch control. Uncheck **Single touch control** if you don't want to include this channel's stream for One Touch control.

5. Click **Apply**.

> To learn how to configure your channels for streaming, see **Stream**.

CMS event controls using the touch screen
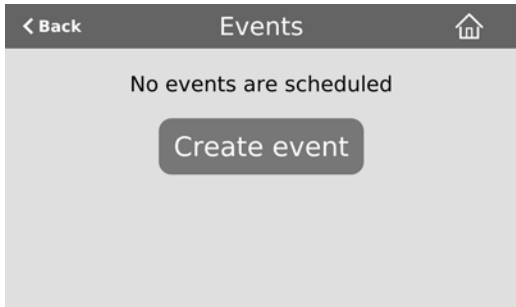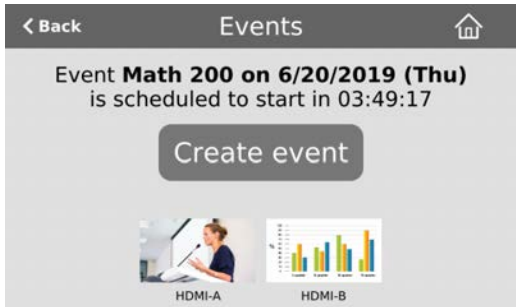
Pearl starts recording scheduled events automatically; however, you can use the touch screen to start and stop scheduled events sooner. The touch screen can also be used to authenticate with your Content Management System (CMS) to create unscheduled ad hoc recordings and webcasts. For detailed instructions, see:

- Stop/start scheduled events using the touch screen

- Create ad hoc events using the touch screen

For important considerations before recording or webcasting to a CMS, see About Kaltura recording and webcasting and About Panopto recording and webcasting.

Table 12 *Events screens using Pearl for scheduled Kaltura and Panopto events*
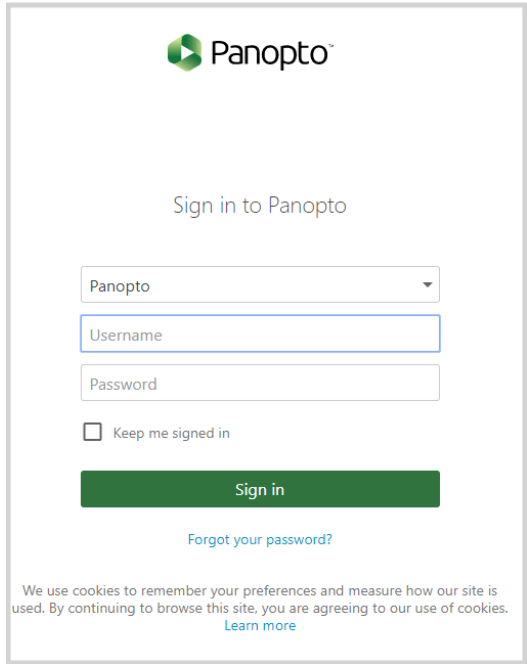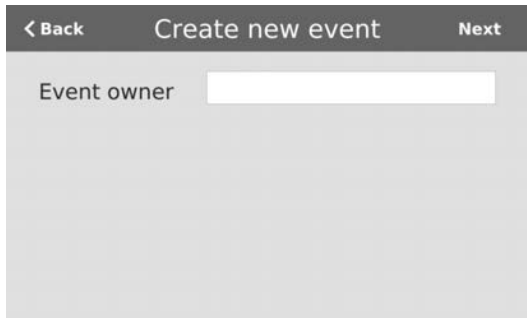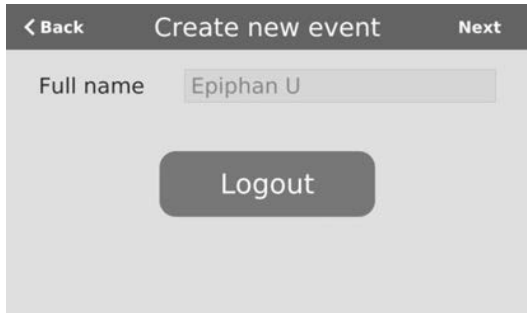
Events screens	Description
	The Calendar icon appears on the touch screen of Pearl when CMS is setup using the Admin panel.
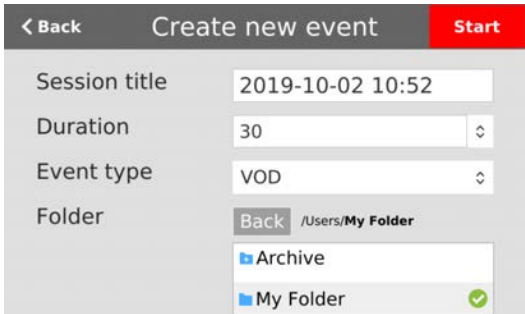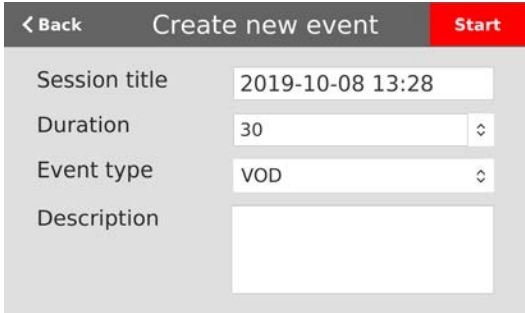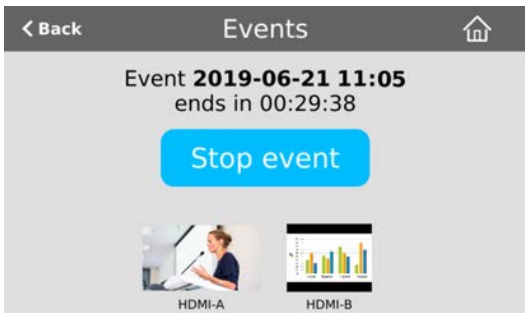
Events screens	Description
HDMI-A ● 00:00:00	Tap the calendar icon to display the Events screen. For example: From the Channel view, the calendar icon appears along the bottom of the screen.
‹ Back Events ⌂ No events are scheduled **Create event**	This Events screen displays when no scheduled events are configured. To create an ad hoc recording or webcast, tap **Create event** and authenticate using your CMS credentials. **Note:** Pearl must be registered with the CMS to create ad hoc events.
‹ Back Events ⌂ Event **Math 200 on 6/20/2019 (Thu)** is scheduled to start in 03:49:17 **Create event** HDMI-A HDMI-B	This Events screen displays when a scheduled event is configured and it's 30 minutes or more before the event start time. Notice that this is a recurring event with the date appended to the event name. To create an ad hoc recording or webcast, tap **Create event** and authenticate using your CMS credentials. Tap the channel thumbnail to go to the Channel view and see a live preview of that channel with an audio VU meter for confidence monitoring.
‹ Back Events ⌂ Event **Epiphan U Session** starts in 00:06:41 **Start event** **Create event** HDMI-A HDMI-B	This Events screen displays when a scheduled event is set to start within 30 minutes. To start the scheduled event early, tap **Start event**. To create an ad hoc recording or webcast, tap **Create event** and authenticate using your CMS credentials. **Note:** Scheduled events override ad hoc events. Pearl stops the ad hoc event and starts the scheduled event when it's time for the scheduled event to start.

Events screens	Description
	This Events screen displays when a scheduled event is set to start in five minutes or less. To start the scheduled event early, tap **Start event**. **Note:** For Panopto, the video quality you select for the session overrides the channel encoding settings in Pearl. Notice the lower resolution of HDMI-B for the slides with the inserted black bars. Video quality encoding settings applied to the channel by Panopto persist for that channel after the scheduled event ends.
	This Events screen displays while a scheduled or an ad hoc session is in progress. To stop the event early, tap **Stop event**.

Authenticating using the touch screen lets you create unscheduled ad hoc recordings and webcasts.

Table 13 *Unscheduled ad hoc event screens*

Unscheduled ad hoc event screens	Description
	Panopto login screen: When Pearl is registered with Panopto, this authentication screen appears when you tap **Create event** from the Events screen. Tap in a field and enter your credentials, then tap **Sign in**.
	Kaltura login screen: When Pearl is registered with Kaltura, this authentication screen appears when you tap **Create event** from the Events screen. Tap in the Event owner field and enter your Kaltura user ID as your login credentials, then tap **Next**.
	This screen displays after a successful authentication. To create an ad hoc event, tap **Next** to go to the next screen and set the event title and details. Tapping **Logout** logs you out of your CMS session and you return to the Events screen.

Unscheduled ad hoc event screens	Description
	Now enter your event details. For **Panopto**, you can change the ad hoc session title, duration, choose the type of event (VOD or Live Stream), and select the folder in Panopto to upload the file. **My Folder** is the default. Swipe to scroll down the list. Double tap and use the Back button to navigate nested folders. Tap **Start** when you're ready to start the ad hoc event.
	For **Kaltura,** you can change the ad hoc session title, duration, choose the type of event (VOD, Live Stream, or VOD + Live Stream), and add a description. Swipe to scroll down to add Kaltura categories and tags. Tap **Start** when you're ready to start the ad hoc event.
	This Events screen displays after you have started the ad hoc event. To stop the ad hoc event, tap **Stop event**. **Note:** To log out after stopping an ad hoc event, tap **Create event** from the Events screen and re-enter your User ID to return to this logout screen.

Stop/start scheduled events using the touch screen

You can use Pearl's touch screen to manually start scheduled events up to thirty minutes before the scheduled start time. A calendar icon appears when CMS is setup on Pearl.

From the touch screen, tap the calendar icon to display the Events screen or wait for the Events screen to appear automatically about five minutes before the event starts.

Tap **Start event** to start recording or webcasting right away. The button changes to **Stop event**. When you're done, tap **Stop event** or just wait for the event to stop automatically at the scheduled time. Recordings upload automatically to your CMS.

If there's more than five minutes before the next scheduled event, a **Create event** button for ad hoc events appears beside the **Start event** button. For more about the different Events screens, see CMS event controls using the touch screen.

Important information

- Pearl must already be registered with your CMS to appear listed as a remote recorder resource in Kaltura or Panopto. Contact your CMS administrator responsible for setting up hardware encoders for your organization if Pearl isn't listed as a resource or the calendar icon does not appear on the touch screen.

- For Kaltura, each channel on Pearl corresponds to a separate video source, which are treated as separate views for multi-view recordings.

- For Kaltura, the channel used for live streaming is pre-configured by the Pearl administrator.

- The number of channels on Pearl are pre-configured by the Pearl administrator. However, you can physically connect different video sources to the video inputs on Pearl.

- Panopto users can choose which channels on Pearl to include when scheduling a multiple source recording or webcast in Panopto.

- Only Pearl administrators can create or delete channels on Pearl.

- The primary and secondary video sources you select in Panopto correspond to individual channels configured on Pearl. Panopto users select the resolution for each video source in Panopto when a new scheduled or recurring session is created. The encoding settings are applied automatically to the channels on PearlPearl.

- After the event ends, recordings automatically upload to the CMS. It may take a while for content to show up in Kaltura's media lists, depending on how busy the Kaltura CMS system is at that time. Recordings are associated with the user account that scheduled the event.

- If network connectivity is lost during a scheduled VOD event, Pearl continues to record the event locally. When network connectivity re-establishes and the event ends, the recording uploads to the CMS as expected.

- See your Pearl administrator if you need to add or remove channels on Pearl. For information about Pearl administration and control using the Admin panel, see Integration.

> **STOP** For Panopto VOD events, if you manually stop a scheduled VOD event before the scheduled end time when Pearl doesn't have network connectivity, Pearl uploads the completed event's recording when network connectivity resumes. However, Panopto does not recognize that the event has ended. The event remains in the In Progress state in Panopto and you must wait until the original event's scheduled end time before creating a new event using that Pearl.

Create ad hoc events using the touch screen

You can create unscheduled ad hoc recordings and webcasts directly from Pearl's touch screen using the Events screen. To manually display the Events screen, just tap the Calendar icon that appears along the bottom of the Channel view. Tapping a thumbnail takes you back to the Channel view where you can monitor a live preview of the video source and check the audio VU meters. For more about the Channel view, see **The Channel view**.
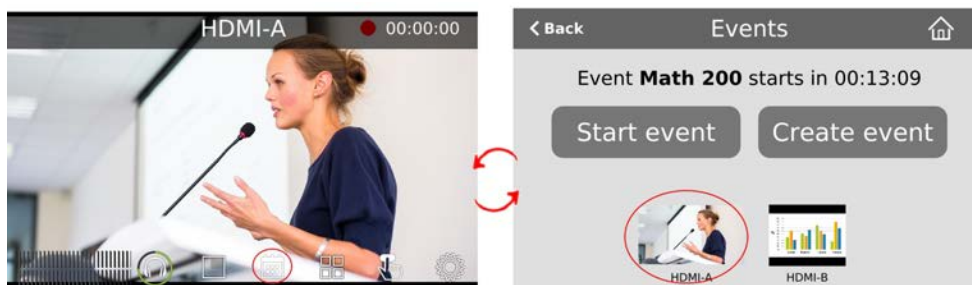
In this example, the scheduled event **Math 200** starts in about 13 minutes. To create an ad hoc event, tap **Create event** and login using your CMS login credentials.

> If you get the login error that your account is not active, your CMS has blocked your account. If login to the CMS is denied, the account you entered may not exist or may not have access rights to create an ad hoc event using Pearl. Contact your CMS administrator for CMS related login and account issues.

Once you're logged in, you can choose to either log out and return to the Events screen or continue. Tap **Next** to continue.

On the next screen, tap in any field to change the title and event details. The current date and time is the default session title. Depending on which CMS you use, different fields are visible. Swipe the screen to see more event details.

Kaltura event details screen	Panopto event details screen

Tap **Start** when you're ready to start the event. When you're done, tap **Stop event**. The recording automatically uploads to your CMS.

After your event ends, you remain logged in for one hour. To prevent someone else from starting an ad hoc event using your account, you should manually logout using the touch screen. Tap **Create event** from the Events screen to return to the Logout screen.
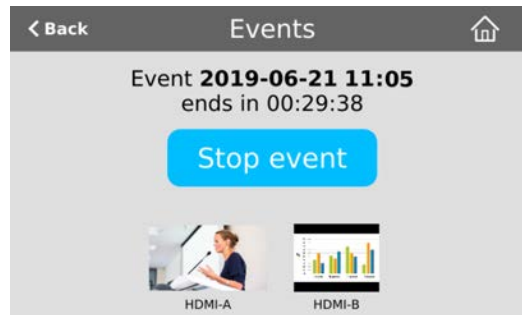
Important considerations

- You cannot start an ad hoc event if it's within five minutes of a scheduled event's start time. The Create event button does not display.

- Scheduled events have priority over ad hoc events. If an ad hoc event is still in progress when it's time to start a scheduled event, Pearl gracefully stops the ad hoc event and automatically starts the scheduled event. The ad hoc recording automatically uploads to the CMS.

- For ad hoc events to work, the user must have an account with their Content Management System (CMS) so they can login using Pearl's touch screen. CMS must also be set up on Pearl and Pearl must be registered with the CMS. If you don't see a calendar icon in the Channel view of the touch screen, contact your CMS administrator responsible for setting up hardware encoders to confirm that Pearl is properly registered as a remote recorder resource.

- For Kaltura, only Pearl administrators can configure channels for ad hoc events using the Admin panel, see Integration.

- For Panopto, each channel that is configure on Pearl is treated as a separate video source for multi-source ad hoc events.

- The maximum event duration using the touch screen is 600 minutes (10 hours); however, do not enter a duration that produces a recording that's larger than the capacity of the local storage available on Pearl.

- Separate back up recordings of each channel are automatically saved on Pearl. Contact your Pearl administrator for the availability of back up recordings.

Configure the touch screen

The touch screen on Pearl is enabled by default and all its features are available. You can disable the entire screen or some of its features using the Admin panel. For information about how to connect to and use the Admin panel, see The Admin panel.

Topics include:

- Disable or enable the touch screen

- Hide or show channel previews on the touch screen

- Disable or enable the system status screen

- Disable or enable configuration using the touch screen

- Disable or enable recording, streaming and switching from the touch screen

- Set the touch screen timeout

- Set a 4-digit PIN security code

Disable or enable the touch screen

You can enable or disable Pearl from displaying anything on the touch screen. The touch screen remains touch-sensitive even when the display is disabled.

To disable or enable the touch screen display:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, click **Touch Screen**. The touch screen configuration page opens.
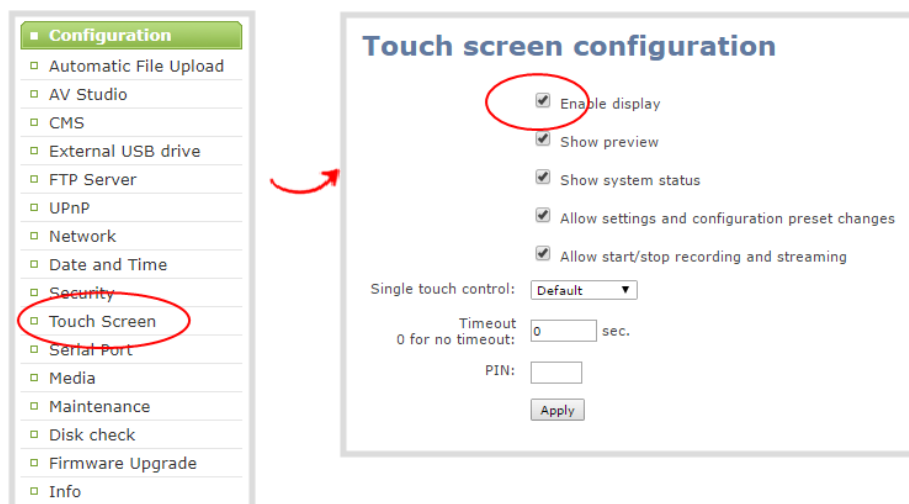
3. Uncheck **Enable display** to disable the touch screen display. Check **Enable display** if you want the touch screen display enabled.

4. Click **Apply**.

Hide or show channel previews on the touch screen

Previews of your configured channels display on the touch screen of Pearl by default. You can disable channel previews using the Admin panel.

A message displays on the touch screen when channel previews are disabled. If you have configured **system status** or **settings and configuration preset changes** to be allowed, then tapping anywhere on the touch screen opens the settings page.
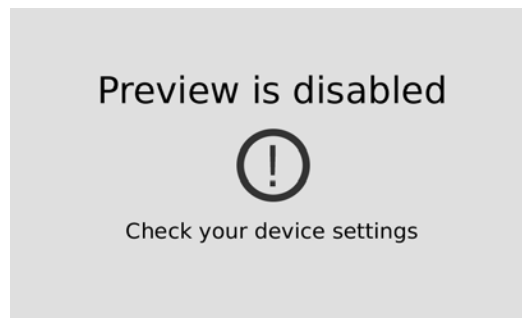
To hide or show the channel previews on the touch screen:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, click **Touch Screen**. The touch screen configuration page opens.
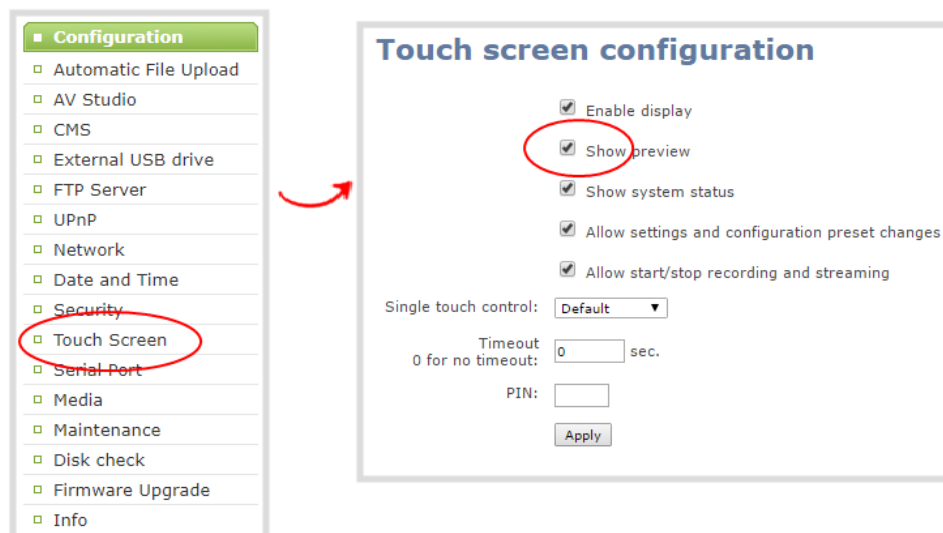
3. Uncheck **Show preview** to disable channel previews from displaying on the touch screen. Check **Show preview** if you want to enable channel previews on the touch screen.

4. Click **Apply**.

Disable or enable the system status screen

The system status screen displays network and system related information, such as the IP address needed to access Pearl. You may not want this information visible on the touch screen after you've configured Pearl. You can use the Admin panel to disable the system status screen from displaying on the touch screen.

To disable or enable the system status screen from displaying on the touch screen:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, click **Touch Screen**. The touch screen configuration page opens.
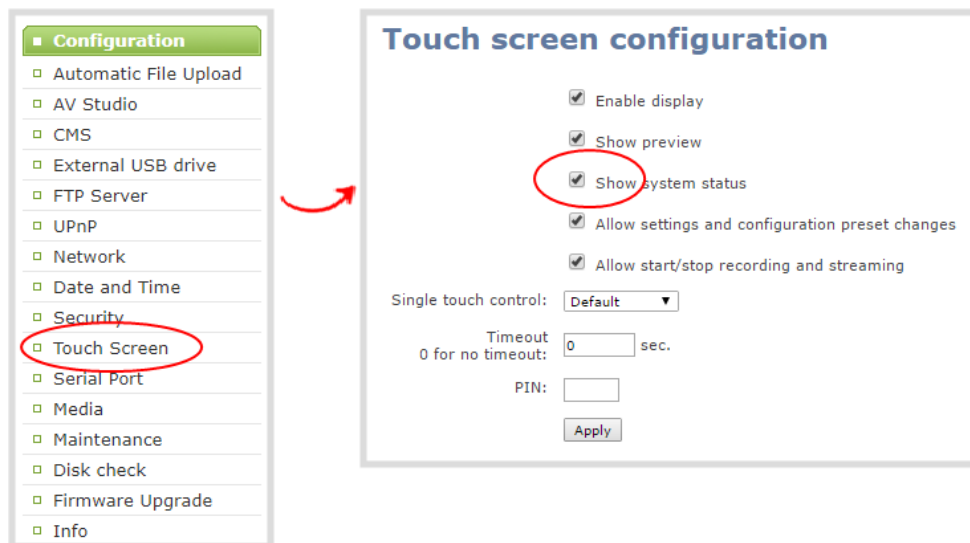
3. Uncheck **Show system status** to prevent the system status screen from opening on the touch screen. Check **Show system status** if you want to enable the system status screen to open on the touch screen.

4. Click **Apply**.

Disable or enable configuration using the touch screen

You can apply configuration presets and configure network settings using the touch screen on Pearl by default. You can disable this ability using the Admin panel.

If configuration is blocked and system status is permitted, touch screen users see an *i* icon instead of the configuration gears icon in the lower right corner of the touch screen.

To disable or enable configuration using the touch screen:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. Select the **Touch Screen** link in the Configuration menu. The touch screen configuration page opens.
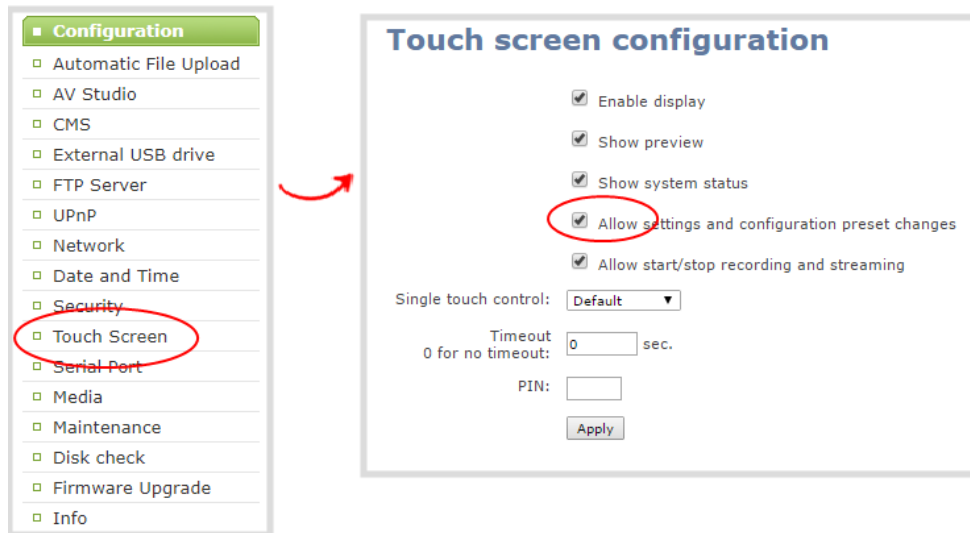
3. Uncheck **Allow settings and configuration preset changes** to disable configuration from the touch screen. Check the check box if you want to enable configuration from the touch screen.

4. Click **Apply**.

Disable or enable recording, streaming and switching from the touch screen

Recording, streaming, and live switching control using the touch screen on Pearl is enabled by default. You can disable this function using the Admin panel to stop users from switching layouts and from starting or stopping live streams and recordings.

> Channel preview must be enabled for the touch screen for recording, streaming, and live switching control to work. See **Hide or show channel previews on the touch screen**

To disable or enable recording, streaming, and switching control using the touch screen:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, click **Touch Screen**. The touch screen configuration page opens.
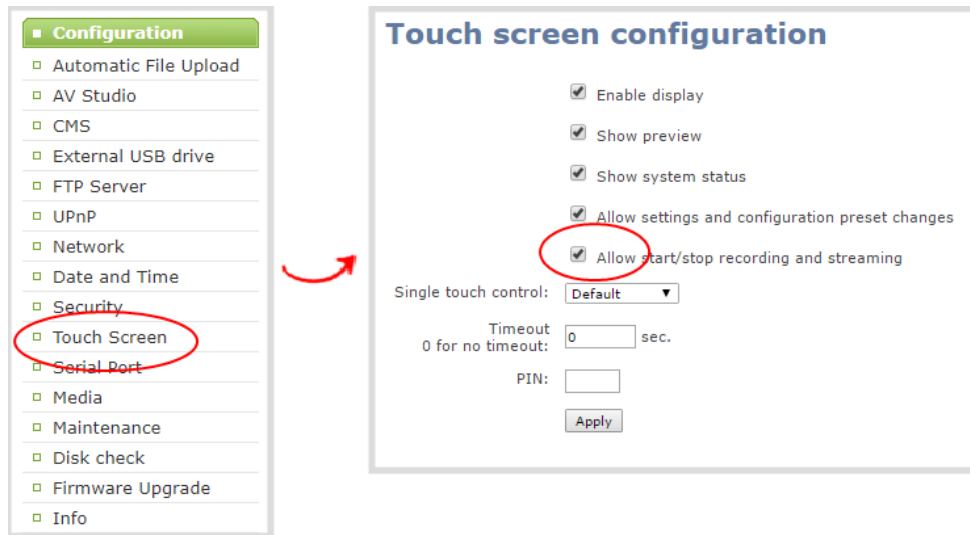
3. Uncheck **Allow start/stop recording and streaming** to disable recording, streaming, and live switching control from the touch screen. Check the check box to enable recording, streaming, and live switching control.

4. Click **Apply**.

Set the touch screen timeout

Initially, the touch screen is always on for easy monitoring. However, you can set the touch screen to shut off after a given amount of time. To re-enable the touch screen after it times out and shuts off, simply tap anywhere on the screen.

To set a timeout for the touch screen:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, click **Touch Screen**. The touch screen configuration page opens.
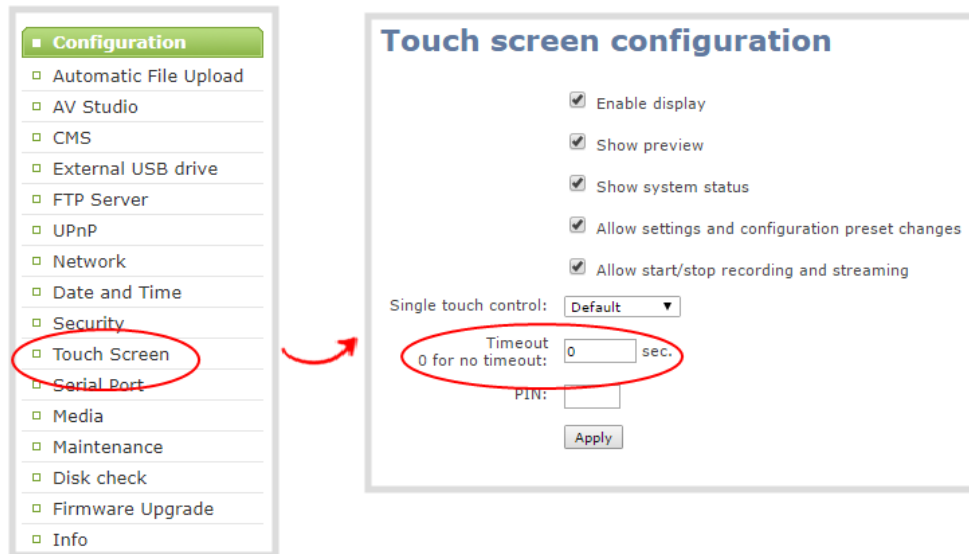
3. Enter the number of seconds before the touch screen automatically shuts off in the **Timeout** field. A value of 0 keeps the touch screen on at all times when the system is on.

4. Click **Apply**.

Set a 4-digit PIN security code

You can set a 4-digit PIN code to protect the touch screen of Pearl from unauthorized access. By default, the PIN is not set.

If a PIN is configured, users are prompted to enter the PIN code whenever:

-   When you power on or restart Pearl.

-   When Pearl recovers from timeout mode, see Set the touch screen timeout.
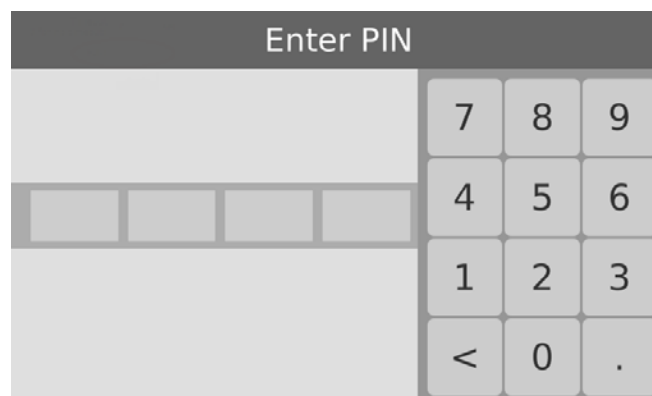
To configure a 4-digit PIN code:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, click **Touch Screen**. The touch screen configuration page opens.
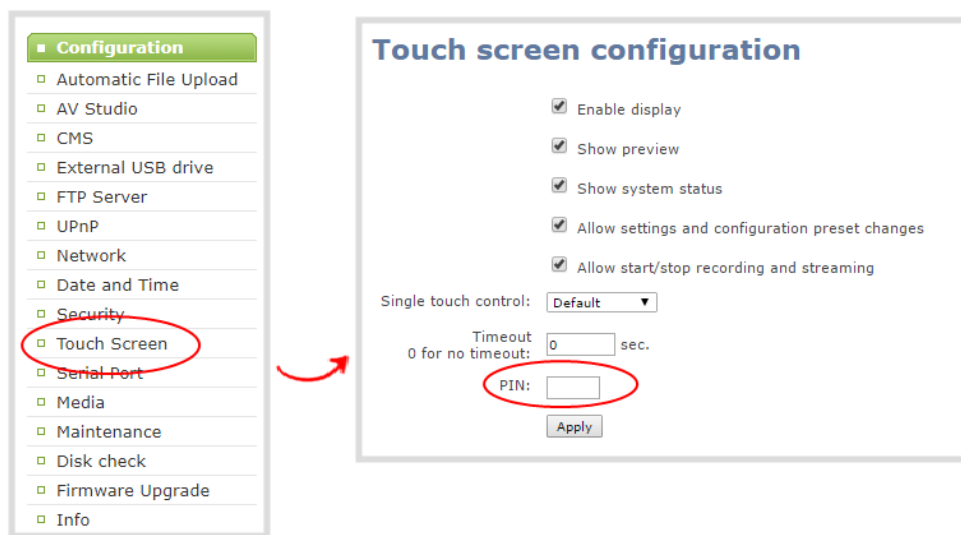
3. Enter a 4-digit PIN code in the **PIN** field.

> Record the PIN code in a safe location for future reference. You need this PIN to access the touch screen of your Pearl.

4. Click **Apply**.

The Admin panel

The Admin panel is used primarily to set up your Pearl and perform administrative tasks. Most tasks in this user guide are performed using the Admin panel.This section contains what you need to get started using the Admin panel.

Topics include:

- About the Admin panel
- Connect to Admin panel
- Connect to Admin panel using local console
- Connect using a DNS-based service discovery
- Connect using persistent static IP address
- Switching / mixing using the Admin panel

For information about remote access to the cloud version of the Admin panel, see Access cloud versions of the Admin panel and Epiphan Live.

For information about integrating Pearl with Content Management Systems (CMSs) like Panopto and related administrator tasks, see Integration.

About the Admin panel

The Admin panel is a web-based user interface that's used primarily to set up your Pearl and perform administrative tasks.
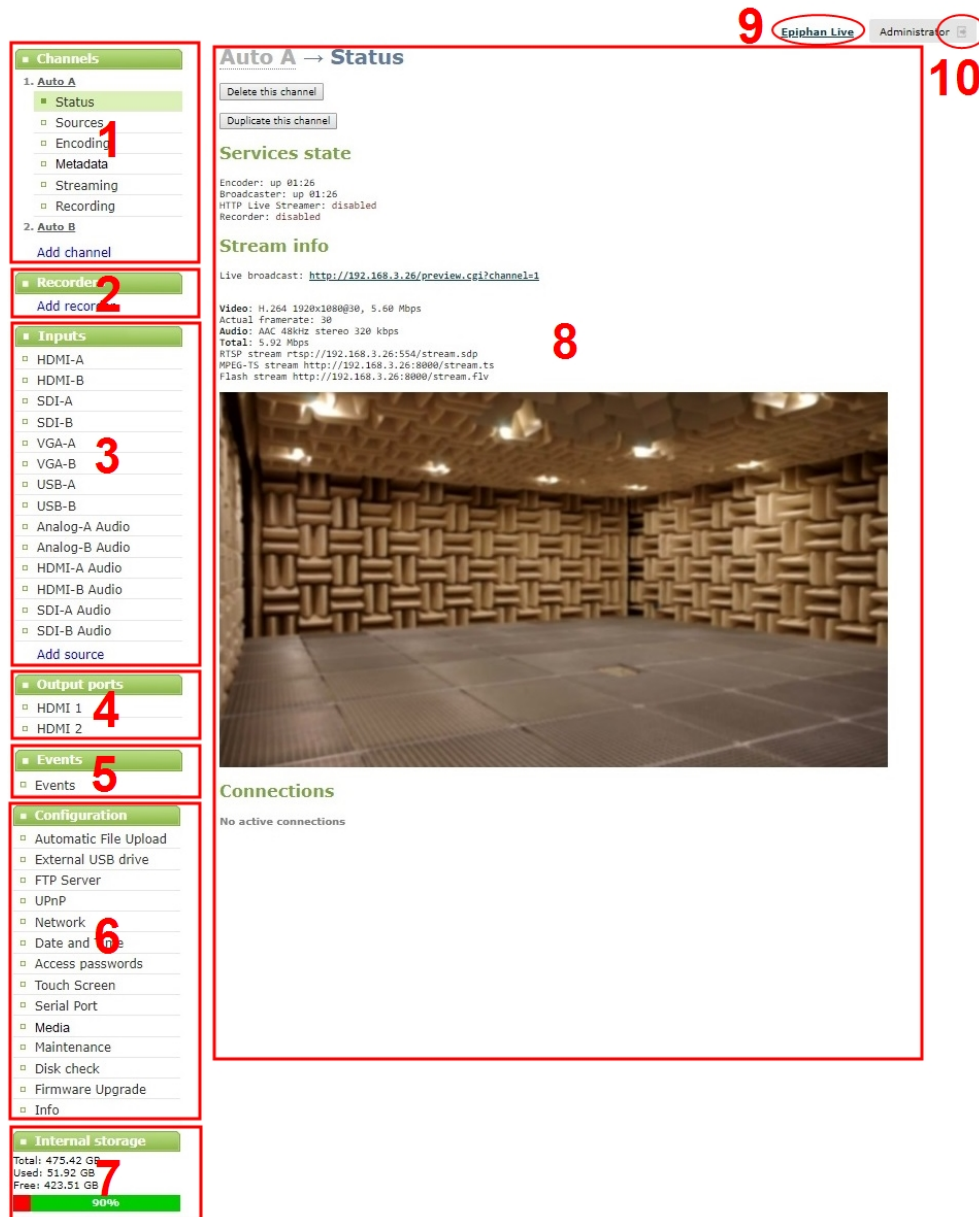
Table 14 *The Admin panel*

Label	Name	Description
1	**Channels menu**	The channels that are available for the current configuration of your Pearl are listed. Select a channel to access the drop down list of options that are available to configure channel encoding, add video and audio source, create layouts, perform confidence monitoring, record the channel, and more.

Label	Name	Description
2	**Recorders menu**	Recorders you add to your Pearl are listed. Select a recorder to open the status page and list of related recordings for that recorder. You can start and stop recording, as well as configure the recorder settings from this page.
3	**Inputs menu**	The available video and audio input ports on your Pearl are listed. Select a port to open the configuration and status page for that port.
4	**Output ports menu**	The output ports available on your Pearl are listed. Select a port to open the configuration and status page for that port.
5	**Events menu**	Access the Content Management System (CMS) events list containing up to three months of scheduled Kaltura events, in progress events, and completed ah hoc and scheduled events.
6	**Configuration menu**	A list of all the available configuration options.
7	**Internal storage and system information menu**	System details are displayed in this area, such as the total amount of internal storage, how much space is currently used, and how much free space is available.
8	**Main panel**	The main panel is where the all the related information displays. What gets displayed in the main panel depends on which menu item you select.
9	**Link to Epiphan Live**	Click to open Epiphan Live in a new tab.
10	**Log out**	Click to log out of Pearl. Click icon again to display the log in window. The role of the currently logged in user displays beside the icon.

You can access the Admin panel using these methods:

- Any web browser, see Connect to Admin panel.
- Using a connected USB mouse, keyboard, and monitor, see Connect to Admin panel using local console.
- Remotely using AV Studio, see About using AV Studio to control Pearl.

Connect to Admin panel

You can access the Admin panel using an internet browser on a computer or tablet that's connected to the same local Ethernet network as your Pearl. You need the IP address of the system, which you can get from the

settings using the front touch screen of your Pearl. Using the touch screen is the easiest way to find the IP address of your system.

There are two ways to get the IP address using the touch screen to log in to the Admin panel:

1. Get the IP address of Pearl. Do one of the following:

    a. From a single channel view or grid view, tap the system settings (**gears**) icon, then tap **System Status**, or

    b. If your system doesn't have any channels showing, tap the touch screen anywhere to go to the system settings screen, then tap **System Status**.

    c. To check the CPU usage from the touch screen, tap the gear icon and select **System Status**.

    d.

3. When you have the IP address of your Pearl, enter the following into the address bar of your web browser to launch the Admin panel.

> http://<IP Address of Pearl>/admin

> 📋 If HTTPS is enabled on Pearl, replace *http* with *https* in the URL.

4. Enter your user name and password when prompted. The administrative user name is **admin**. Initially no password is set so you can leave that blank and click **OK**.

> 🛑 We recommend setting an admin password for higher security, see **User administration**.

If you don't know the IP address, you can do one of the following:

For networks with DHCP, you can:

- Connect using a DNS-based service discovery

For networks without DHCP, you can:

- Connect using persistent static IP address

Connect to Admin panel using local console

Operators and administrators can access the Admin panel locally to reconfigure Pearl without needing a laptop. When you enable the local console feature, you can connect a USB mouse, keyboard, and a monitor directly to Pearl. Or connect a touch screen monitor. A built-in virtual keyboard is readily available.

Local console is enabled for a video output port using either the touch screen or the web-based Admin panel. When enabled, simply connect your USB mouse and keyboard directly to any USB port on Pearl and connect your HDMI monitor to the video output port that has local console enabled.

Using the Admin panel, you can disable whether or not users must login to the Admin panel when they access the local console. Login is enabled by default. You can also change the keyboard layout to any of the supported languages and toggle between languages if you select multiple languages (using Ctrl+Shift or Ctrl+Alt).

- American English
- Dutch
- French
- German
- Italian
- Netherlands
- Portuguese (European)
- Spanish (Spain)
- Swiss
- Norwegian (Bokmal)
- Russian

Important considerations

- Epiphan Live is not accessible from the local console.
- The live preview link is not accessible from the Channel Status page using the local console.
- You cannot upload/download the following types of media using the local console:
  - Images
  - Channel recordings
  - EDID files

- Configuration files
- Firmware update files

> Use the web-based Admin panel from your administration computer for access to all Admin panel functions.

To enable local console using the Admin panel or the touch screen on Pearl:

1. To enable local console using the Admin panel, login to the Admin panel as **admin**, see Connect to Admin panel using local console.

2. From the Output ports menu, click the output port (**DisplayPort 1** or **DisplayPort 2**). The video output port configuration page opens.

3. Under Settings, select **Local console** in the Source drop-down menu.

4. (Optional) Check **Disable authentication**.

5. (Optional) Check a different keyboard language layout or multiple language layouts. The default layout is American English.

6. (Optional) Choose the keyboard key combination to toggle between keyboard layouts if multiple languages are selected: **Ctrl+Shift** or **Alt+Shift**.

7. Click **Apply**.

8. To enable local console from Pearl's touch screen, tap the **gear** icon to open the System settings screen. If the control icons aren't showing, tap anywhere on the touch screen.

9. Tap the arrow icon in the lower-right corner of the screen to go to the second Settings page.
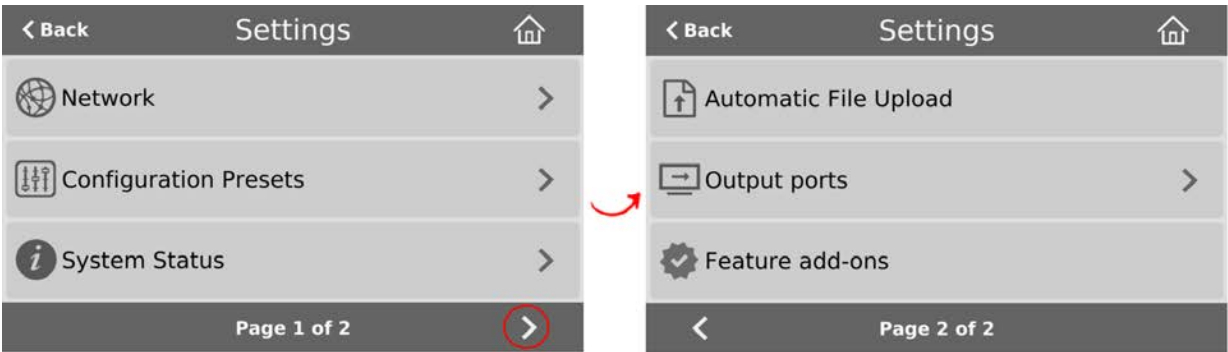
10. Tap Output ports and select an output port.

11. From the Output port's screen, select **Local console** as the Source and tap **Apply**.
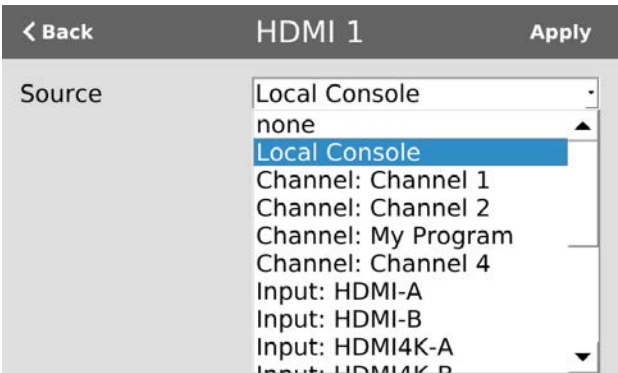
What's next?

Connect your USB mouse, keyboard, and connect an HDMI monitor to the output port that has local console enabled to access the local console directly from Pearl.

Connect using a DNS-based service discovery

Pearl uses DNS-based messages to advertise details about itself, including its host name. With a compatible utility installed on your computer, you can access the system simply by typing its serial number and the suffix ".local" into the address bar of your browser.

The following table lists the compatible systems and Bonjour Print Services software needed.

Table 15 *Install Bonjour Print Services*

System	Action Needed
Microsoft Windows	You must install Bonjour Print Services: 1. Use the following URL http://support.apple.com/kb/DL999 2. Click Download. 3. Follow the system prompts to download and install the application.
Mac OS X	The Bonjour software used for service discovery is built into the Mac OS. No special actions are needed.
Linux	The Avahi implementation used for DNS-based discovery is shipped with most Linux distributions. If necessary, check with your administrator to ensure you have the Avahi package installed.

To access the Admin panel of Pearl using DNS discovery:

1. Find the system's serial number that's printed on a label attached to the device.

   TIP: The serial number also appears on the System information screen from the touch screen of Pearl. Tap the system information gear icon to display the System information screen. If needed, tap the screen once to display the control icons.

2. Enter the following string into the address bar of your web browser on your admin computer, where *<serial>* is the serial number of your Pearl:

   http://*<serial>*.local/admin

   For example: http://95dd40d5.local/admin

   > If HTTPS is enabled on Pearl, replace *http* with *https* in the URL.

3. Enter your user name and password when prompted, then click **OK**. The administrative user name is **admin**. Initially no password is set. To set a password, see User administration.
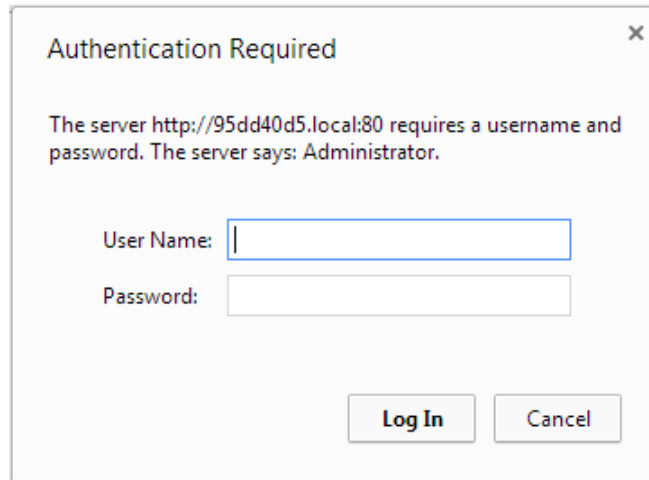
4. (Optional) From the Configuration menu, click **Network** and note the **IP address** of the system from the network configuration page.

Connect using persistent static IP address

Pearl has a default persistent static IP address, also known as the **recovery IP address**. If ever you need to set up Pearl on a network that does not support DHCP, or you need to recover from a previous static IP address setting, you can use this procedure to connect directly to the system for configuration.

A workstation computer with access rights to modify your network settings is required.

Pearl static IP address defaults are:

- **IP Address**:   192.168.255.250
- **Netmask**:   255.255.255.252
- **Username**:   admin
- **Password**:   your admin password (by default set to no password)

To access the Admin panel using the persistent static IP address:

1. Establish an Ethernet connection between Pearl and the workstation using one of the following methods:

   a. Connect Pearl to a local Ethernet network shared with the workstation.

   b. Connect Pearl directly to the workstation's Ethernet port using either a regular or a crossover Ethernet cable.

2. Record the network settings of the workstation that are used to connect to Pearl so that they can be restored later.

3. Temporarily change the network configuration on the workstation to the following:

   a. Use Static IP assignment

   b. IP address: 192.168.255.249

   c. Subnet mask: 255.255.255.252

4. Start a web browser on the workstation and go to: **http://192.168.255.250/admin/**

> If HTTPS is enabled on Pearl, replace *http* with *https* in the URL.

5. Log in as the administrator user with the user name **admin** and enter the admin password (by default there is no password assigned). The Admin panel opens.

6. From the Configuration menu, click **Networking**.

7. Click **use a static address** and enter a static IP address and network settings you want for Pearl. For more information, see Configure network settings.

8. Restore the previously saved network configurations on the workstation.

Switching / mixing using the Admin panel

Switching live video inputs, or video mixing, is fast and easy using the Admin panel. For best results, you may wish to be in a location where you can see the live action, and have a solid understanding idea of what is in each of your layouts. Good layout names can help with this. See Rename a layout.

> Performing live switching using one interface, like the Admin panel, does not dynamically update the visuals in the other interfaces (e.g. the touch screen and Epiphan Live). The other interfaces must be manually refreshed to accurately reflect the current live switching layout information.

To do live video mixing:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Channels menu, select a channel and click **Layouts**. The layout editor page opens.

3. In the layouts list, the layout with the big red circle beside it is the currently chosen "live" layout.

4. To switch to a different layout as the active "live" layout, click the gray circle beside the layout you want to make go live. The circle turns red to indicate that it's now the active "live" layout.

Epiphan Live

Epiphan Live is a friendly and easy to use web and tablet interface designed for confidence monitoring of channels and sources, switching between layouts while recording and streaming, and to easily stop or start streaming and recording.

Topics include:

- About Epiphan Live
- The Dashboard interface
- Access Epiphan Live using a web browser or mobile device
- Access Epiphan Live from the Admin panel
- Stream, record, and monitor using the Dashboard interface
- Switching / mixing using Epiphan Live
- Your recordings

For information about remote access to the cloud version of Epiphan Live, see Access cloud versions of the Admin panel and Epiphan Live.

About Epiphan Live

The Epiphan Live interface lets you easily operate your Pearl using a computer or mobile device such as a tablet. You can:

- Control streaming and recording of channels and recorders.
- Do live switching between sources and layouts while streaming and recording.
- Perform video, audio and system confidence monitoring.

You need administrator or operator-level privileges to use Epiphan Live. See User administration for more information about user privileges.

Epiphan Live is supported on the following operating systems on mobile devices and web browsers:

Operating system or mobile device	Supported web browser(s)
Windows	- Google Chrome - Microsoft Edge
Mac	- Google Chrome - Safari
Linux	- Google Chrome
Android phone or tablet	- Google Chrome
iPhone or iPad	- Google Chrome - Safari

Most instructions assume that a touch screen device is used; however, you can tap or click, depending on your device.

> Text scaling using Google Chrome for Android is not supported.

The Dashboard interface

The Dashboard interface is the first page you see when you open Epiphan Live. You'll find helpful tools for confidence monitoring, as well as streaming and recording control.
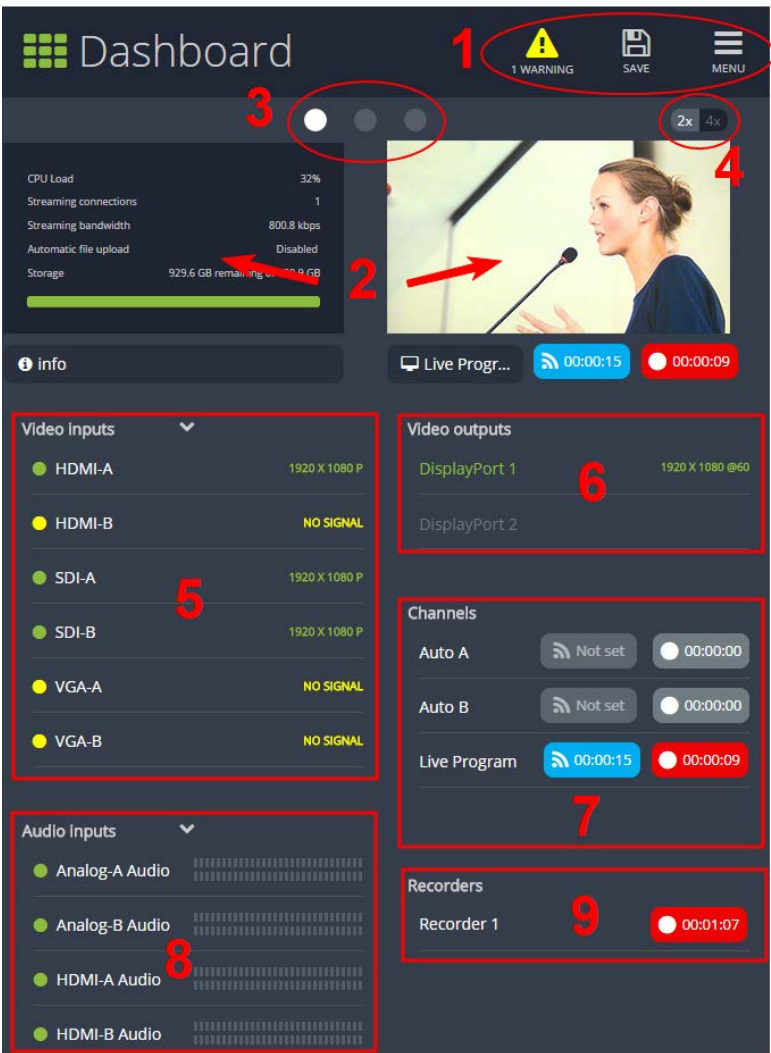
Table 16 *Elements in the Dashboard interface*

Number	Title	Description
1	**Dashboard header icons**	• **Warning** – This icon displays only if there are any configuration errors in your channels, sources, streams or recordings. Clicking the icon displays more detail about the errors. • **Save** – Save the current Dashboard layout. Tap **Save** to preserve the current layout. Logged in operators and administrators will see the

Number	Title	Description
		latest Dashboard layout when they refresh their Epiphan Live page. The latest saved layout displays the next time you log in. • **Menu** – Access links to the Switcher view, Recordings, and Admin panel.
2	**Dashboard monitoring panels**	Configurable panels for confidence monitoring. You can set each panel to display a source, channel, output, or basic system information. Panels are empty by default.
3	**Dashboard panel navigation icons**	Each dot represents a set of panels. Select a dot to navigate between the three different sets of Dashboard monitoring panels.
4	**Dashboard panel set quantity icons**	• **2x** – Changes the quantity of Dashboard panels per set to 2 (as in the screen shot above). • **4x** – Changes the quantity of Dashboard panels per set to 4.
5	**Video inputs**	Displays a list of your video inputs configured in the Admin panel and includes basic status information for each input.
6	**Channels**	Displays a list of your channels configured in the Admin panel and includes streaming and recording control buttons for each channel, as well as individual control buttons for each stream when you set up multiple streams in a channel.
7	**Audio inputs**	Displays a list of your audio inputs configured in the Admin panel. Includes basic status information and a VU meter for each input.
8	**Recorders**	Displays a list of your recorders configured in the Admin panel and includes a recording control button for each recorder.

Access Epiphan Live using a web browser or mobile device

You can open Epiphan Live using a web browser on your Windows, Mac, or Linux computer. You can also use Epiphan Live on an Android phone or tablet, an iPhone, or an iPad.

You need the IP address of your Pearl to connect to Epiphan Live, see Connect to Admin panel.

1. Enter the following into the address bar of your web browser.

    a. For a web browser on a computer, enter:

    > http://<IP address of your Pearl>/admin/m

    b. For a web browser on a mobile device, enter:

    > http://<IP address of your Pearl>

2. Enter your administrator or operator credentials when prompted.

> Some versions of Chrome and Microsoft Edge don't display channel previews from the
> Dashboard if you're on an HTTPs network and your website has an insecure or invalid security
> certificate, even after you update the security certificate. Use a different web browser such as
> Firefox or update the version of your web browser, then add the security certificate for the
> website to the exceptions list.

Access Epiphan Live from the Admin panel

You need the IP address of your Pearl to log in to the Admin panel for this procedure, see Connect to Admin
panel.

1. Log in to the Admin panel using your credentials. In your web browser, enter:

> http://<IP address of your Pearl>

2. Click **Epiphan Live** in the upper-right corner of the Status page for the channel. The Epiphan Live
    dashboard opens in a new tab.

To open the Admin panel from Epiphan Live, click the **Menu** icon in the upper-right corner of the Dashboard
or Switcher interface, and then click **Admin panel**.
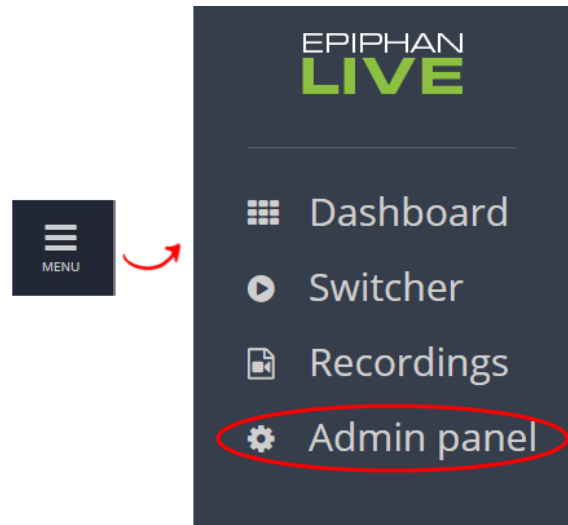
Stream, record, and monitor using the Dashboard interface

The Dashboard interface in Epiphan Live is where you can do confidence monitoring, as well as start and stop streaming and recording for your channels.

Topics include:

- Configure Dashboard panels
- Monitor video and audio input sources
- Monitor and setup the output port source and audio
- Control streaming and recording

Configure Dashboard panels

You can customize each Dashboard panel to display a specific channel, input source, or video output for live confidence monitoring. Panels can also be set up to display system information:

- CPU load (%)
- Quantity of streaming connections
- The current streaming bandwidth (bitrate)
- Automatic file upload status (enabled or disabled). See FTP and automatic file transfers.
- Storage available on your Pearl.

Other logged in operators and admins must refresh their web browsers to see the latest changes to the Dashboard.

> **STOP** Up to 8 Epiphan Live preview panels can be open at the same time. The limit of 8 live preview
> panels applies **across all open instances of Epiphan Live**, including multiple users
> accessing Epiphan Live simultaneously from different web browsers, or duplicate instances of
> the same Epiphan Live interface open on multiple browser tabs at the same time.

To configure Dashboard panels:

1. Log in to Epiphan Live (see Access Epiphan Live using a web browser or mobile device).

2. Tap the drop down menu that appears below the panel and select the channel, source, or output to
   display. The label says "None" if the panel is not yet configured.
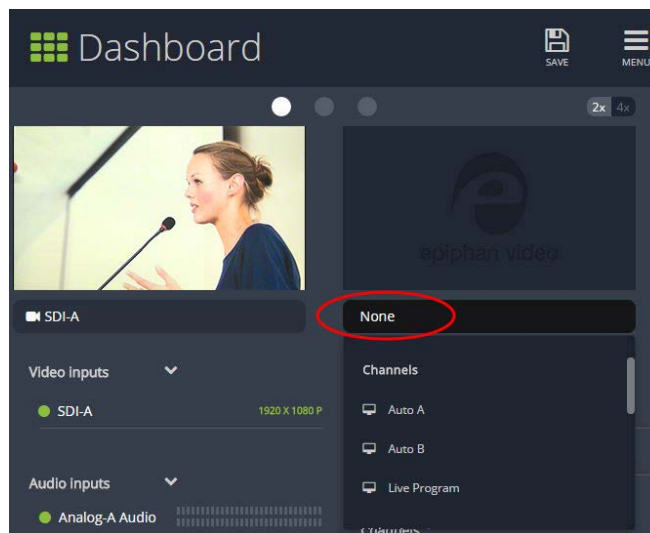
> When a channel is selected, streaming and recording control buttons appear below the
> panel. You can control streaming and recording of that channel using those buttons.

3. (Optional) To choose between displaying 2 or 4 panels, tap the **2x|4x** icon that appears in the upper-
   right corner of the panels area.

4. Tap **Save**.
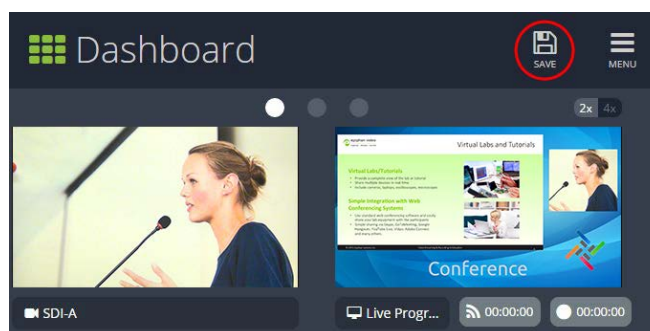
> You can navigate between 3 separate sets of Dashboard panels by selecting the **circle icons** along the top of the first row of panels.

Monitor video and audio input sources

Use the Dashboard to monitor your video and audio inputs. The video inputs section of the Dashboard lists all inputs configured on your Pearl and displays the video resolution.
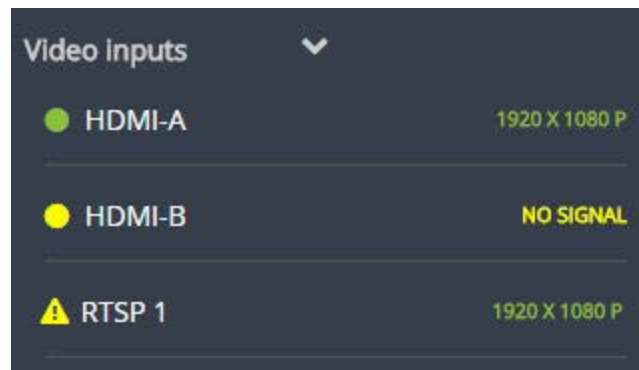
- A **green dot** means that the video source is connected and a signal is received.
- A **yellow dot** means that a signal is not being receiving from the source.
- A **triangular warning icon** means there is a source configuration issue that needs attention.

Tap **the name of a video input** to open the source details in a thumbnail view, including warning information if applicable.
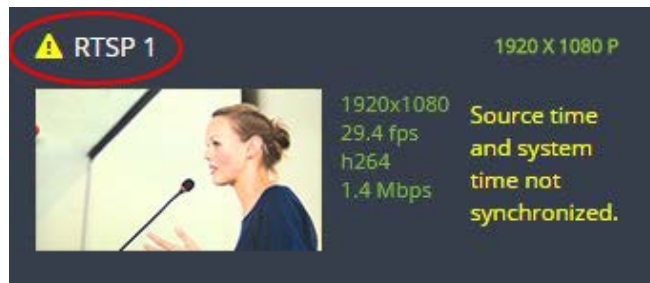
The audio inputs configured on your Pearl appear in the Audio inputs section of the Dashboard.
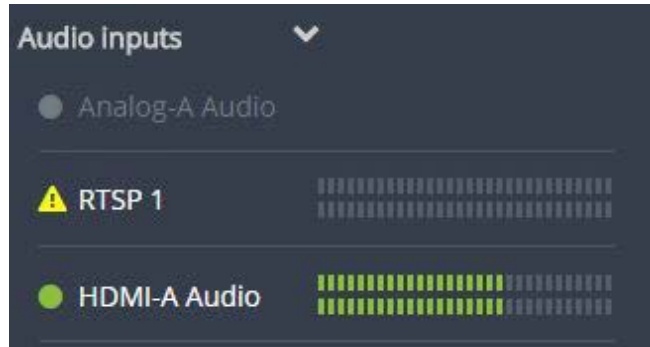
- A **grayed-out audio source** means that the audio source is not used in any channels.

- A **triangular warning icon** means there is a source configuration issue that needs attention. Click the audio source name to display the warning message.

- A **green dot** means the source is connected and the accompanying VU meter shows the audio level.

The audio VU meter uses quasi-peak ballistics with samples averaged every 10 ms. The maximum average in each 100 ms period is displayed as a series of colored bars. The following table describes the levels at which the meter changes from green to yellow and red.

Table 17 *Audio VU meter levels*

Color	Decibel range
Red	0 to -9 dBFS
Yellow	-9 to -18 dBFS
Green	-18 dBFS and lower

Show or hide video inputs in the list

You can pick which video inputs display in the Dashboard view. Just tap the **Video inputs** header and then check the **checkbox** next to the name of each source you want showing in the Dashboard view. Tap **Save** when you're done. The Dashboard video input list updates automatically.
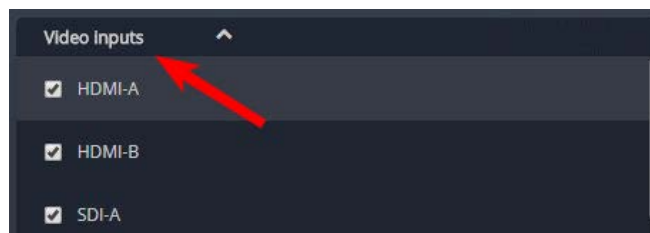
Show or hide audio inputs

You can pick which audio inputs display in the Dashboard view. Just tap the **Audio inputs** header and then
check the **checkbox** next to the name of each source you want showing in the Dashboard view. Tap **Save**
when you're done. The Dashboard audio input list updates automatically.
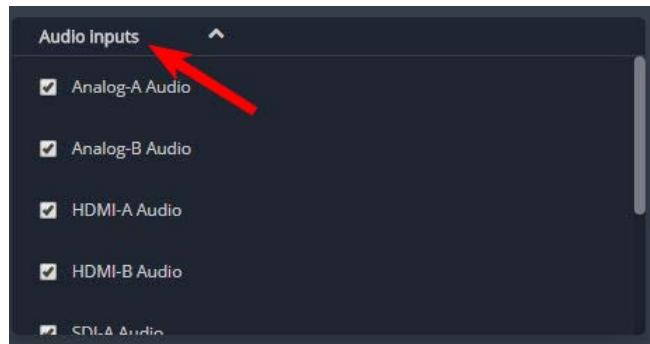
Monitor and setup the output port source and audio

The Dashboard lists the output ports along with the resolution and frame rate. You can enable and disable a
video output port, as well as choose if you want to display a channel or a video source. You can also enable or
disable the audio volume for the output port. However, you cannot hide video output ports from displaying
on the Dashboard.

To configure the output port audio using the Admin panel, see Disable or enable audio and output port
volume.
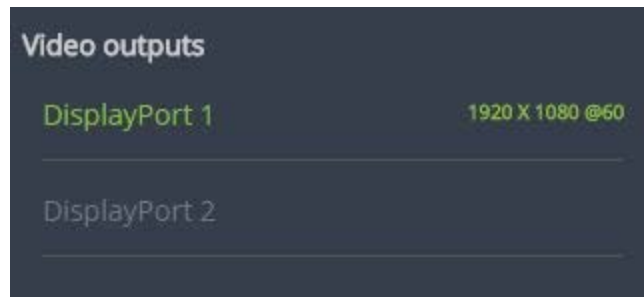
- **Green text** means your output is connected and transmitting to your external display.

- **Grayed-out text** means the output port is disabled.

- **White text** means the output port is enabled but is not connected to an external display.

Click **the name of a video output** to open the port's details in a thumbnail view.
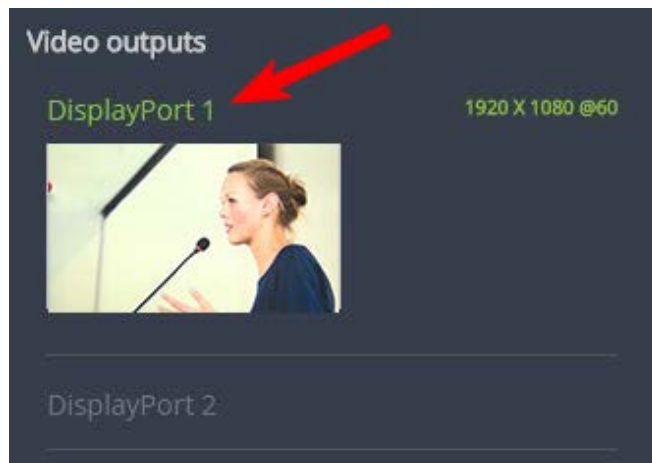
> By default, video output ports are configured to maintain aspect ratio, use the display's default resolution, include audio at 100% and they don't include the audio VU meter. You can change these defaults in the Admin panel. See **Video output ports** to learn more about advanced-level video output configuration using the Admin panel.

To configure a video output port and enable or disable the audio:

1. Tap **Video outputs** to display the video output configuration menu.
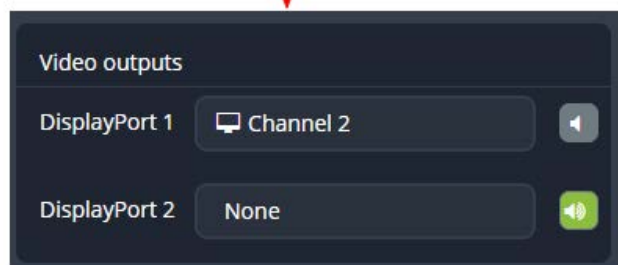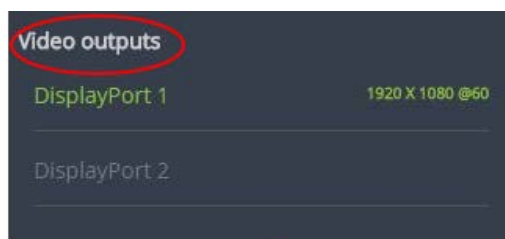
2. Tap the **text field beside the output port** and select a channel or source from the list.
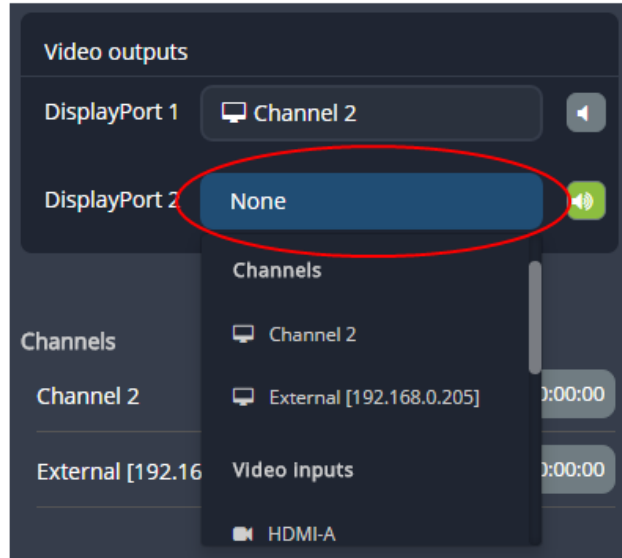
3. To enable or disable audio for the output port, tap the **speaker icon** to toggle audio On and Off for the port. A green icon means audio is enabled. A gray icon means audio is disabled.
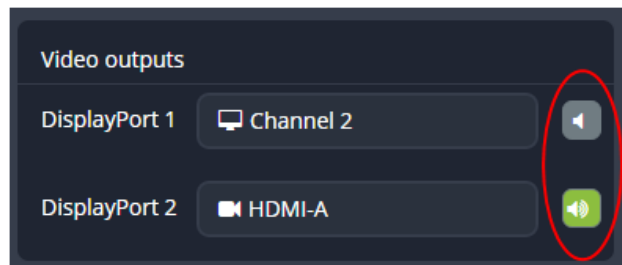
Control streaming and recording

From the Epiphan Live Dashboard, you can control streaming and recording for channels using the buttons in the **Channels** section. When a channel is not currently streaming or recording, the buttons are gray and their respective timers are set to 00:00:00. If streaming isn't configured for a channel, the streaming button displays as "Not set". See Streaming a channel direct to viewers to learn how to configure streaming for a channel using the Admin panel.

- The left-most button with the "signal" icon starts and stops streaming for the channel.

- The right-most button with the circle icon starts and stops recording for the channel.
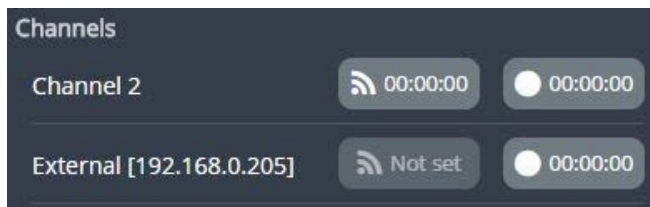
> If multiple streams are configured for a channel, a pair of control buttons is displayed for each stream.

Click the channel name to open a preview thumbnail view.
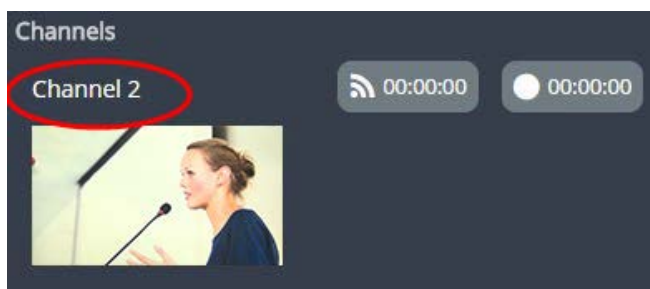
When you're ready to start streaming and recording the channel, tap the streaming and recording control buttons. Tap the buttons a second time to stop streaming and recording.

- The streaming button turns blue when the channel is streaming and the timer's clock increments.
- The recording button turns red when the channel is recording and the timer's clock increments.
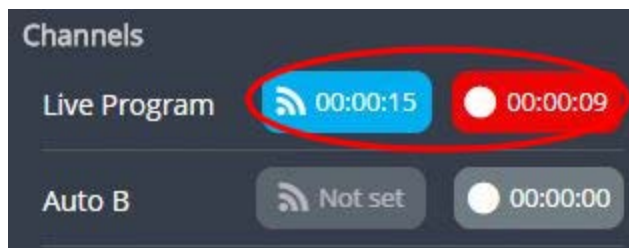
Streaming and recording control buttons also appear below the Dashboard monitoring panels when they're configure to display a channel. You can use those control buttons to start and stop streaming or recording for a channel too.
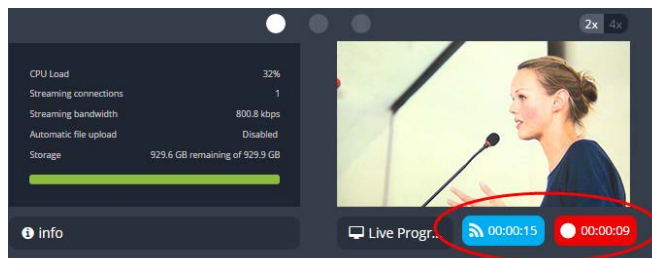
If the stream fails to publish, the streaming button flashes blue and displays "ERROR". Check the streaming settings for your channel using the Admin panel, see Streaming a channel direct to viewers.

Recording using multi-track recorders

From the Admin panel, you can create multi-track Recorders to capture multiple channels and audio sources in a single recording. You can then select which combination of video and audio sources to extract from the recording. This feature is useful when you're capturing a video source and multiple languages from different audio sources. Multi-track recorders appear on the Dashboard if they are configured on your Pearl.

Each multi-track recorder has a recording control button to start and stop recording. When a Recorder is not recording, the button is gray and the timer is set to 00:00:00. See Add a recorder to learn more about configuring multi-track recorders using the Admin panel.
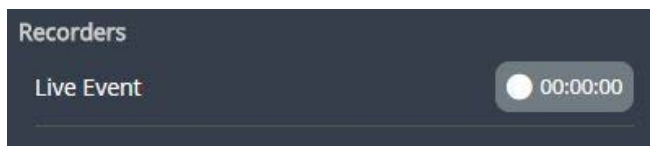
To start recording, simply tap the recording control button for that multi-track recorder. The button turns red when the multi-track recorder is recording and the timer's counter increments. Tap the button a second time to stop recording.
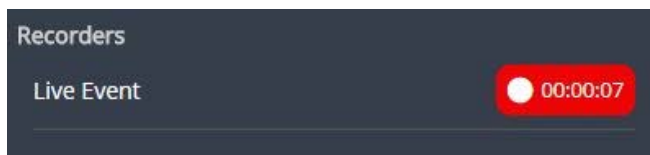
Switching / mixing using Epiphan Live

The Live Switcher view in Epiphan Live is a simple interface that lets you live switch between layouts while streaming and recording. To learn how to create different layouts for a channel using the Admin panel, see Add or edit a custom layout.

Switching between layouts using one of the switcher interfaces, such as the touch screen, does not dynamically update what you see in the other switching interfaces (i.e. Epiphan Live and the Admin Panel). You must manually refresh the other interfaces separately to reflect the current state.

Topics include:

- About the Switcher interface
- Switching / mixing using Epiphan Live
- Switching / mixing using the touch screen
- Switching / mixing using the Admin panel

About the Switcher interface

The Switcher interface is accessed from the Menu button in the top right corner of the Dashboard interface. See The Dashboard interface.
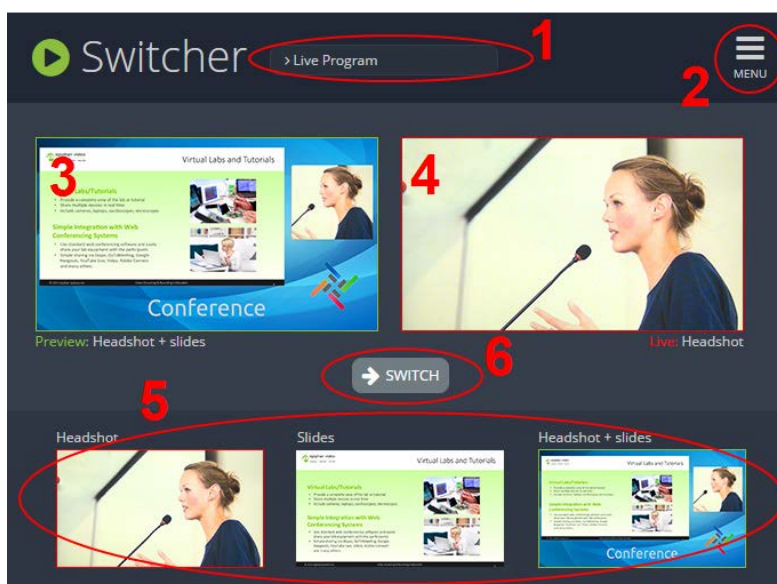
Table 18 *Elements in the Switcher view*

Number	Title	Description
1	**Channel selector**	A list of channels configured on your Pearl. When a channel is selected, you can switch between the different layouts that are configured for that channel.

Number	Title	Description
2	**Menu icon**	Displays links to the Dashboard view and the Admin panel when clicked.
3	**Preview panel**	Displays a preview of a selected layout, which is outlined with a green border. When you click the **Switch** button, this preview layout becomes the live layout. See Switching while live streaming and recording using Epiphan Live for more information.
4	**Live view panel**	Displays the active "live" layout that is currently being streamed or recorded. The live layout is outlined with a red border. When you select the **Switch** button, this live layout is replaced with the layout that's loaded in to the **Preview panel**.
5	**Layout carousel**	Displays small previews for all layouts contained within your selected channel. Select a layout from the carousel to add it to the **Preview panel**. Note that the layout selected for the **Preview panel** has a green border and the layout in the **Live panel** has a red border.
6	**Switch button**	When selected, the layout in the **Preview panel** replaces the layout in the **Live panel** and is immediately reflected in your active stream and recordings.

Switching while live streaming and recording using Epiphan Live

The Switcher interface lets you easily live switch between custom layouts with the simple press of a button.

To switch layouts while live streaming and recording:

1. Log in to Epiphan Live. The Dashboard view opens by default. See Access Epiphan Live using a web browser or mobile device.

2. Tap the **Menu** icon in the upper-right corner of the Dashboard screen and tap **Switcher** to open the Switcher interface.
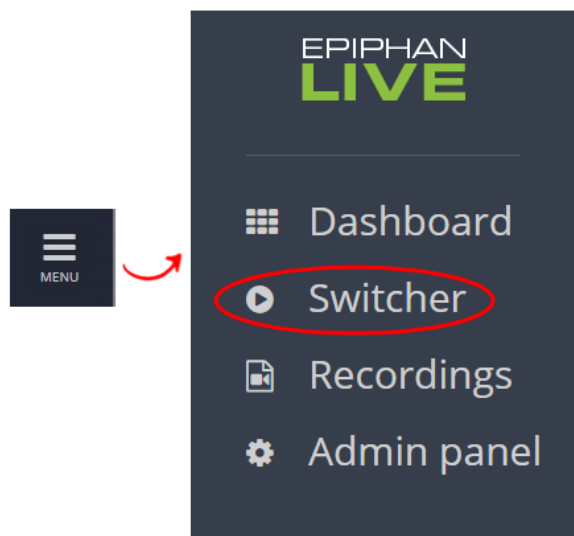
3. Tap the **field** beside the "Switcher" header and select a channel. The field is blank if this is your first time configuring the Switcher. Channels with only one layout are grayed-out and cannot be selected for switching.
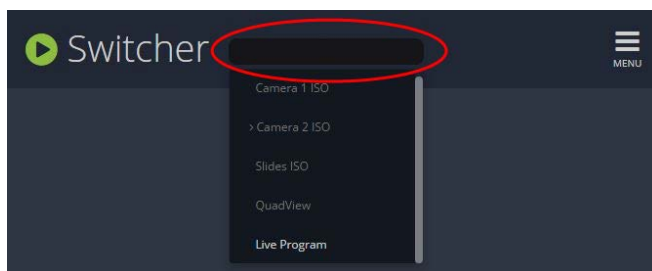
All the layouts for the selected channel are displayed in a carousel along the bottom of the screen. The layout that is live is displayed in the **Live panel** on the right side of the interface, see About the Switcher interface.
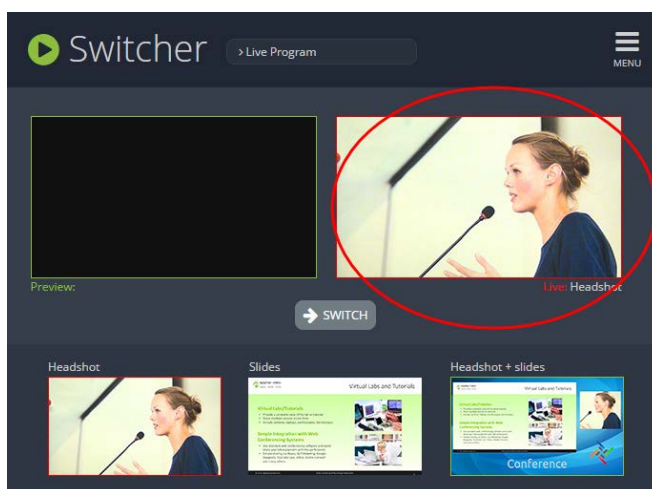
4. In the carousel, tap the layout that you want to switch to next. That layout is loaded into the **Preview panel**.
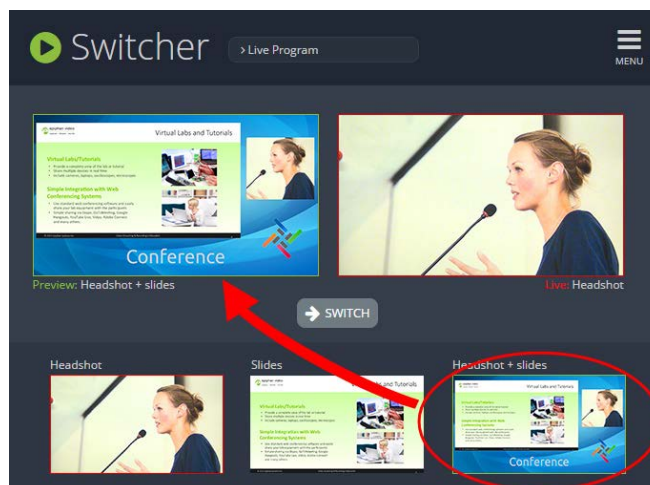
5. Tap the **Switch** button to switch the layout that is currently in the **Preview panel** to the **Live panel**. The layout that was in the Live panel moves to the Preview panel so that it's ready for the next time you switch.
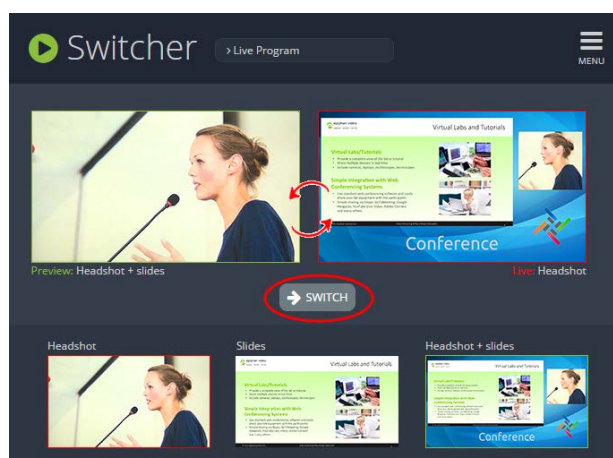
6. To load a different layout into the Preview panel, tap another layout in the carousel.

Your recordings

All recordings made using Epiphan Live are saved to the **Your recordings** panel.
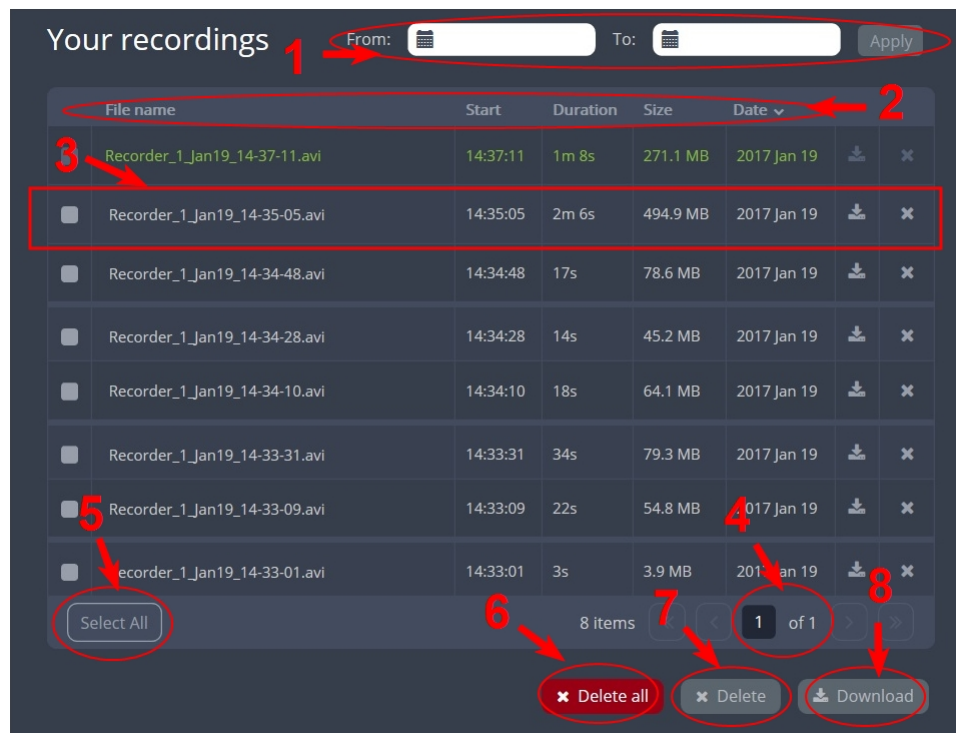
After recoding a file, you can manage it and any other files using the following tools on the page:

Number	Title	Description
1	**Date selector**	Select a **From** and a **To** date from the pop-up calendar to create a date range. Then tap **Apply**. Only recordings that were recorded within that time frame appear in the list below.
2	**File details**	Each heading in the list gives information about that category. Selecting **Date** organizes the list chronologically by the date the recording began.
3	**Files**	Each recorded file that falls within the search parameters appears in this list, including important metadata about the file. Tap or click on the file selects it so that it can be managed through the other tools on the page. You may also download or delete an individual file by using the action items at the end of the file line. Tap the file name to rename the file.
4	**Page indicators**	The page number indicates which page of results you are currently viewing, and how many pages of results are there. The buttons allow you to move between pages one at a time, or straight to the beginning or end of the list. You can also change which page you are on by typing a valid page number into the text box.

Number	Title	Description
5	**Select all**	Tap to select all files on the page.
6	**Delete all**	Tap to delete all files on the list. **Warning**: Deleted files can not be recovered.
7	**Delete**	Tap to delete all selected files. **Warning**: Deleted files can not be recovered.
8	**Download**	Click this button to download all selected files to your local hard drive.

Remote login access

Securely login to the cloud versions of the Admin panel and Epiphan Live remotely from anywhere you have
Internet access. Perform off-site rescue troubleshooting, channel configuration, control streaming, recording,
and more using your favorite web browser over a secure connection to the Internet. You don't need to be on
the same, local network as Pearl. This section contains what you need to remotely access Pearl.

Topics include:

- About remote login and control

- Enable or disable AV Studio for remote login

- Pair and unpair Pearl from AV Studio

- Access cloud versions of the Admin panel and Epiphan Live

See The Admin panel and Epiphan Live for details about how to use these interfaces and how to access the
local web versions.

About remote login and control

Perform secure remote rescue troubleshooting, channel configuration, and more when you pair Pearl to your
free AV Studio account. Remote login access to your Pearl is available as soon as you pair Pearl to AV Studio,
see Pair and unpair Pearl from AV Studio.

From AV Studio, you can access the cloud versions of the Admin panel or Epiphan Live to securely control
recording and do everything you'd normally do using the Admin panel or Epiphan Live, see Access cloud
versions of the Admin panel and Epiphan Live.

You can see if Pearl is paired from the AV Studio status page using the Admin panel . A simple, clickable link
pairs Pearl to your AV Studio team. All you need to do is login.
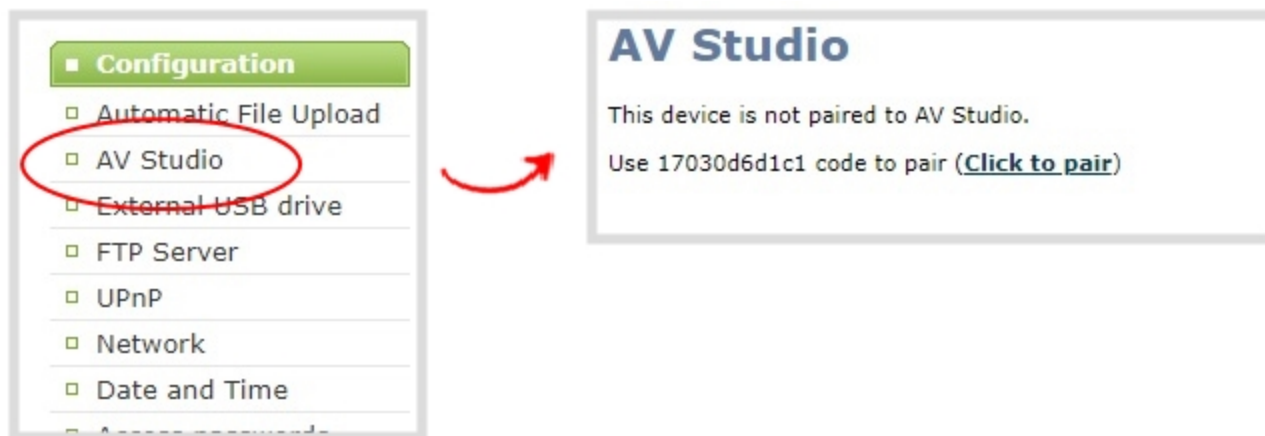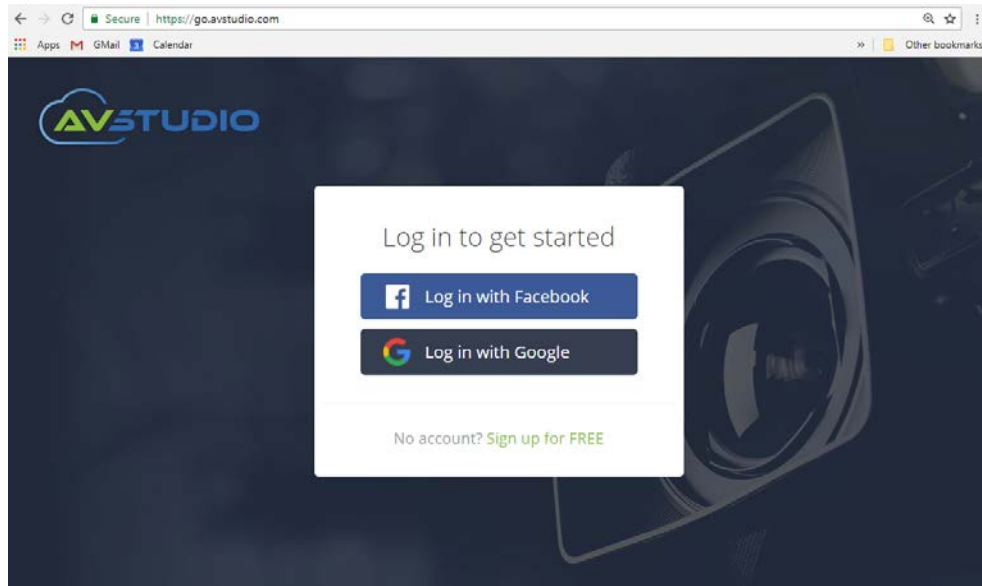
Important considerations

- Pearl stays paired until you manually unpair.

- Unpairing Pearl in AV Studio causes Pearl's encoder entry in AV Studio to permanently go offline. You must pair Pearl again to use AV Studio to remotely login to Pearl.

- If you pair Pearl again after you have successfully unpaired from AV Studio, a new encoder instance is created in AV Studio. The previous encoder instance for Pearl remains permanently offline.

- Disabling the AV Studio feature on Pearl using the Admin panel while Pearl is paired to AV Studio causes Pearl's encoder entry in AV Studio to permanently go offline.

For information about how to use AV Studio and perform quick, low touch video editing and deliver the rendered recordings conveniently from the cloud, see Using AV Studio to control Pearl.

Enable or disable AV Studio for remote login

Pairing Pearl to your AV Studio account for remote login and control is enabled by default. You can disable the AV Studio feature for remote login using the Admin panel and enable it again at a later time.

Important considerations

- Unpair Pearl from AV Studio before disabling AV Studio using the Admin panel.

- If you disable AV Studio access while Pearl is paired, the encoder instance in AV Studio goes permanently offline. For more information about encoder conditions and pairing, see Pair and unpair Pearl from AV Studio.

To enable or disable pairing Pearl with AV Studio:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, click **Maintenance**. The Maintenance page opens.

3. Uncheck **Enable AVStudio** to disable AV Studio remote login or leave it checked to use this feature with Pearl, then click **Save**.
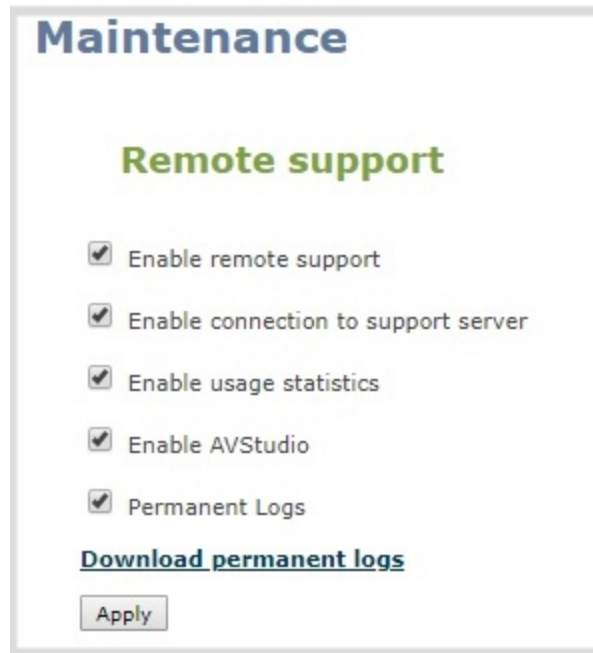
Pair and unpair Pearl from AV Studio

To use the remote login feature, you must pair Pearl to AV Studio. An AV Studio account is needed. You can sign up for a free AV Studio account the first time you pair Pearl. For more information, see Using AV Studio to control Pearl.

You can pair Pearl directly using the Admin panel or you can add Pearl as an encoder manually from within AV Studio by entering Pearl's device ID paring code. To add Pearl as an encoder manually in AV Studio, go to the AV Studio online user guide.

You can unpair Pearl using either the Admin panel or directly within AV Studio. Each time you unpair Pearl, the device ID pairing code changes value. When you pair Pearl again, a new encoder instance is created with the new device ID.

Important considerations

- Pearl's encoder entry in AV Studio permanently goes offline when you unpair. You must pair Pearl again to use AV Studio to remotely login to Pearl.

- If you pair Pearl again after you have successfully unpaired from AV Studio, a new encoder instance is created in AV Studio. The previous encoder instance for Pearl remains permanently offline; however, you can still access all recordings and scenes for the offline encoder instance.

> You can still access recordings that were previously uploaded and any scenes that were previously created for a Pearl encoder instance that is permanently offline in AV Studio.

To pair and unpair Pearl:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, select **AV Studio**. The AV Studio status page opens. The pairing code device ID for Pearl is shown, as well as a link to pair the device.
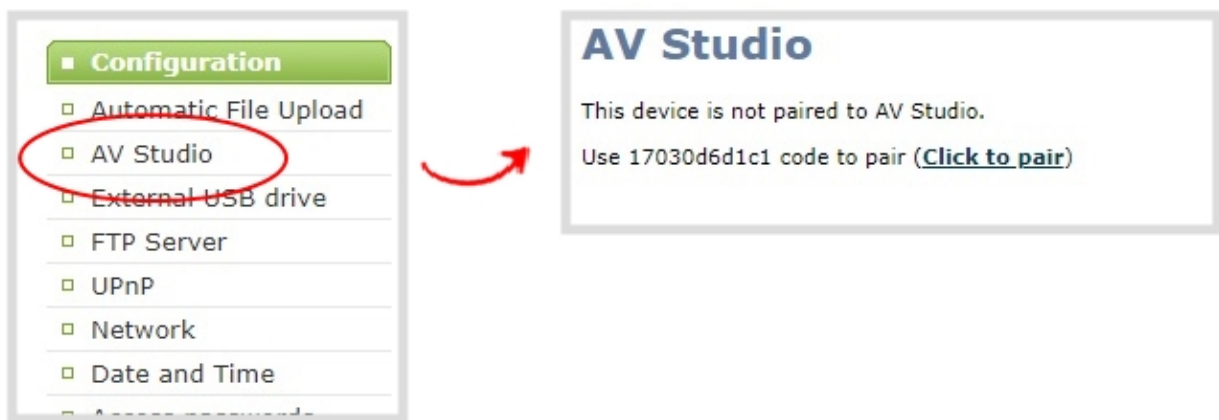
3. Select **Click to pair**. The AV Studio login page opens in a new tab (https://go.avstudio.com)

4. Login to your existing AV Studio account or sign up for a free account.

5. After you've logged in to AV Studio, select a team that's associated with your AV Studio account. Your default AV Studio team is selected by default. Then click **Pair encoder**. Your Pearl is now paired to your AV Studio team and is listed on the Encoders page in AV Studio.
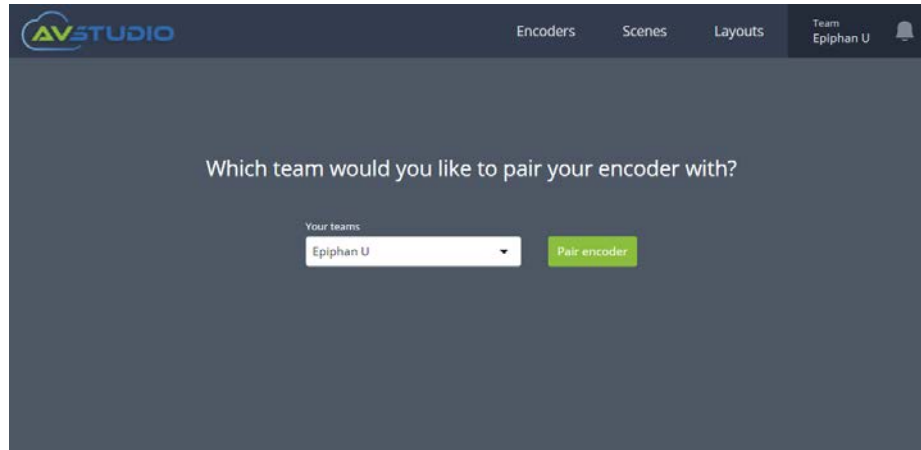
6. In the Admin panel, the status of Pearl updates to **paired** on the AV Studio status page. To unpair Pearl, select **Unpair**.
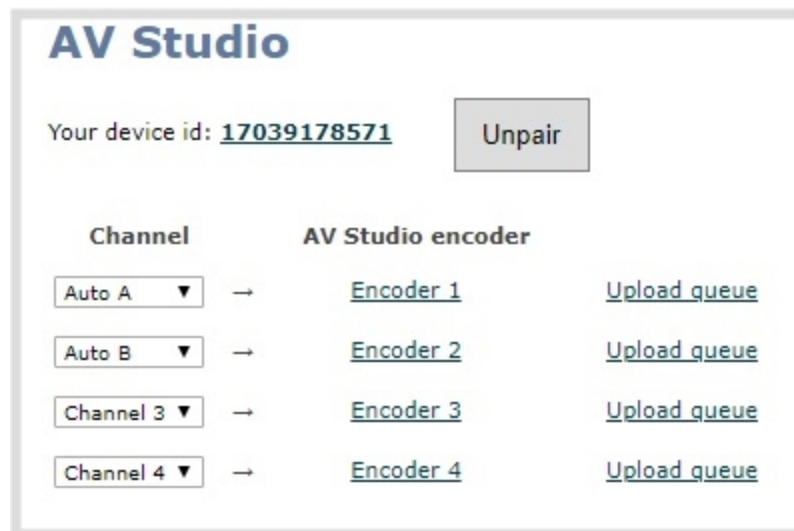
Access cloud versions of the Admin panel and Epiphan Live

Perform remote configuration and rescue troubleshooting using the cloud version of the Admin panel. It's really convenient to remotely control live switching, recording, and streaming from anywhere using the cloud versions of Epiphan Live and the Admin panel.

You can access the cloud versions of the Admin panel and Epiphan Live from any location that has access to the Internet after you've paired Pearl to AV Studio, see Pair and unpair Pearl from AV Studio.

After you've logged in to the cloud Admin panel, you can open the cloud version of Epiphan Live. The same login credentials are used for both the local web-based and the cloud-based versions.

> The URLs of the local web versions of the Admin panel and Epiphan Live are not the same as the URLs of the cloud versions.

To access the cloud versions of the Admin panel and Epiphan Live:

1. Login to your AV Studio account at https://go.avstudio.com

2. In the top header bar, click **Encoders**. The list of encoders opens.

3. Click **Remote login** beside the Pearl encoder entry. A new tab with the cloud Admin panel login opens in your browser.
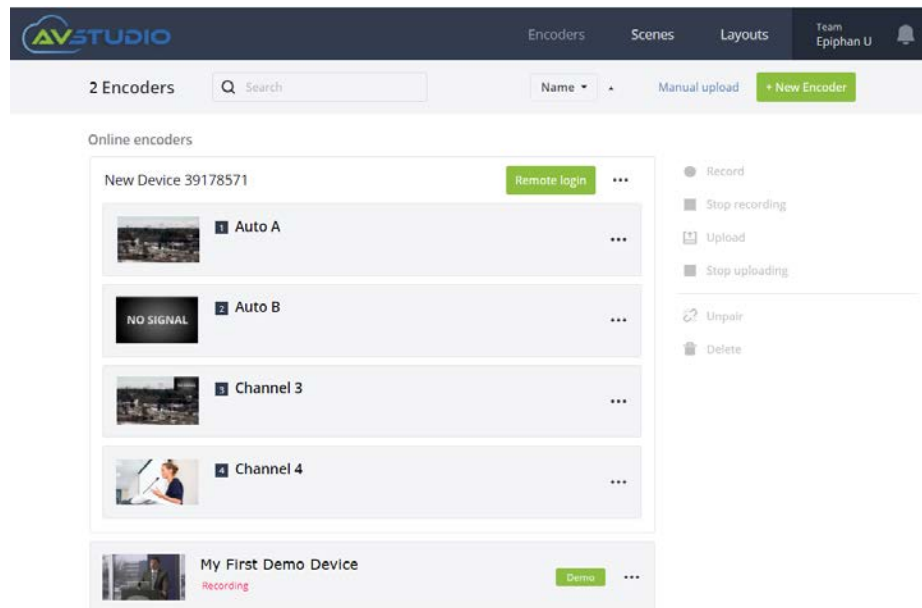
4. Enter your Admin panel login credentials to log in to the cloud version of the Admin panel . The default administrator username is **admin**.

5. Click **Epiphan Live** in the upper-right corner. The Epiphan Live dashboard opens in a new tab.


See The Admin panel and Epiphan Live for details about how to use these interfaces or how to access the local web versions.

Using AV Studio to control Pearl

When Pearl is paired with AV Studio, teams can use AV Studio to remotely control video recording on Pearl and do quick, low touch editing for fast turn around and cloud delivery of recorded conferences, break out room sessions, seminars, and more.

Topics include:

- Select channels for remote control
- Control recording using AV Studio
- View and download AV Studio recordings locally
- Configure channel encoding using AV Studio

For more information about AV Studio, see the AV Studio online user guide.

About using AV Studio to control Pearl

AV Studio is a cloud-based video production platform that lets teams remotely control video encoders like Pearl. Using AV Studio, you can control recording and do quick, low touch editing for fast turn around and cloud delivery of recorded conferences, break out room sessions, seminars, and more.

When Pearl is paired with AV Studio, you can:

- Preview channels remotely.
- Start and stop channel recording directly in AV Studio.
- Upload and post process recordings using the AV Studio Scene Editor. Some costs are incurred when uploading recordings to a pay-as-you-go AV Studio account.
- Render and share recordings with others from the cloud.
- Change video and audio encoding settings for a channel.
- Access cloud versions of the Admin panel and Epiphan Live for remote login and control, see Access cloud versions of the Admin panel and Epiphan Live.

For more information about AV Studio, see the AV Studio online user guide.

Important considerations

- Channels that you record directly using AV Studio are not saved to the same location as recordings you make for the channel using the Admin panel or Epiphan Live. The AV Studio upload queue is accessed from the AV Studio page using the Admin panel.

- Until the recordings are uploaded to AV Studio, they are available for downloading to a locally connected admin computer. After recordings are uploaded to AV Studio, they are no longer available locally on Pearl.

- Recordings do not automatically upload to AV Studio by default. You can manually start uploading using AV Studio. Once uploading is enabled, recordings continue to upload automatically until you select stop uploading.

- Some costs are incurred when uploading recordings to a pay-as-you-go AV Studio account.

- The following actions cause Pearl's encoder entry in AV Studio to permanently go offline. You must pair Pearl again to remotely control recording using AV Studio or to change the encoding settings using AV Studio.

    - Unpairing Pearl in AV Studio.

    - Using the Admin panel to disable the AV Studio feature on Pearl while the device is paired to AV Studio.

- If you pair Pearl again after you have successfully unpaired from AV Studio, a new encoder instance is created in AV Studio. The previous encoder instance for Pearl remains permanently offline.

> You can still access recordings that were previously uploaded and any scenes that were previously created for a Pearl encoder instance that is permanently offline in AV Studio. Deleting an offline encoder instance in AV Studio removes all uploaded recordings and scenes that were created for that encoder.

Select channels for remote control

When Pearl is paired to AV Studio, up to four channels configured on Pearl are automatically listed on the AV Studio status page in the Admin panel. The listed channels can be remotely controlled from AV Studio just like separate encoders for as long as Pearl is paired.

You can easily change which channels are listed and deselect channels to prevent them from being remotely controlled using AV Studio.

Important considerations

- If you use the Admin panel to delete a selected channel while Pearl is paired, no channel appears selected. However, you can still access any recordings or scenes that were created with that channel in AV Studio.

- When you select or change channels using the Admin panel, the changes are automatically reflected in AV Studio.

> Updates may take a little time to show in AV Studio. Refresh your browser to see the updated status.

To select channels for remote control:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, select **AV Studio**. The AV Studio status page opens.

3. From the Channel drop down menu, select a different channel. The status of the channels update on the AV Studio status page in the Admin panel and in the AV Studio interface.
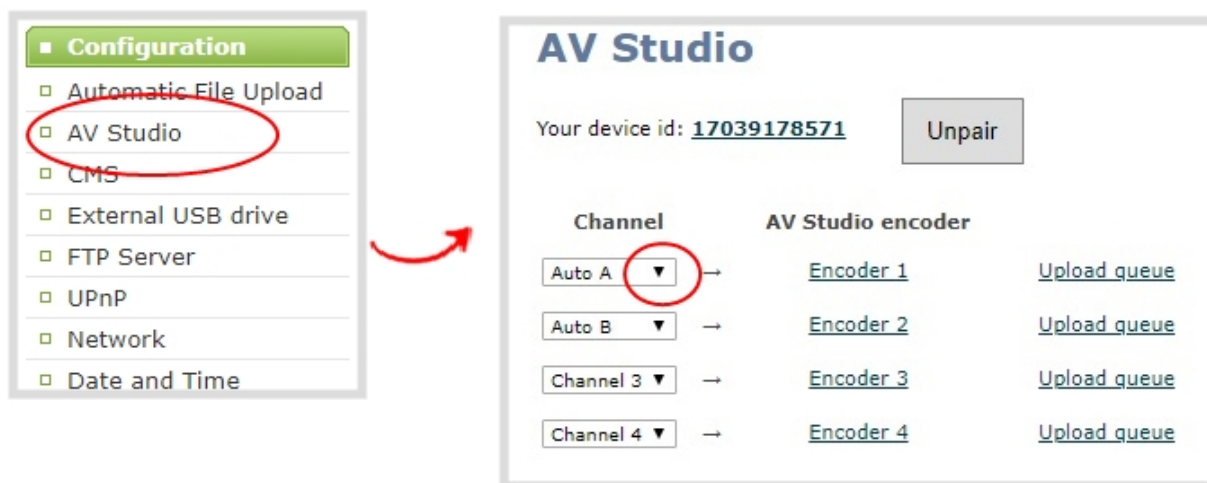
Control recording using AV Studio

You can remotely start and stop recording the channels on Pearl directly in AV Studio from either the Encoders page or from the Encoder's detailed status page.

Important considerations

- Recordings do not automatically upload to AV Studio by default. You can manually start uploading using AV Studio. Once uploading is enabled, recordings continue to upload automatically until you select stop uploading.

- Some costs are incurred when uploading recordings to a pay-as-you-go AV Studio account.

- If you use the Admin panel to delete a selected channel while Pearl is paired, no channel appears selected. However, you can still access any recordings or scenes that were created with that channel in AV Studio. To select another channel, see Select channels for remote control.

> Updates may take a little time to show in AV Studio. Refresh your browser to see the
> updated status.

To start and stop recording using AV Studio:

1. Login to your AV Studio account at https://go.avstudio.com

2. In the top header bar, click **Encoders**. The list of encoders opens.

3. Select the row for the channel you want to record and do one of the following:

   a. Click **Record** in the right-side panel. When you're done recording, click **Stop recording**.
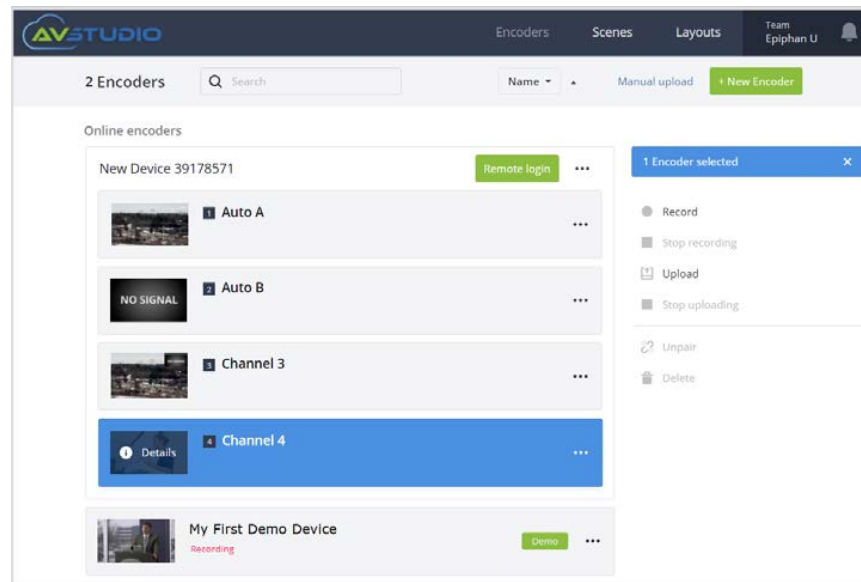
   b. Click **Details** in the thumbnail or click the three dots and choose **Details**. The Encoder Status page opens.

   c. From the Encoder Status page, click **Start recording** to remotely start recording the channel on Pearl. The button changes to **Stop recording**. When you're ready to stop recording the channel, click **Stop recording**.
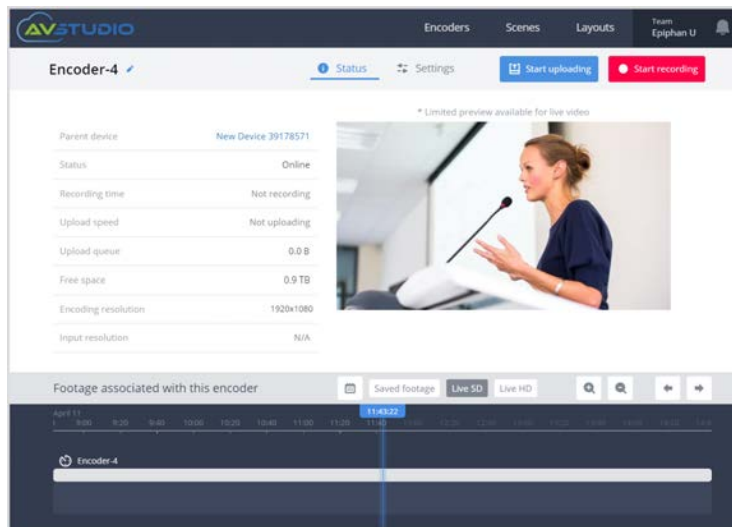
View and download AV Studio recordings locally

Channels that you record directly using AV Studio are not saved to the same location as recordings you make for the channel using the Admin panel or Epiphan Live. A different queue is used, called the AV Studio upload queue. The AV Studio upload queue lists recordings that are stored locally on Pearl that have not yet been uploaded to AV Studio.

To see the AV Studio upload queue, Pearl must be paired to AV Studio. Recordings listed in the upload queue can be download locally to your admin computer if the files have not yet uploaded to AV Studio. The AV Studio upload queue is accessed from the AV Studio page using the Admin panel.

> **STOP** Recordings are permanently removed from Pearl after the files are uploaded to AV Studio. For more information about AV Studio, see the **AV Studio online user guide**.

Important considerations

- Pearl must be paired to AV Studio to view the AV Studio upload queue using the Admin panel.

- Recordings do not automatically upload to AV Studio by default. You can manually start uploading using AV Studio. Once uploading is enabled, recordings continue to upload automatically until you select stop uploading.

- After recordings are uploaded to AV Studio, the local copy on Pearl is permanently removed.

- Some costs are incurred when uploading recordings to a pay-as-you-go AV Studio account.

- If you use the Admin panel to delete a recording that is listed in the AV Studio upload queue before the file has uploaded, the recording is permanently deleted.

To view and download AV Studio recordings locally using the Admin panel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, select **AV Studio**. The AV Studio status page opens.
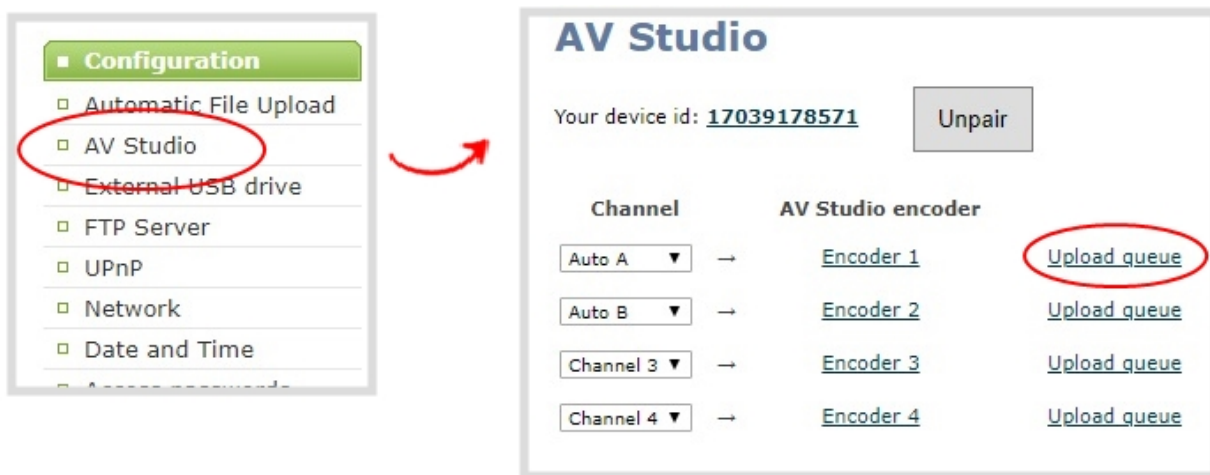
3. Select **Upload queue**. The AV Studio upload queue page opens. To download recordings to your admin computer, select the download icon.
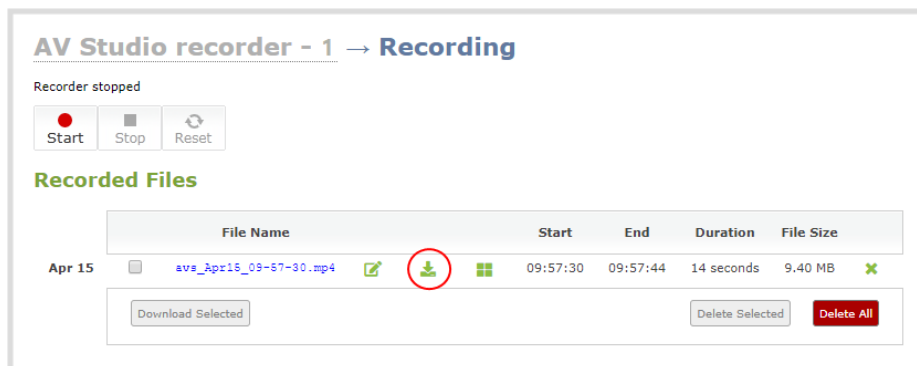
Configure channel encoding using AV Studio

You can remotely configure certain video and audio encoding settings for a channel using AV Studio for Pearl when it is paired with AV Studio. You can set:

- **Frame size**: Manually select a fixed resolution for the channel to use when streaming, recording, and for output to a confidence monitor. Options include 1920×1080, 1280×720, and 640×360. For more options and custom frame size settings, use the Admin panel, see Configure encoding.

- **Video bitrate**: If using the H.264 video codec, you can increase or decrease image quality by increasing or decreasing the channel's **Bitrate** value. Video with a high level of motion and high resolution, such as sporting events, requires a higher bitrate.

- **Frame rate**: Enter a specific video frame rate for your channel. The default is 30 fps.

- **Enable audio**: Select to include audio from this channel.

- **Audio preset**: Choose the audio encoding for the channel. The default encoding is AAC 48 kHz.

- **Audio bitrate**: Manually select a bitrate for the audio when streaming and recording the channel. For stereo audio, we recommend 254 kbps or 360 kbps.

- **Audio channels**: You can set the channel's audio to stream and record in stereo or mono.
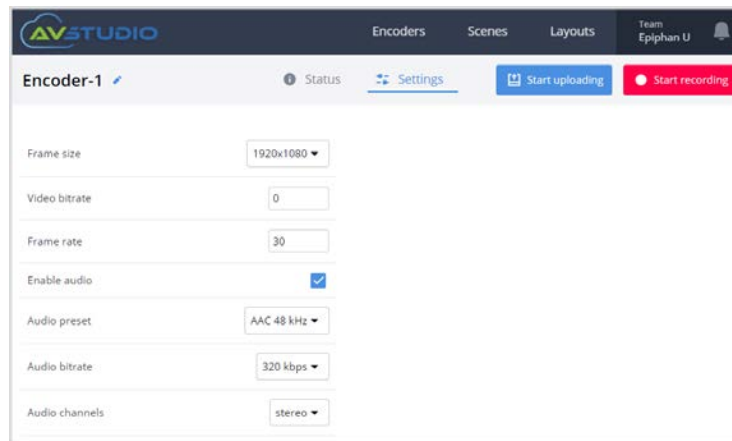
> Choose **Mono** to have left and right stereo channels combined so that when you listen to the streamed or recorded audio, the same blended sound comes through both the left and right channels.
>
> If you have only one mono analog input, use the left TRS jack and select mono encoding to have the same sound come from both the left and right channels. (If stereo sound is chosen, the sound will only come through on the left channel.)

To configure channel encoding using AV Studio:

1. Login to your AV Studio account at https://go.avstudio.com
2. In the top header bar, click **Encoders**. The list of encoders opens.
3. Select the row for the channel and click **Details** in the thumbnail or click the three dots and choose **Details**. The Encoder Status page for that channel opens.
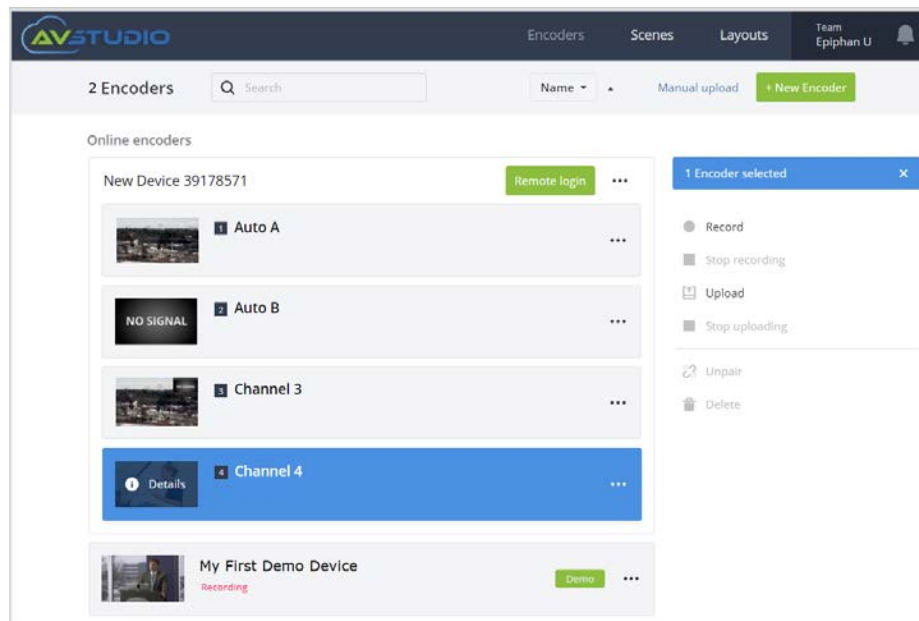
4. Select the **Settings** tab to configure the encoder settings for the channel. The channel settings on Pearl change automatically after you select the new values here.

> The amount of time it takes for the selected option to update on the Settings tab depends on the speed of your Internet connection and how often your connection refreshes. Allow some time for the selected option to update.

PART 1: Setup

This section contains tasks that are needed to get your Pearl configured to connect to your local network, make system settings, add passwords, make backups of your configuration, and covers how to access status information and monitor the performance of your Pearl.

Topics include:

- Rackmount installation
- Configure network settings
- Configure network security
- Configure date and time
- Configure device info, name, description, and location
- Audio input ports
- Video output ports
- Configuration presets
- User administration
- Status and monitoring

For information about integrating Pearl with Content Management Systems (CMSs) like Panopto and related administrator tasks, see Integration.

Rackmount installation

All Pearl models can be used in desktop mode, with the system placed on any flat, stable surface. They are also all rackmountable into fixed racks or portable rack cases like the one depicted below.

If you purchased Pearl Rackmount or Pearl Rackmount Twin, you can install your system directly into a 19-inch rack. For the smaller, portable Pearl model, you can purchase our optional rackmount shelf for installation in a rack. (Instructions for the rackmount shelf are included with the shelf.)

To install Pearl Rackmount or Pearl Rackmount Twin in a 19-inch rack:

1. Ensure you have the correct bolts needed for your rack (not included). Pearl's rackmount holes are sized to work with both threaded and non-threaded mounting systems.

2. Carefully slide the system into and available 2U space in your 19-inch rack.

3. Attach four bolts as shown below.
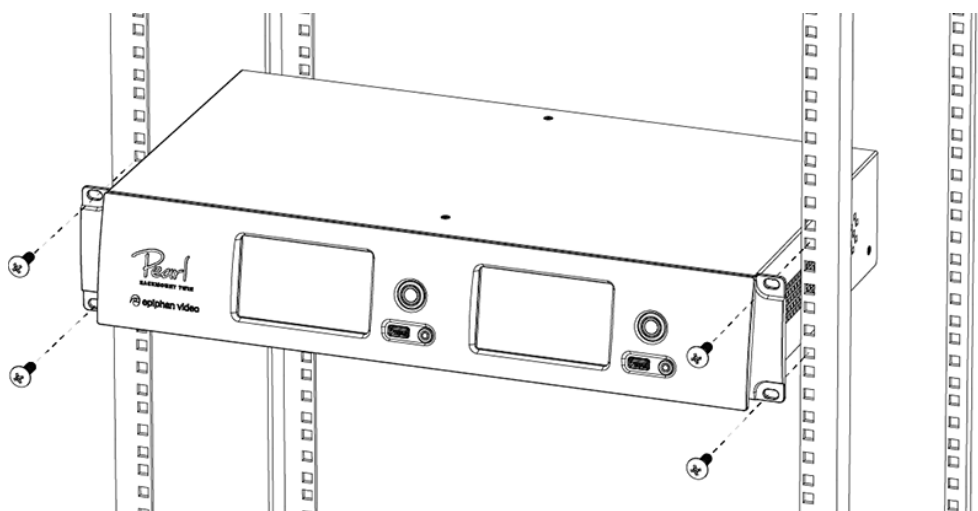
Configure network settings

Pearl uses DHCP to obtain an IP Address over an Ethernet-based network by default; however, you can easily change the network settings.

Topics include:

- Network ports used by Pearl
- Verify IP address and MAC address of Pearl
- Configure a static IP address
- Configure DHCP
- Change the HTTP/HTTPS port values
- Perform network diagnostics

To monitor network status information, see View network status

To set up traffic shaping for multicast streams, see Set up traffic shaping.

Network ports used by Pearl

The following table lists the default incoming and outgoing network ports that Pearl uses.

Do not block traffic over these ports. If you want Pearl to operate properly, make sure that your firewall is configured to open these ports. Blocking a port will cause the service that uses that port to fail. It is possible to use the Admin panel to change the default ports that are used for some services.

Table 19 *Default incoming network ports for Pearl*

Port (or range)	Protocol	Description
21	TCP	FTP server, if enabled. See Local FTP server.
22	TCP	SSH for remote support. See Support.
80	TCP	HTTP/HTTPS for web-based access to the Admin panel and Epiphan Live, HTTP/HTTPS API, REST API, HLS streaming (if enabled) and the live channel preview. You can change the default HTTP port value using the Admin panel, see Configure HTTPS.
123	TCP/UDP	NTP server, if enabled. See Configure a time server.
319 and 320	UDP	PTP server, if enabled. See Configure a time server.

Port (or range)	Protocol	Description
443	TCP	HTTPS for the Admin panel and HLS streaming if enabled. Port is open only when HTTPS is enabled. You can change the default HTTPS port value using the Admin panel, see Configure HTTPS.
554 to 554+(x-1)	TCP	For RTSP/TCP and RTSP/HTTP streaming on your network (where x is the number of channels configured). The number of ports used depends on how many channels you have with RTSP streaming enabled. See Share a live broadcast stream (HTTP, HTTPS or RTSP). Note that client video players choose whether they are using RTSP/TCP, RTSP/HTTP or RTSP/UDP. Ports 554 and 555 are also used for internal communications. If streaming is disabled, these ports remain open but refuse all external connection requests.
Random in range 32768 - 61000	UDP	If the client video player chooses RTSP/UDP, it will negotiate 4 random UDP ports (two for audio and two for video). The port range is dependent on the OS of the client video player and can change with updates to that OS.
1900	UDP	UPnP server for UPnP discovery, if enabled. See Stream using UPnP.
Random in range 50000 to 65000	TCP	UPnP media server, if enabled. Each time the UPnP server is started, a random TCP port in this range is used to enable connections with other UPnP devices.
5353	UDP	For multicast DNS discovery. See Connect using a DNS-based service discovery.
8000 to 8000+(x-1)	TCP	For Flash (FLV) live stream and MPEG-TS streaming on your network (where x is the number of channels configured). The number of ports used depends on how many channels you have with streaming enabled. See Share a live broadcast stream (HTTP, HTTPS or RTSP). Ports 8000 and 8001 are also used for internal communications. If streaming is disabled for the channel from the Channel > Streaming , these ports remain open but refuse all external connection requests.

In addition to the incoming ports, Pearl uses some outgoing connections as follows:

- **Port 80** - used for firmware update checks and downloads.
- **Publishing/streaming port** - the actual ports used for streaming to a server depends on the server and protocol used. See Streaming to servers, CDNs, and other devices
- **AFU file recording transfer port** - for actual ports used for AFU depends on your configuration. See FTP and automatic file transfers

Verify IP address and MAC address of Pearl

There are two ways to view the current IP address and MAC address of your Pearl:

- From the Network configuration page using the Admin panel.
- From the Settings menu using the touch screen on Pearl.

Table 20 *Network Information*

Item	Description/Options
MAC Address	A media access control address (MAC address) is a unique identifier for the network interface. The value is read-only and cannot be changed. You may need to share this value with your system administrator.
Current IP Address	Reflects the current internet protocol address (IP address) of the system. This value is either obtained from the DHCP server (if using DHCP) or is the configured static IP address. Pearl supports IPv4 addresses. It does not support IPv6 addresses.

To view network information using the Admin panel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.
2. From the Configuration menu, click **Network**. The network configuration page opens.

IP Configuration for eth0

MAC address is 00:55:56:55:52:5f

Current IP address is 192.168.1.208

To view network information using the touch screen:

1. Tap the **gear** icon to open the System settings screen. If the control icons aren't showing, tap anywhere on the touch screen.
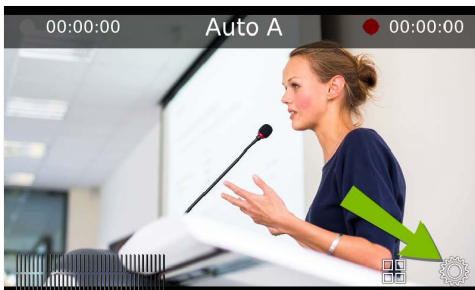
2. Tap **System Status** to see the System Status page.

3. Tap **Back** to return to the **System Settings** screen, or the **Home** icon to return to the channel view.

> If the system settings control icon won't appear when you tap the touch screen, it may be disabled. See **Configure the touch screen** to enable system information.

Configure a static IP address

There are two ways you can set up Pearl to use a static IP address:

- From the Network configuration page using the Admin panel.
- From the Settings menu using the touch screen on Pearl

TIP: Using the touch screen, you can choose to apply a configuration preset that contains a static network IP. See Configuration presets.
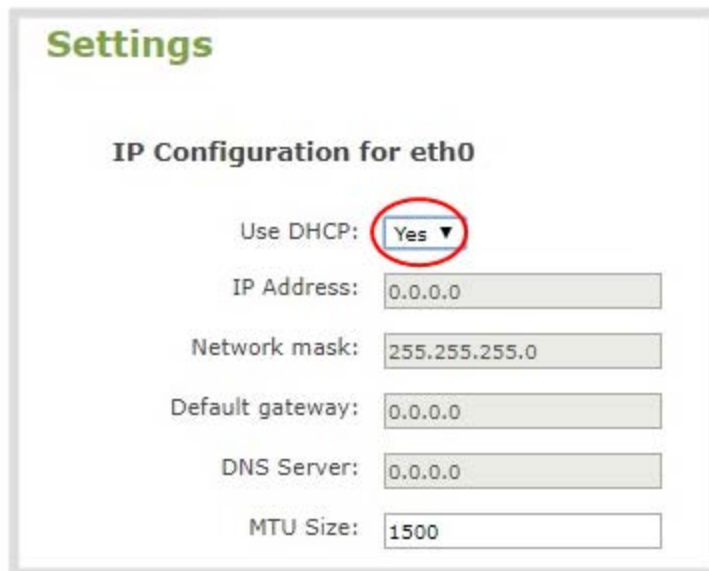
> Only IPv4 addresses are supported. Pearl does not support IPv6.

To configure a static IP address using the Admin panel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, select **Network** . The Network configuration page opens.

3. Choose **No** from the **Use DHCP** drop-down and enter your networking information in to the required fields. Click **Apply** when you're done.

Settings

IP Configuration for eth0

Use DHCP:	Yes ▼
IP Address:	0.0.0.0
Network mask:	255.255.255.0
Default gateway:	0.0.0.0
DNS Server:	0.0.0.0
MTU Size:	1500

Table 21 *Static IP Address Fields*

Label	Description
Use DHCP	Select **Yes** to dynamically obtain an IP address at boot up or select **No** to use the configured static IP address.
IP Address	The internet protocol address (IP Address) to assign. Obtain this from your network administrator. Pearl supports IPv4 addresses. It does not support IPv6 addresses.
Network Mask	Also called the subnet mask, this value denotes a range of IP addresses. Obtain this from your network administrator, from another computer on the same subnet, or calculate the value using an online subnet calculator.
Default gateway	The network node that serves as an access point to the rest of the network. This value cannot be blank unless you are using DCHP. Specify the system's IP address if you don't have a default gateway on your network.
DNS Server	The domain name system server (DNS server) translates human-readable hostnames into corresponding IP addresses. Specify the system's IP address if you don't have a DNS server on your network. This value cannot be blank unless you are using DHCP.
MTU Size	The maximum transmission unit (MTU) specifies the maximum packet size for transfer on the network. The default value is 1500, which is the largest value allowed

Label	Description
	by Ethernet at the network layer. It's best for all nodes in your network to use the same value. Only change the MTU value if you know that other nodes use a different value.

> 🛑 The default gateway and DNS Server fields cannot be left blank. If you do not have a default gateway or a DNS server for your network, enter the static IP address in those fields.

4. Reboot Pearl when prompted. From the Configuration menu, select **Maintenance** and click **Reboot Now** on the Maintenance page.

5. After the system has finished rebooting, use the new IP address to log back in to the Admin panel as **admin** and verify that all changes were applied.

To configure a static IP address using the touch screen:

1. Tap the **gear** icon to open the System settings screen. If the control icons aren't showing, tap anywhere on the touch screen.

2. Tap **Network**. The Network settings page opens. The currently enabled network type (DHCP or static) is highlighted green.
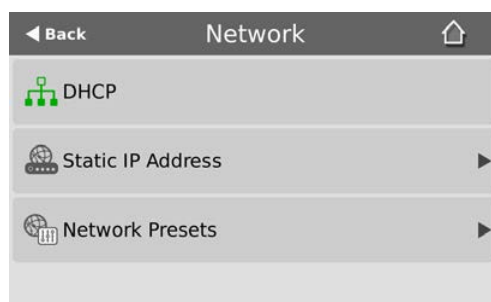
3. Tap **Static IP Address**. The Static IP Address configuration page opens.

4. Tap a segment of the **IP Address** (e.g. 192) to select it and use the keypad to enter a new static IP address. Continue to enter your Network Mask, Default Gateway, and DNS server information. Tap

Apply when you're done.

> 🛑 The default gateway and DNS Server fields cannot be left blank. If you do not have a default gateway or a DNS server for your network, enter the static IP address in those fields.

Configure DHCP

If you need to switch Pearl from using static IP address allocation to using dynamic allocation with DHCP, you can do this three different ways:

- Restore factory settings, which clear all your custom settings. See Perform a factory reset.
- Load a configuration preset file that uses DHCP networking. See Apply a configuration preset using the Admin panel or Apply a configuration preset using the touch screen.
- Change the network settings manually using either the touch screen or the Admin panel.

To manually select DHCP as the network type using the touch screen:

1. Tap the **gear** icon to open the System settings screen. If the control icons aren't showing, tap anywhere on the touch screen.

2. Tap **Network**. The Network settings page appears. The currently enabled network type (DHCP or static) is highlighted green.

3. Tap **DHCP**, and then tap **OK** to confirm.

To manually select DHCP as the network type using the Admin panel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

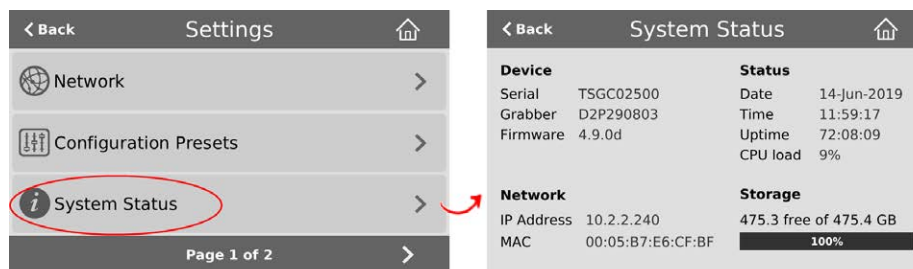2. From the Configuration menu, select **Network**. The Network configuration page opens.

3. Choose **Yes** from the **Use DHCP** drop-down and change the **MTU Size** if needed, then click **Apply**.

Table 22 DHCP Fields

Label	Description/Options
Use DHCP	Select this option to dynamically obtain an IP address at boot up using DHCP
Use static address	Only select this option if you ant to use the configured static IP address instead.
MTU Size	The maximum transmission unit (MTU) specifies the maximum packet size for transfer on the network. The default value is 1500, which is the largest value allowed by Ethernet at the network layer. It's best for all nodes in your network to use the same value. Only change this value if you know that other nodes use a different value.

4. Reboot Pearl when prompted. From the Configuration menu, select **Maintenance** and click **Reboot Now** on the maintenance page.

5. After the system has finished rebooting, log back in to the Admin panel as **admin** and verify that all changes were applied.

Change the HTTP/HTTPS port values

On Pearl, the default HTTP port is 80 and the default HTTPS port is 443. If the default ports used by Pearl are not available on your network, you can change them using the Admin panel. Consult your system administrator for the correct port values to use for HTTP and HTTPS traffic.

> Ensure that the port value you choose is unique and is not currently assigned on Pearl, see **Network ports used by Pearl**.

To change the HTTP/HTTPS port values using the Admin panel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, select **Security**. The Security configuration page opens.

3. Under HTTPS configuration, change the default HTTP and HTTPS port numbers. Click **Apply** when you're done.

HTTPS configuration

☑ Secure connection (HTTPS)

HTTP port: `80`   (HTTP redirects to HTTPS port when HTTPS is enabled)

HTTPS port: `443`

Current Certificate: Built-in self-signed certificate   [Restore default certificate]

Certificate info: Issuer: O=Epiphan Video, Subject: O=Epiphan Video, From: 08/09/2016 To: 08/07/2026, Valid

New certificate: [Choose File] No file chosen

Private Key: [Choose File] No file chosen

[Apply]

> **Secure connection (HTTPS)** must be checked before you can change the HTTPS port.

4. Reboot Pearl when prompted. After the system has finished rebooting, log back in to the Admin panel as **admin** and verify that all changes were applied.

Perform network diagnostics

You can perform basic network troubleshooting tasks from the Network configuration page using the Admin panel. To troubleshoot networking issues yourself, gather the IP address and MAC address of your Pearl and

try to ping the IP address or use traceroute to determine the path taken to the IP address. However, note that not all networks support ping and traceroute.

If you are unable to resolve your networking issues, contact your network administrator and provide them with the IP address and MAC address of your Pearl; otherwise, contact Epiphan Video support for assistance.

To ping or traceroute an IP address:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, select **Network**. The Network configuration page opens.

3. Enter the IP address of Pearl into the **Address** field and click **ping** or **traceroute**. The console-like results are displayed below the Address field.

Disable the network discovery port

You can disable the network discovery port on Pearl using the Admin panel so that services can no longer discover Pearl systems using multicast DNS (mDNS). The network discovery port on Pearl is port 5557 and is enabled by default.

Important considerations

- You cannot connect to the Admin panel using a DNS-based service discovery if you disable the network discovery port, see Connect using a DNS-based service discovery.

To disable the network discovery port using the Admin panel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, select **Network**. The Network configuration page opens.

3. Uncheck **Make this device discoverable on the network as <uniqueID.local>**, then click **Apply**.

Configure network security

Pearl supports 802.1x network security. You can choose the authentication method, upload user certificates and private key, as well as manage signed CA certificates using the Admin panel. You can also configure Pearl to use HTTPS.

Topics include:

- Configure 802.1x network security and manage user certificates
- Manage CA and self-signed certificates
- Configure HTTPS

For higher security, we recommend setting admin, operator and viewer-level passwords on Pearl, see Set or change user passwords.

Configure 802.1x network security and manage user certificates

You can enable 802.1x security and configure the EAP method for Pearl to use for secure network access using the Admin panel. Supported EAP methods include:

- PEAP (default)
- EAP-TLS
- EAP-TTLS

Important considerations

- If TLS authentication is used on the network, then you need to get a user certificate and a user private key from the network administrator and upload those to Pearl as part of this procedure.
- Before you proceed with this setup, check that the network server's signed CA certificate appears in the list of CA certificates on Pearl and is valid, see Manage CA and self-signed certificates.
- If the network server's CA certificate doesn't appear in the list of signed CA certificates and you can't obtain a valid signed CA certificate for network server authentication, do not check **Verify server's identity** when performing this setup.
- Security certificates must be PEM encoded.

To configure 802.1x and upload the user certificate and user private key using the Admin panel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.
2. From the Configuration menu, select **Network**. The Network configuration page opens.
3. Under IEEE 802.1x, check **Enabled** and select an **EAP method**: PEAP, EAP-TLS, or EAP-TTLS.

4. (Optional) Check **Verify server's identity**.

5. Choose an **Authentication method** if you selected EAP-TTLS as the EAP method. The authentication method is automatically selected if PEAP or EAP-TLS is the EAP method.

Table 23 *Authentication methods*

EAP method	Authentication method
PEAP	EAP-MSCHAPv2
EAP-TLS	TLS
EAP-TTLS	EAP-MSCHAPv2
	TLS
	PAP

6. Enter the network access **User name** and **Password** to use for this device. Available fields depend on the EAP method that is selected.

7. If **TLS** is chosen as the Authentication method, upload a user certificate and a user private key. You can request those from your network administrator.

8. Click **Apply** when you're done.

9. Reboot Pearl when prompted. After the system has finished rebooting, log back in to the Admin panel as **admin** and verify that all changes were applied.

> 📋 If you need to delete the user certificate or private key, click **Delete certificate**.

Manage CA and self-signed certificates

You can view the list of CA and self-signed certificates that come preloaded on Pearl. CA and self-signed certificates are used for server authentication if **Verify server's identity** is selected when 802.1x network security is configured, see Configure 802.1x network security and manage user certificates.

You can add more CA signed and self-signed certificates using the Admin panel, as well as delete any certificates that you've uploaded. You cannot delete any of the built-in CA certificates that came preloaded on Pearl. Security certificates must be PEM encoded.

To manage CA and self-signed certificates on Pearl using the Admin panel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, select **Security**. The Security configuration page opens.

3. Under CA certificates, click the arrow head to expand the list of built-in CA and self-signed certificates that came preloaded on Pearl.
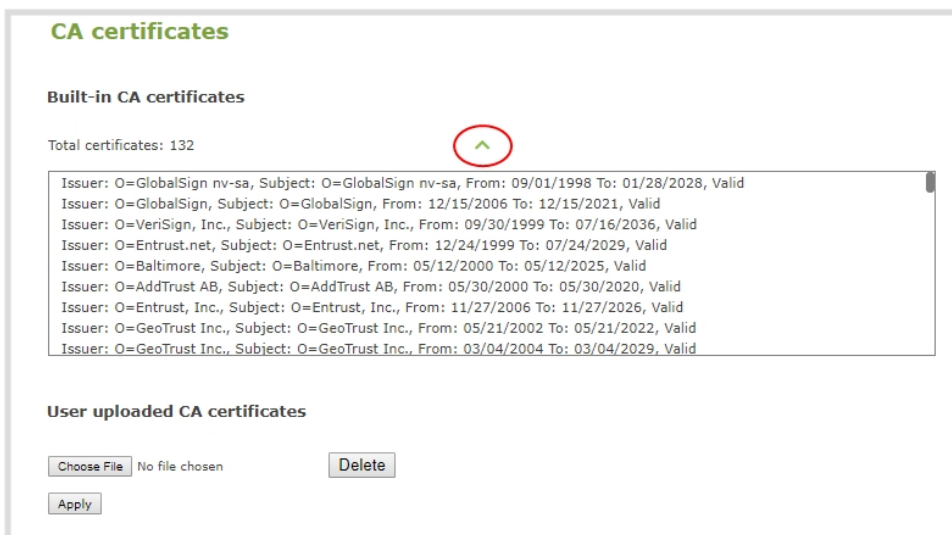
4. To upload a new CA or self-signed certificate, click **Choose File** and select the certificate you want to upload. Then click **Apply**. The uploaded certificate is added to a list of user uploaded CA certificates.

5. To delete a CA or self-signed certificate that you've uploaded, click **Choose File** and select the certificate you want to delete from the list. Then click **Delete**. When you're done, click **Apply**.

6. Reboot Pearl when prompted. After the system has finished rebooting, log back in to the Admin panel as **admin** and verify that all changes were applied.

Configure HTTPS

You can configure Pearl to use HTTPS for secure, local network access to the Admin panel, as well as for viewing the live channel preview stream on the local network using the Live broadcast URL.

> Custom applications that use the Pearl HTTP API should continue to work if you configure Pearl for HTTPS.

A default, self-signed certificate from Epiphan Video comes preloaded on Pearl. You can upload and delete your own certificate and private key. However, you cannot delete the default, self-signed certificate that comes preloaded onPearl.

If you upload your own self-signed certificate and private key, ensure they're PEM encoded. Certificates can either include the private key or be separate files.

If you attempt to access the web-based Admin panel using a web browser and the required security certificate isn't found in the list of certificates loaded on Pearl, a warning message appears stating that the device isn't trusted. You can choose whether to proceed and connect to Pearl's web-based Admin panel without the security certificate authentication or cancel the connection.

> The default HTTP port 80 redirects traffic to the default HTTPS port 443 when HTTPS is enabled. If the default ports used by Pearl are not available on your network, you can change them using the Admin panel, see **Change the HTTP/HTTPS port values**.

To configure HTTPS and upload a self-signed certificate using the Admin panel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, select **Security**. The Security configuration page opens.

3. Under HTTPS configuration, check **Secure connection (HTTPS)**.

HTTPS configuration

> Secure connection (HTTPS)
>
> HTTP port: 80 (HTTP redirects to HTTPS port when HTTPS is enabled)
> HTTPS port: 443
> Current Certificate: Built-in self-signed certificate   [Restore default certificate]
>
> Certificate info: Issuer: O=Epiphan Video, Subject: O=Epiphan Video, From: 08/09/2016 To: 08/07/2026, Valid
>
> New certificate: [Choose File] No file chosen
> Private Key: [Choose File] No file chosen
> [Apply]

4. (Optional) Change the default HTTP and the HTTPS port numbers. Consult your network administrator.

5. (Optional) Upload a new certificate and private key as required. You can request those from your network administrator.

> If the required certificate isn't included in the list of certificates on Pearl when you try and connect to Pearl using a web-browser, you'll receive a warning that the device isn't trusted.

6. Click **Apply** when you're done.

7. Reboot Pearl when prompted. After the system has finished rebooting, log back in to the Admin panel as **admin** and verify that all changes were applied.

> If you need to delete the certificate you uploaded and the private key, click **Delete certificate**, or click **Restore default certificate**.

Configure date and time

Pearl uses the current date and time in naming recorded files and when synchronizing and timestamping inputs from multiple sources (i.e. when synchronizing an audio and a video source). The Admin panel lets you specify date and time settings to ensure they are correctly configured for your time zone and your network.

Topics include:

- View the current date and time settings
- Configure a time server
- Manually set the date, time, and zone

View the current date and time settings

There are two ways to view the current date and time settings of Pearl:

- From the Date and Time page using the Admin panel.
- From the Settings menu using the touch screen on Pearl.

You can manually set the date and time, change the time zone, and set up for a local Network Time Protocol (NTP) server from the Date and Time page using the Admin panel.

To view the current Date and Time configuration page using the Admin panel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.
2. From the Configuration menu, select **Date and Time**. The Date and Time configuration page opens.
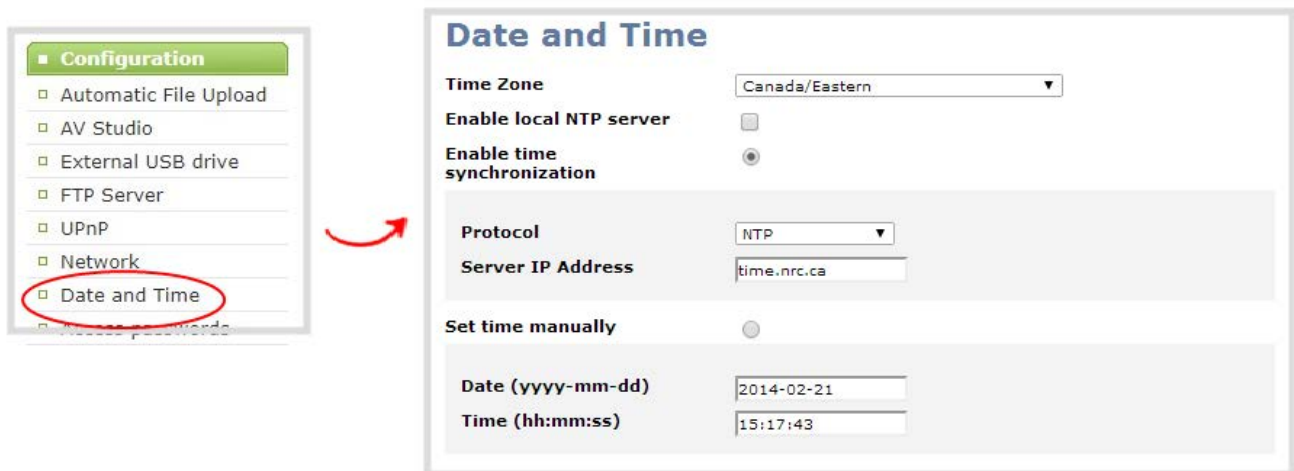
Table 24 Date and Time configuration options

Label	Description/Options
Time Zone	The currently selected time zone.
Enable time synchronization	Whether or not a time synchronization protocol is being used for setting time. If not selected, time is set manually.
Protocol	The time synchronization protocol.
Service IP Address	The time synchronization server address.
Set time manually	Whether or not time is set manually. If time is not being set manually, a time synchronization protocol is used.
Date	The current date. This is the current date even if the radio button Set time manually is not selected.
Time	The current time. This is the current time even if the radio button Set time manually is not selected.

To view the current date and time using the touch screen:

1. Tap the **gear** icon to open the System settings screen. If the control icons aren't showing, tap anywhere on the touch screen.
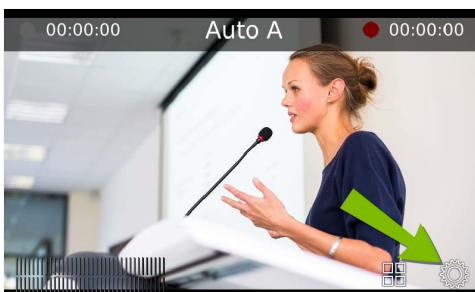
2. Tap **System Status** to see the System Status page.
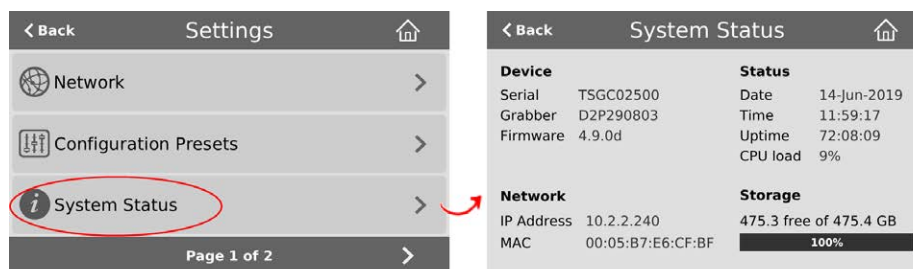
3. Tap **Back** to return to the **System Settings** screen, or the **Home** icon to return to the channel view.

> If the system settings control icon won't appear when you tap the touch screen, it may be disabled. See **Configure the touch screen** to enable system information.

Configure a time server

Pearl uses the Network Time Protocol (NTP) server from the National Research Council of Canada by default. You can change to a different time server using the Admin panel. Contact your system administrator for the time synchronization server settings you should use.

The following table lists the time server types that Pearl supports.

Table 25 *Supported time servers*

Label	Description/Options
NTP	Network Time Protocol (NTP) servers are used to synchronize system time. Many NTP servers are available on the Internet. Or your company may have its own local NTP server. All you need is the IP address of the NTP server and network access to the server to use that as the time synchronization source for Pearl. For more information about NTP and to find NTP servers, refer to http://support.ntp.org/bin/view/Servers/WebHome.
RDATE	RDATE is a tool for querying the current time from the network. It is generally considered obsolete and has been replaced by NTP. It's offered here for backwards compatibility purposes.
PTP v1	The Precision Time Protocol (PTP) is used for clock synchronization over the Internet. It has clock accuracy in the sub-microsecond range, making it more granular than NTP.

> NTP sends UDP packets over port 123 on Pearl and PTP sends UDP packets over ports 319 and 320. If Pearl is behind a firewall, you must open these ports to allow traffic when Pearl is configured to use either an NTP or a PTP server to obtain its time and date information.

To set the time synchronization method for Pearl:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, click **Date and Time** . The Date and Time configuration page opens.

3. For local NTP servers, check **Enable local NTP server**. Otherwise, skip this step.

4. Select **Enable time synchronization** and choose the time synchronization protocol from the
    Protocols drop down.

    a. If **NTP** is selected, enter the IP address or server name for the NTP server in the **Server IP
        Address** field.

    b. If **RDATE** is selected, enter the IP address or server name for the RDATE server in the **Server IP
        Address** field and select an **Update interval**.

    c. If **PTP v1** is selected, choose a multicast address for the PTP v1 server from the **PTP domain**
        field.

Table 26 *PTP multicast addresses*

PTP Domain	Description
Default	PTP at multicast address 224.0.1.129
Alternative 1	PTP at multicast address 224.0.1.130
Alternative 2	PTP at multicast address 224.0.1.131
Alternative 3	PTP at multicast address 224.0.1.132

5. Click **Apply**.

Manually set the date, time, and zone

Pearl uses NTP for time synchronization by default. However, you can manually set the date and time for
Pearl using the Admin panel. You can also set the time zone. Pearl uses the Eastern (Canada) time zone by
default.

To manually set the date, time, and zone:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, click **Date and Time**. The Date and Time configuration page opens.

3. Enter the current date in the **Date** field using the format *yyyy-mm-dd* and enter the current time in the
    Time field using the format *hh:mm:ss*.

4. Select a time zone from the **Time Zone** field.

5. Click **Apply**.

Configure device info, name, description, and location

You can assign Pearl a unique device name using the Admin panel and add information such as a description and location. Alphanumeric characters and hyphens are supported. The serial number of Pearl is the default device name.

For AFU and USB file transfers that are configured to create a folder upon file upload, the device name you set for Pearl is used for the folder name instead of Pearl's serial number.

For Kaltura and Panopto, the device name you set here for Pearl appears as the registered name for this device.

To configure the device name, description, and location using the Admin panel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, click **Info**. The system information page opens.

Pearl D569D035 info

Status

Date:	Fri Dec 13 2020
Time:	12:36:26 GMT-0500
Uptime:	4 days 1:04:51
System load:	22%

Firmware

Version:	4.12.0i
Revision:	47607_1823
Date:	2020-11-28

Hardware

Serial number:	D569D035
CPU board:	D53427RKE (G87790-405)
BIOS:	11/29/2013

Device info

Name:	D569D035
Description:	
Location:	

Apply

Channels

#	Name	Status	Recording	Streaming	Video inputs	Audio inputs	Codec	Frame size	Bitrate / Actual bitrate	FPS / Actual FPS	
1	Auto A	⚠	Stopped	Stream 1 Stopped	2 items	Auto A	H.264+AAC	1280x720	1.628 / 1.628 Mbps	30 / 30.000	View
2	Auto B	✓	Stopped	No streams	Auto B	No items	H.264+AAC	1920x1080	0.660 / 0.660 Mbps	4 / 4.000	View

3. Under **Device info**, do any of the following and then click **Apply**:

   a. Enter a name using alphanumeric characters including hyphens up to a maximum of 64 characters.

   b. Enter a description using alphanumeric characters including hyphens up to a maximum of 50 characters.

   c. Enter a locaion using alphanumeric characters including hyphens up to a maximum of 50 characters. alphanumerical characters and hyphens.

Audio input ports

You can connect external audio devices like mixers directly to the audio input ports on Pearl. There are:

There are:

- Four ¼" TRS professional line-level inputs + 4.0 dBu up to 12.3 V RMS, (+24 dBu) support balanced and unbalanced signals.

- Two USB video/audio ports

- Two HDMI ports

- Two SDI ports

- Two VGA ports

The four ¼" TRS audio input ports are configured as two stereo pairs by default: TRS A (left/right) and TRS B (left/right).

Topics include:

- Configure audio ports for stereo or mono

- Adjust audio gain and delay

- Mute audio

For details about the audio inputs, see AV inputs.

Configure audio ports for stereo or mono

The four ¼" TRS professional line-level inputs are configured as two stereo pairs by default: TRS A (left and right stereo pair) and TRS B (left and right stereo pair).

Using the Admin panel, you can configure these ports to function as a stereo pair (left/right) or as separate mono ports.

To configure audio ports as stereo or mono:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Inputs menu, click **Analog-A Audio** for the TRS A ports or click **Analog-B Audio** for the TRS B ports. The configuration page for the audio ports opens.

3. Do one of the following.

   a. To make the ports function as a stereo pair, check **Stereo pair** and click **Apply**.

   b. To make the ports function as separate mono ports, uncheck **Stereo pair** and click **Apply**.
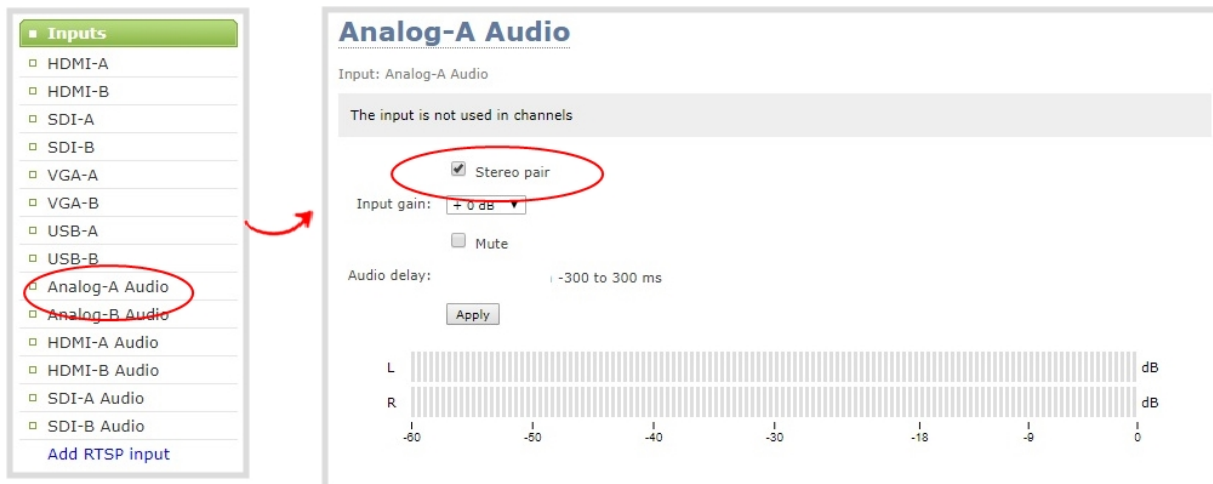
> When mono is selected, two sets of parameters and two audio VU meters appear on the configuration page - one for each audio input port on Pearl. Parameters that are listed only once on the page applies to both ports.

Adjust audio gain and delay

Pearl does not introduce audio delay and has near-zero latency when capturing. However, other external factors can cause audio to become de-synchronized, such as the length of audio cables or the configuration of your equipment. The audio delay feature helps you adjust audio coming from external sources so that your video and audio sources are synchronized when captured, streamed, and recorded.

By default, there's 0 ms of delay applied to your audio sources. You can set the amount of delay for any audio source using the Admin panel and apply from -300 ms and +300 ms of delay.

The analog audio input ports on Pearl are calibrated for -10 dBV audio signals and provide moderate signal headroom. For the analog audio inputs, you can add up to +30 dB of gain using the Admin panel.

Adjusting the **Input Gain** for an analog audio source affects the volume for that audio source in recordings, streamed output, video output ports, and in the headphone jack. Be aware that excessive amounts of gain can increase the perception of any noise that may be present in the audio signal.

For signals with a high dynamic range or for signals that are coming in at 0 dBu or +4 dBu, we recommend using 25 dB external attenuator pads with your Pearl. If you need help selecting attenuator pads, please contact our Support team.

> 🛑 Microphones typically have low audio signals (less than -30 dBu) and are not supported directly as inputs to Pearl. Use an audio mixing board or preamp to amplify microphones and supply the appropriate line level input.

The rackmount models include on-board 25 dB audio attenuator pads and are calibrated for +4 dBu input signals with excellent audio headroom. We recommend always keeping the attenuator pad active, unless you have a weak audio signal that's too low even if you add 30 dB of gain.

Here are some suggested audio gain levels based on the input signal strength when using external attenuator pads with Pearl. Start with these values and check audio levels using the VU meter and headphones. Adjust the gain as needed. As a rule, each 10 dB of gain doubles the perceived loudness of the audio signal.

Table 27 Suggested gain based on input audio signal strength

Input signal strength	Gain setting
+4 dBu	8 dB
0 dBu	12 dB
-10 dBV	20 dB
lower than -10 dBV	Test with 20 dB or more. Turn off the attenuator if adequate gain is not achievable.

This table offers some guidelines for adjusting the gain at the audio input port of Pearl for common types of audio input devices. You should add the suggested gain to the audio input to get an average signal to register at a nominal level in the VU meter (i.e. where the green bars change to yellow). The actual amount of gain needed depends on the strength of the original audio signal.

Table 28 Audio input port gain guidelines

Audio source	Input port	Gain
Mobile phone or other consumer line level device	TRS	Add +6 to +12 dB gain to the audio input port.
Professional mixer	TRS	Nominal
USB microphone	USB	Nominal

Ensure the audio input source is connected to an analog audio input port on Pearl before proceeding.

To adjust the gain and delay for an audio source:

1. Login to the Admin panel as **admin**. See Connect to Admin panel.

2. From the Inputs menu, select an audio source. The audio configuration page for the audio source opens.

3. In the **Input Gain** field, select the amount of gain to apply to the audio source.

> For Pearl Rackmount models, keep the attenuator pad engaged unless you've tested with up to 30 dB of gain and your audio signal is still too weak.

Pearl Rackmount and Pearl Rackmount Twin

4. In the **Audio delay** field, enter a value between 300 and -300. A positive value adds delay to the audio signal. A negative value adjusts the audio to start earlier.

5. Click **Apply**.

Mute audio
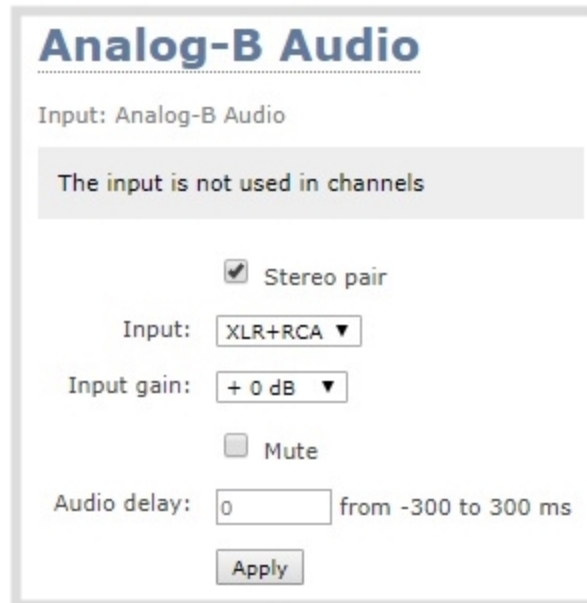
You can mute any audio input port using the Admin panel. For analog audio ports that are configured as mono inputs, you can mute each port separately.

Some audio input ports share internal audio processing resources in Pearl. Muting an audio input that shares internal resources mutes all the associated audio sources. The following table lists the audio input ports that share internal processing and the results of applying mute.

To mute an audio source:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Inputs menu, select an audio source. The audio configuration page for the audio source opens.
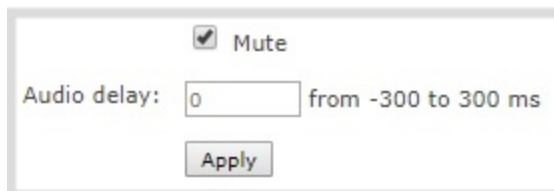
3. Check **Mute** to mute the audio source or uncheck **Mute** if you no longer want the audio source muted.

4. Click **Apply**.

Video output ports

Video output ports on Pearl let you connect external displays for confidence monitoring. You can use the Admin panel or the touch screen on Pearl to send any video source or channel to the video output port with (or without) the audio.

Topics include:

- About video output ports
- Video output port resolution
- Show a channel or video source on the output port
- Select the video output source using the touch screen
- Preview the video output port
- Disable the video output port
- Disable or enable audio and output port volume
- Display and reposition the audio VU meter
- Rename a video output port
- Mirror the video output port display

About video output ports

Pearl's rear panel includes two dual-mode DisplayPort video output ports (DisplayPort++) that can operate in either DisplayPort or HDMI/DVI video modes.

DisplayPort 1 is set to show Auto A and DisplayPort 2 is set to show Auto B by default. Both video output ports are configured to maintain aspect ratio, use the display's default resolution, and include audio at 100% volume. However, the audio meter is not shown by default.

> Using the video output port takes CPU cycles and adds to the overall load on your Pearl-2. For optimum performance, keep displays disconnected from the video output port if you're not using them. Setups that already put a heavy load on the system's CPU may be negatively impacted if the external video output port is used.

You can use the Admin panel to configure the video output port parameters, see Show a channel or video source on the output port. If you're simply selecting a video source or channel and enabling/disabling audio for the output port, you can use your choice of either the Admin panel, the touch screen on Pearl, or Epiphan Live. For channels that have audio, the audio is enabled by default.

To select the video output port source using the touch screen, see Select the video output source using the touch screen. To select the video output port source using Epiphan Live, see Monitor and setup the output port source and audio.

Important considerations

- When changing encoding parameters for a channel that's displayed on the video output port, it may revert to the display's default resolution if the output resolution is set to "Same as source". To resolve this, change the video output to a different resolution then back to "Same as source".

- When using the video output port for confidence monitoring, some delay can be expected. For a 1080p video source, the average delay on the video output port is approximately 100 ms. For a 1080p channel, the average delay on the video output port is approximately 300 ms. The actual amount can vary, depending on the setup.

- Using the video output ports adds to the overall system load on Pearl. If your system has a high system load and you're using the video outputs, monitor the frame rate of your channels on Pearl and adjust your setup if there's an unacceptable drop in the frame rate. Remedial measures you can take include eliminating video scaling at the inputs, adjusting the encoding bitrates, and deleting extra layouts and channels that are no longer being used.

- If an SDI or HDMI video input source that is selected to display at the HDMI output port also appears in a custom layout for a channel, then the channel's encoding settings are used at the HDMI output. Changing the channel's frame rate will change the frame rate used at the output port for that video input. If the video source appears in multiple layouts in different channels, the one with the highest frame rate set in the encoding settings is used.

- When one of the video output ports is configured for local console, the other video output port does not display any content.

- To use the video output port with an HDMI or DVI display or projector, you'll need a DisplayPort to HDMI/DVI converter.

- To use both video outputs, they must use the same type of HDMI to DisplayPort converter and have the same resolution, see Important information about DisplayPort converters.

Important information about DisplayPort converters

Using converters and the type of converter you're using affects Pearl functionality.

There are two types of DisplayPort to HDMI/DVI converters: active and passive.

Passive DisplayPort converters

Passive DisplayPort to HDMI converters work only with DisplayPort++ video ports. They tell the video port to switch the video output signal to HDMI. Pearl video output ports are DisplayPort++, so they can be used with this type of converter.

For the purposes of this manual, these converters are referred to as **passive converters** attached to **HDMI displays** (although you may also be converting to DVI or any other video signal before connecting it to your monitor or display).

Active DisplayPort converters

Active converters are DisplayPort sink devices (also called DisplayPort receivers) that convert the DisplayPort signal to your desired output signal type.

For the purposes of this manual, these converters are referred to as **active converters** and have the same behavior as though the video output port is directly attached to a **DisplayPort display** (although you may also be conversion to HDMI, DVI, VGA, or any other video signal before connecting it to your monitor or display).

If you're using only one of the two video output ports, you can use either a direct DisplayPort cable, an active converter, or a passive converter. However, if you're using both video output ports on Pearl, they must have the same type of converter attached. For example, two passive converters or two active converters. Or, you can connect an active converter to one port and connect an actual DisplayPort cable to the other port.

When using passive converters, both video output ports must use the exact same output resolution.

The following table lists the full restrictions.

Table 29 *Supported video output port configurations*

Number of Displays	Cable 1	Cable 2	Output resolution
1	passive converter	n/a	Any (1024×768, 1280×720, 1280×960, 1360×768, 1400×1050, 1920×1080)
1	active converter or DisplayPort cable	n/a	Any (1024×768, 1280×720, 1280×960, 1360×768, 1400×1050, 1920×1080)

Number of Displays	Cable 1	Cable 2	Output resolution
2	passive converter	passive converter	Video output ports must both be set to the same resolution. Ideally pick a manual resolution setting. Do not use **destination default** resolution unless both monitors are the exact same make and model. Do not use **same as source** unless both video output ports are configured to show the same source or to show channels with identical encoding settings.
2	active converter or DisplayPort cable	active converter or DisplayPort cable	Displays can be set independently to any resolution up to 1080p (1024×768, 1280×720, 1280×960, 1360×768, 1400×1050, 1920×1080)
2	active converter or DisplayPort cable	passive converter	One of the two displays will fail to receive a signal. Do not mix passive converters with active converters and DisplayPort cables.
2	passive converter	active converter or DisplayPort cable	

What if I only see output on one display when I'm trying to use both?

Check to make sure both your converters are active, both are passive, or if you are using one DisplayPort cable and one converter, that the converter is active.

If both your converters are passive but you still only see output on one display, ensure the displays are configured to the same resolution (do not use destination default) and that both display monitors support that configured resolution, see Show a channel or video source on the output port for configuration information. If the two monitors are not 100% compatible and don't accept the same resolution refresh rate, switch to using two monitors that support the same ratings.

If you're using two active converters or one active converter and a DisplayPort cable, ensure that you are requesting resolutions supported by your display monitors and that both video output ports are displaying at 1920×1080 or less.

Video output port resolution

The video output port's **resolution** (also known as frame size or display mode) defines the number of pixels displayed horizontally and vertically. For example, the resolution 1920×1080 (1080p) produces an image that is 1920 pixels wide by 1080 pixels tall.

> Pearl always assumes that the output display uses square pixels.

The **aspect ratio** (eg. 4:3 or 16:9) describes the proportional relationship between the video output's pixel width and height. The resolution 1920×1080 (1080p), for example, is quite a bit wider than it is tall. The ratio of its width to height is 16 to 9, which has an aspect ratio that is 16:9.

By default, you can choose from the following output resolutions in 4:3 and 16:9 aspect ratios for your video output ports, but you can also change settings to allow a variety of other resolutions through.

4:3 resolutions

1024×768	1280×960	1400×1050

16:9 resolutions

1280×720	1360×768	1920×1080

Show a channel or video source on the output port

You can send any channel or video source to the video output port and adjust the video output resolution, aspect ratio, and choose to send the audio using the Admin panel. The video output port frame rate is set automatically to the channel's configured frame rate for that video source.

For channels with audio, you can configure whether or not audio is included and adjust the volume. You can also choose to include the audio meter. The audio meter is set to a fixed size of 15% of the width (or height if displayed horizontally) of the display. Audio is not supported when sending a video source to the video output port.

To set up the video output port using Epiphan Live, see Monitor and setup the output port source and audio.

To use the video output port with an HDMI or DVI display or projector, you'll need a DisplayPort to HDMI/DVI converter. Ensure you read this **Important information about DisplayPort converters**.

Important considerations

To display channel or video source on the video output port:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Output ports menu, click the output port (**DisplayPort 1** or **DisplayPort 2**). The video output port configuration page opens.

3. In the **Source** field, select a channel (prefixed by the word **Channel**) or a video source (prefixed by the word **Input**).

4. In the **Resolution** field, select the resolution for the video output port.

Value	Description
Same as source	Set the output to the same resolution as the channel or video source. If that resolution is not supported by the display, the video output port will negotiate a new resolution with the display (generally this ends up being the display's default resolution).

Value	Description
Destination default	This is the default value. Each display has a preferred resolution, and when you choose this setting, the video output port will use the display's default resolution.
640×360, 640×480, 960×540, 1024×768, 1280×720, 1280×960, 1360×768, 1400×1050, 1920×1080, 1920×1200, 2560×1440	Choose a specific resolution for the output port. For an explanation of the different choices, see Show a channel or video source on the output port. Note: The same specific output resolution must be set for both video ports if using passive DisplayPort to HDMI or DVI adapters. See Video output ports.

5. Do one of the following:

   a. Check **Keep aspect ratio check** to have the system maintain the correct aspect ratio. If the aspect ratio is different between the source and the chosen display aspect ratio, black bars are automatically inserted at the top and bottom or left and right sides of the video.

   b. Uncheck **Keep aspect ratio check** to have the system stretch the source to fit the aspect ratio of the display.

6. For channels, do the following:

   a. Check **Enable audio** to include audio in the output. Leave this unchecked for no audio with the video.

   b. (Optional) For channels with audio enabled, adjust the volume. Enter a value from 0 to 100 percent in the **Audio volume** field.

   c. (Optional) For channels with audio enabled, choose whether or not to display the audio meter from the **Audio meter** drop down.

   d. If displaying the audio meter, select horizontal or vertical from the **Audio meter orientation** drop down to change the orientation of the displayed audio meter.

7. For input sources, do the following:

   a. Select an **Audio source** from the drop down list.

   b. (Optional) Adjust the volume. Enter a value from 0 to 100 percent in the **Audio volume** field.

   c. (Optional) Choose whether or not to display the audio meter from the **Audio meter** drop down.

   d. If displaying the audio meter, select horizontal or vertical from the **Audio meter orientation** drop down to change the orientation of the displayed audio meter.

> Decoupled audio sources appear as a single, stereo audio source. You cannot select individually decoupled audio sources.

8. Click **Apply**.

> The audio meter can be displayed even if you are not playing audio over the video output port (i.e. even when the **Enable audio** check box is not checked).

Select the video output source using the touch screen

When local console is enabled, it's easy to change the video source that appears at the video output port using the touch screen on Pearl. For video sources that have audio, you can enable and disable the audio as well. Audio is enabled by default.

> To configure the video output port parameters, use the Admin panel. See **Video output ports**.

To select the video output source using Pearl's touch screen:

1. From Pearl's touch screen, tap the **gear** icon to open the System settings screen. If the control icons aren't showing, tap anywhere on the touch screen.

2. Tap the arrow icon in the lower-right corner of the screen to go to the second Settings page.
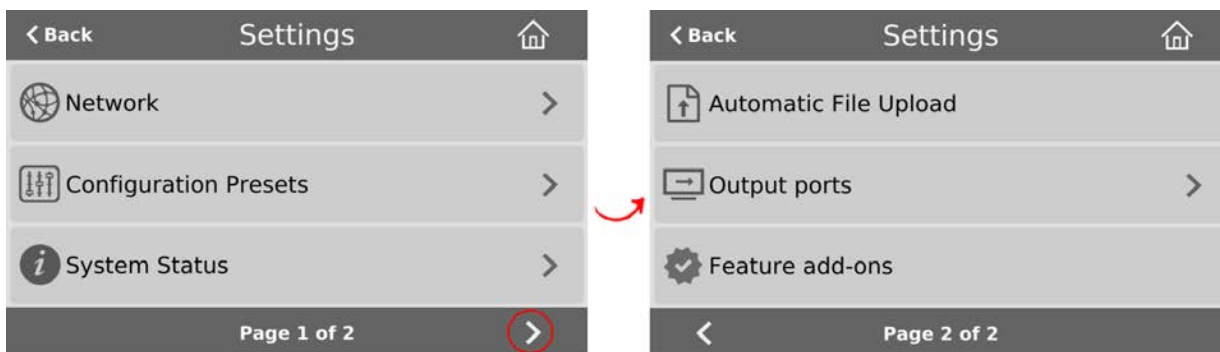
3. Tap Output ports and select an output port.

4. From the Output port's screen, select the source you want displayed on the video output port and tap

Apply.
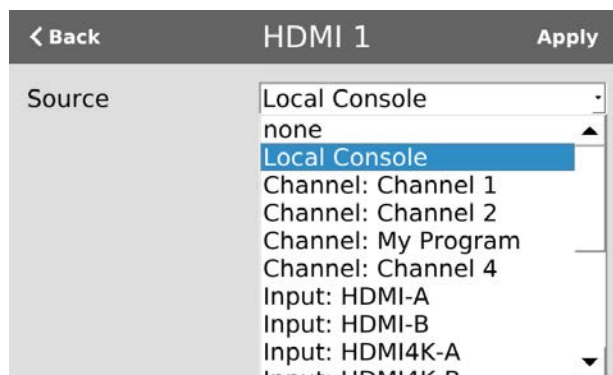
Preview the video output port

You can preview the video signal that is shared over your video output port by looking at the preview window at the bottom of the video output configuration page in the Admin panel.

> 📋 The preview is updated every few seconds and always maintains the same aspect ratio as the source it is copying. It doesn't reflect black bars, the audio meter or actual aspect ratio/resolution on the display.
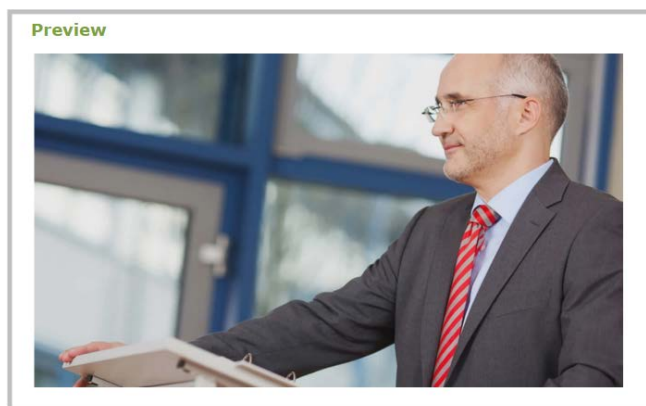
If the video output port is showing a source and that source has no signal, the source's no signal image is displayed.

If the video output port is showing a channel and that channel is unavailable or has no signal, a no signal message is shown for 2.5 seconds, then the display output is changed to a black screen.

> You can also preview video output ports using the Epiphan Live control interface. See **Monitor and setup the output port source and audio** for more information.
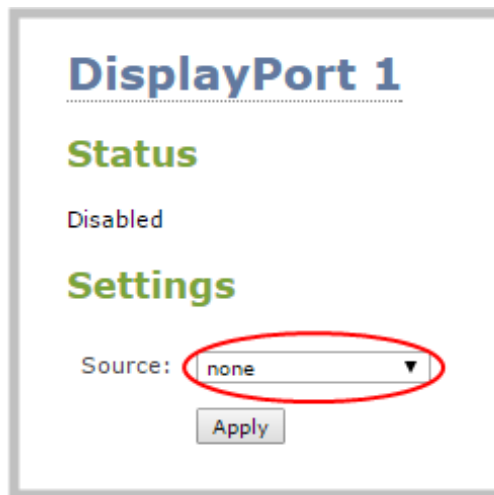
Disable the video output port

You can use the Admin panel to disable a video output port so that even if a display is connected, nothing is shown.

To disable video output ports using the Epiphan Live, see Monitor and setup the output port source and audio.

To disable the video output port using the Admin panel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Output ports menu, click the output port (**DisplayPort 1** or **DisplayPort 2**). The video output port configuration page opens.

3. In the **Source** field, select **none** to disable the video output port and then click **Apply**.

Disable or enable audio and output port volume

If you're displaying a channel as the source for your video output port, audio for that channel is also encoded and sent over the port by default. You can disable the audio on the output port using the Admin panel. You can also adjust the volume of the audio on the video output port using the Admin panel. Disabling the audio on the video output port improves latency for the port.
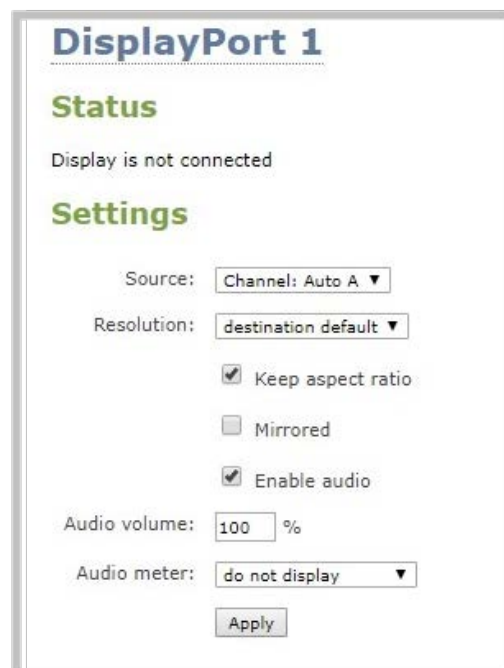
If you're displaying a video input as the source for your video output port, you can select an audio source and adjust the volume. Audio is taken from the video input source you've selected for the video output port by default.

> Decoupled audio sources appear as a single, stereo audio source. You cannot select individually decoupled audio sources.

To disable the audio for a channel on the video output port and adjust the volume using the Admin panel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Output ports menu, click the output port (**DisplayPort 1** or **DisplayPort 2**). The video output port configuration page opens.

3. For channels, do the following:

    a. Check **Enable audio** to include audio in the output. Leave this unchecked for no audio with the video.

    b. (Optional) For channels with audio enabled, adjust the volume. Enter a value from 0 to 100 percent in the **Audio volume** field.

    c. (Optional) For channels with audio enabled, choose whether or not to display the audio meter from the **Audio meter** drop down.

    d. If displaying the audio meter, select horizontal or vertical from the **Audio meter orientation** drop down to change the orientation of the displayed audio meter.

4. For input sources, do the following:

   a. Select an **Audio source** from the drop down list.

   b. (Optional) Adjust the volume. Enter a value from 0 to 100 percent in the **Audio volume** field.

   c. (Optional) Choose whether or not to display the audio meter from the **Audio meter** drop down.

   d. If displaying the audio meter, select horizontal or vertical from the **Audio meter orientation** drop down to change the orientation of the displayed audio meter.

5. Click **Apply**.

> ✅ You can also disable or enable audio on the video output port and adjust the volume using Epiphan Live, see **Monitor and setup the output port source and audio**.

Display and reposition the audio VU meter

When sending a channel with audio over the video output port, you can choose whether or not to display the audio VU meter using the Admin panel. You can also determine the position and orientation of the audio meter.

> ✅ Audio pass-through, adjusting the volume, and displaying an audio meter are only supported when a channel is the selected video source.

To configure the audio meter for the video output port:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Output ports menu, click the output port (**DisplayPort 1** or **DisplayPort 2**). The video output port configuration page opens.

3. In the **Audio meter** field, choose an option.

Value	Description
do not display	No audio meter is displayed.
left top corner	Audio meter is displayed at the top left side of the display.
right top corner	Audio meter is displayed at the top right side of the display.
left bottom corner	Audio meter is displayed at the bottom left side of the display.
right bottom corner	Audio meter is displayed at the bottom right side of the display.
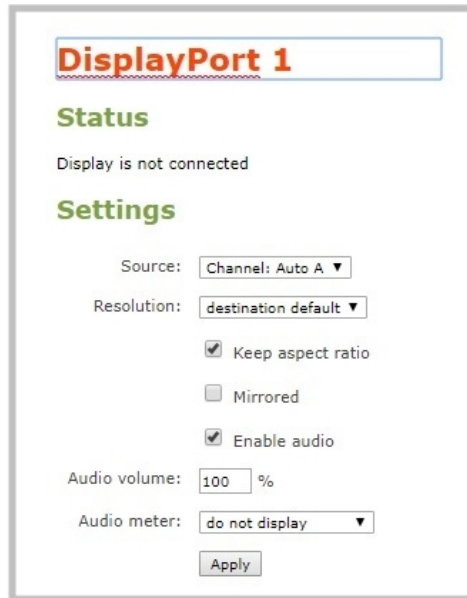
4. If you've selected a location for the audio meter, you can also select an orientation (horizontal or vertical) in the **Audio meter orientation** field.

5. Click **Apply**.

Rename a video output port

Using the Admin panel or Epiphan Live, you can easily change the video output port default name from DisplayPort 1 and DisplayPort 2 to something more suitable. For example, Projector Output or Confidence Monitor.

To change a video output port name:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Output ports menu, click the video output port. The video output port configuration page opens.

3. Click the **video output port name** at the top of the page and enter a new name using your keyboard. The text turns red when it's selected for editing.

4. Press **Enter** using your keyboard to save the changes.

> You must press Enter to save the new name. The **Apply** button does not save the source name change.

Mirror the video output port display
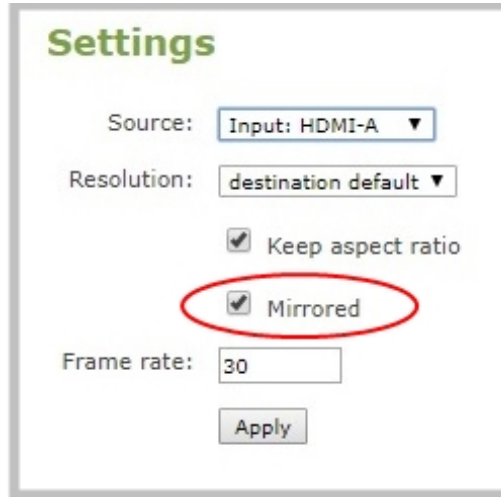
You can use the Admin panel to mirror the original video source on the output port so that it appears reversed on the connected display.
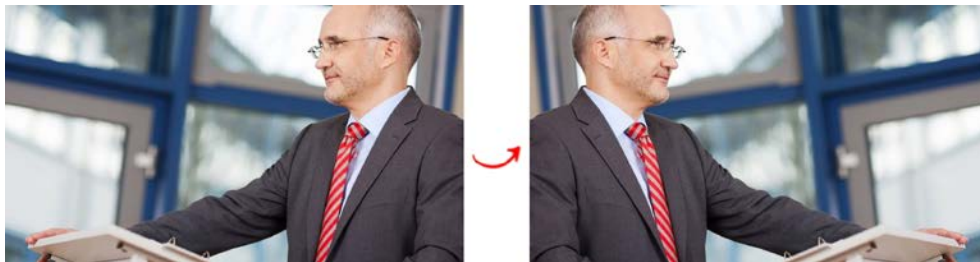
To mirror the video source on the video output port:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Output ports menu, click the output port you want to mirror. The video output port configuration page opens.

3. Check **Mirrored** to flip the video source's orientation on the display port. Uncheck **Mirrored** to display the video source in it's original orientation, then click **Apply**

Configuration presets

Configuration presets are the perfect solution for backing up your system configuration and if you have changing configuration requirements for your Pearl or are managing multiple systems and you want them to have similar configurations.

Topics include:

- About configuration presets
- Configuration preset considerations
- Configuration groups
- The Factory default configuration preset and Factory reset
- Create a configuration preset
- Apply a configuration preset using the Admin panel
- Apply a configuration preset using the touch screen
- Export and import configuration presets
- Update a configuration preset
- Delete a configuration preset

About configuration presets

Configuration presets are groups of settings that get applied to the system, leaving other important settings intact. They make it easy to manage multiple Pearl systems and shared spaces, like a studio, a breeze to set up and maintain a consistent setup each time you go to use your Pearl.

Configuration presets let you quickly apply settings to your Pearl so you can reconfigure it on the fly and get a consistent set up each time. You can even download a configuration preset and upload it to other Pearl systems.

The system's settings are divided into the following configuration groups. You can choose to include any number and combination of configuration groups in a preset and create as many different configuration presets as you need. For a complete list of individual settings that are included in each configuration group, see About configuration presets.

 System

 Inputs

 Automatic file uploads

Network	Network	Channels	Channels	EDID	EDID
Output ports	Output ports	Touch screen	Touch screen	CMS	CMS
AV STUDIO	AV Studio				
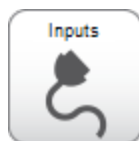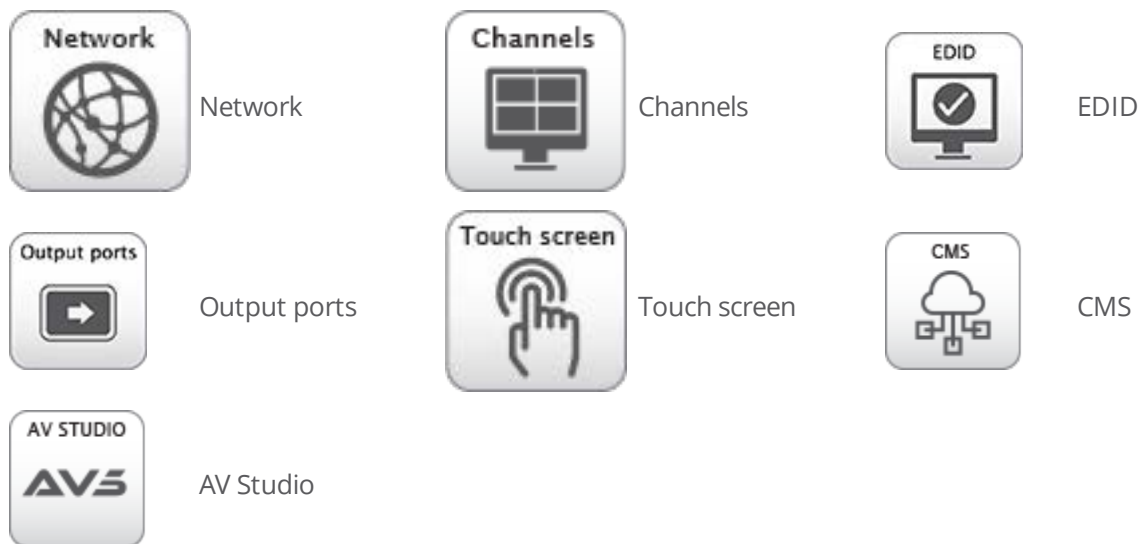
You can create and apply any saved configuration preset from the Configuration menu when you select **Maintenance** using the Admin panel. A special **Factory default** configuration preset, which cannot be erased, is included in the list of configuration presets. Use that to return to the factory setup without destructively erasing any saved recordings or media files you've uploaded.

It's important to note that configuration presets are applied over existing settings. They affect only the settings groups included in the preset. All other settings are unaffected. Read the Configuration preset considerations section carefully to understand caveats around using configuration presets.

Example of presets in action

You could upload custom background images to Pearl in advance of a conference and create custom channel configuration presets for several different keynote speakers, each with a different setup, and then apply them later when you need them.

For example, you could create two configuration presets called Session 1 and Session 2. Each session could include things like custom backgrounds, images and logos, channels and layouts, metadata, streaming settings, network settings, and automatic file upload (AFU) locations. Then download those presets to your local computer so you can upload them to your entire fleet of Pearl systems.

> 📋 Channel configuration includes any applied backgrounds and image files. If these files aren't present when the configuration preset is saved, the save function will fail. Be careful when deleting background images and logo files.

At the conference, simply apply the configuration preset that you need for the appropriate session using either the Admin panel or the touch screen on Pearl. When applying the configuration preset, all other preset groups remain unchanged. The preset only affects channels and their configuration.

    Session 1 preset

Session 1 presenter data and background image

plus the conference IP address

Session 2 preset

Session 2 presenter data and background image

plus the conference IP address
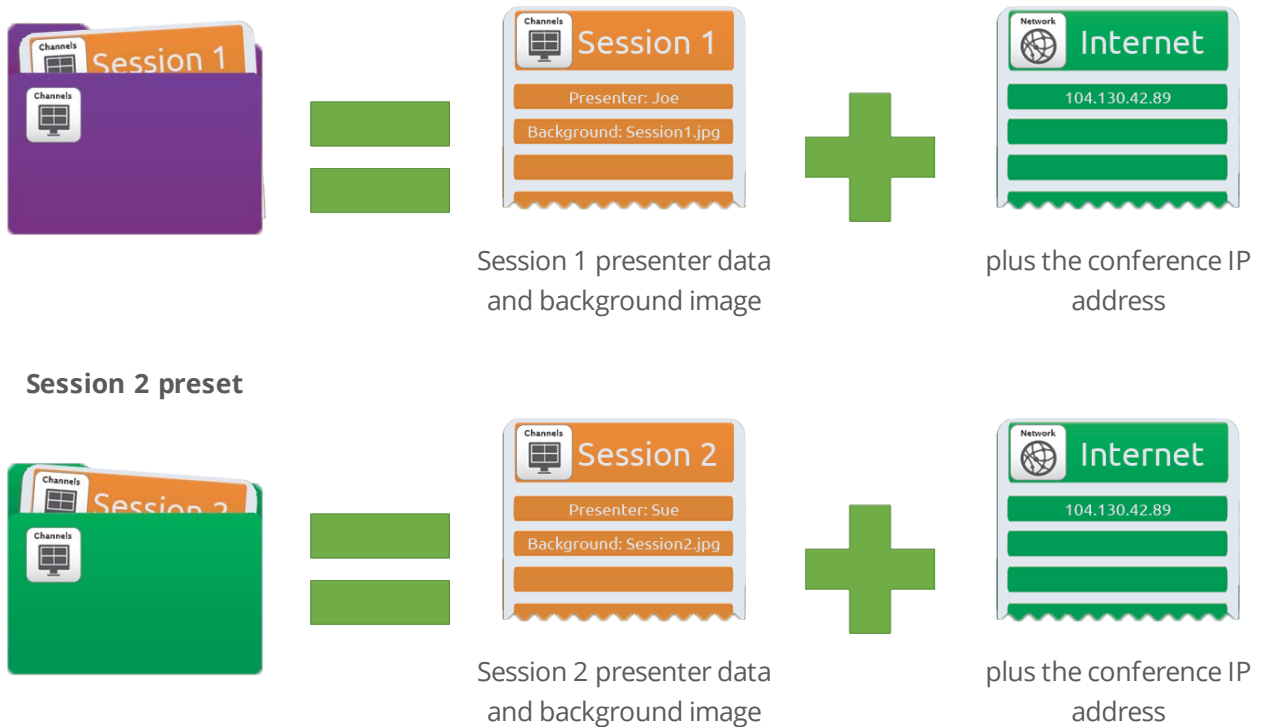
After applying a configuration preset, recorded files from the previous session remain present on the system. If AFU is configured, the recorded files continue to upload even after the new configuration preset is applied (if AFU is not yet complete), but the channels reflect the newly loaded session's background file name and presenter name.

Configuration preset considerations

There are important considerations that you should know before you start using configuration presets, including:

- Access to presets and privacy considerations
- The potential to lock the touch screen
- Channel and recorder index number behavior
- Recording and streaming states
- Recorded files in channels and recorders
- Deleting channels and recorders
- Orphaned Kaltura resource registrations and duplicate resources

Access to presets and privacy considerations

- Recorded files are not removed when you apply a configuration preset. Any user with access to Pearl has access to all the saved recordings, channel layouts, etc that are associated with an applied configuration preset.

- Configuration presets can be overwritten and deleted without a password. Users who are logged in to the Admin panel can remove or change an existing configuration preset.

- Applying a configuration presets does not clear the settings from groups that aren't a part of the preset, which means user information is not private.

- Media and recorded files can be deleted, affecting more than just the currently applied configuration preset. Users can erase uploaded media or recordings that belong to other users.

> **STOP** Media files that you've uploaded to Pearl (logos, background images, etc) are included in the configuration preset and must be present on the system when creating a preset that includes the **Channels** group; otherwise, a failure is reported.

Locking out the touch screen

The **touch screen** configuration group includes all the security settings for the touch screen. It's possible to apply a preset that effectively locks out all further use of the touch screen. If this happens, use the Admin panel to re-enable the touch screen, see Configure the touch screen.

Channel and recorder index number behavior

Each channel and recorder has an index number. The first channel created on a system is channel 1, subsequently channel 2, 3, 4, etc. Recorders are also created starting at index 1 with numbers incrementing as new recorders are created. The channel (or recorder) index number is found to the left of the channel or recorder name in the Admin panel:
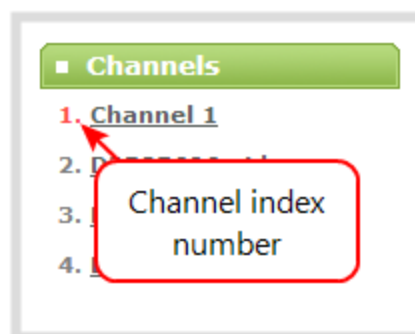
Configuration presets that contain the **channels** configuration group specify the channels in the preset by their index number. This means if you have channels 1, 2, 3 and 4 when you save your preset, applying that preset will overwrite the configuration of your current channels with indexes 1, 2, 3 and 4. If prior to applying that preset you also had channels with indexes 5 and 6, the configuration settings for those two channels are erased when the preset is applied (because the preset only has 4 channels).

There are three areas where channel (and recorder) index numbers affect what happens when applying configuration presets. Read Recording and streaming statesRecorded files in channels and recorders and Deleting channels and recordings for more information.

Recording and streaming states

The Configuration groups section of this chapter shows that each channel and recorder's recording and streaming state is included in the **channels** configuration group. This means that if a channel is streaming or a channel (or recorder) is recording at the time you create a configuration preset, it will immediately start recording (or streaming) when you apply that preset. Similarly, if a configuration preset is saved when channels or recorders are not recording (or streaming), those channels and recorders will not be recording (streaming) when the preset is applied.

> 🛑 This means a channel or recorder may stop recording or streaming as a result of applying the preset.

For example, when applying a preset with channel 3 set to record (the same example applies for streaming):

- If channel 3 exists prior to applying the preset and is already recording, the file will continue recording uninterrupted unless the recording file type is different in the preset (in which case a new file is started).

- If channel 3 exists prior to applying the preset and is not already recording, it immediately begins recording.

- If no channel with index 3 exists prior to applying the preset, the channel is created and it immediately begins recording.

Recorded files in channels and recorders

Channels and recorders keep a list of files recorded in their **Recordings** section of the Admin panel. These files remain on the system even if the channel or recorder configuration is changed or removed as a result of applying a configuration preset.

For example, prior to applying your configuration preset, you have channels with indexes 1, 2 and 3; each of these has five recording files. When you apply a configuration preset that has channels with index 1 and 2 only, you'll notice those channels each still have the same 5 recording files. **Channel** with index 3 is no longer present, but the files are not lost!

Overwritten channel files are still available. To access and download/delete these recorded files, enter the following into the address bar:

http://<deviceIP>/admin/channelN/archive or

http://<deviceIP>/admin/recorderN/archive, where N is the index of the removed channel/recorder.

> For example, if a **Channel** with index 3 is no longer present, its corresponding files can be accessed by entering the following into the address bar:
>
> http://192.168.0.183/admin/channel3/archive

If you now create a new channel with index 3 (or load a preset that contains a channel with index 3), you'll find it starts with five recorded files in the **Recordings** section. These are the same recorded files that existed at the start of this example.

Furthermore, if you delete any of the recordings, you are deleting the *only* instance of those files. Using our previous example, if you delete one of the five recordings from channel index 1, you'll find that even after applying different presets channel 1 will have only four recorded files.

Deleting channels and recordings

Recorded files are stored on the system based on their channel or recorder number. All files saved for channel index 1 are in one folder, and all files for recorder index 2 are in another. When you **delete** a channel (or recorder), you permanently delete all recordings for that channel (or recorder) even if those recordings were made while a different preset is applied.

> 📋   Applying a configuration preset with a different set of channels or recorders is **not** the same as deleting a channel.

When deleting a channel or recorder that has recorded files, the Admin panel warns you of other configuration presets that use the same channel or recorder index numbers. When you see this prompt, we recommend you take a moment to look through the **Recordings** list to make sure you're OK to proceed with permanently deleting all the recorded files.

The page at 192.168.0.28 says:　　　　　　　　　　✕

Are you sure you want to remove this channel with and all
related recorded files?
* 9 recorded file(s).
* These recordings could have been made when using the
following configuration preset(s): extra channel, recording,
recordingTest, session 1, session 2, test.
You can't undo this action.

OK　　　　Cancel
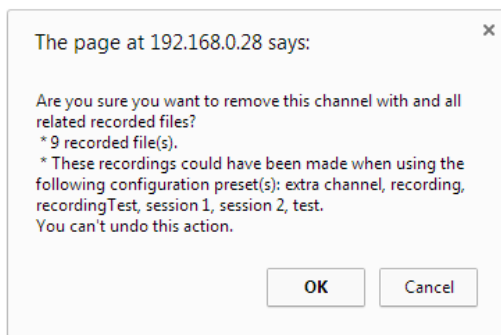
Orphaned Kaltura resource registrations and duplicate resources

Returning Pearl to the factory defaults using the factory default configuration preset or performing a factory reset does not delete the registered resource instance in Kaltura CMS. In that case, you can reregister your Pearl using the same resource name and take over for the resource instance that is still registered in Kaltura, see Reassign a registered resource.

If you apply a configuration preset to set up a replacement Pearl with the settings from a Pearl that is currently registered with Kaltura, the replacement Pearl assumes the identity of the registered resource. However, you risk having two active Pearl resources with the same identity, which can effect recording and the content that's uploaded to Kaltura for scheduled events.
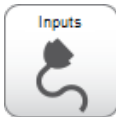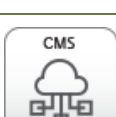
To remove the risk of having two active devices with the same registered resource identity in Kaltura, we recommend powering down one of the Pearl resources, then disconnect it from the network and consider performing a factory reset or applying the factory default configuration preset.

Configuration groups

The following table describes what settings are saved with each configuration group.

Table 30 *Configuration group definitions*

Group Name	Symbol	Settings included in the configuration group
System	System ⚙️	Date and time settings, serial port settings, remote support settings, custom disk check schedule, access passwords, deny/allow lists and LDAP configuration settings.
Network	Network 🌐	Network settings.

Group Name	Symbol	Settings included in the configuration group
Inputs	Inputs	All audio and video source configuration settings (including no signal images) except EDID settings, which are in their own group.
EDID	EDID	EDID settings for sources. Applying configuration presets with this group automatically applies the included EDIDs. This process can take a while.
Channels	Channels	All channel configuration data and current recording state, all layouts, images used in layouts, streaming state, all recorder configuration data and current recording state, individual and global UPnP settings.
AFU	Auto File Upload	Automatic file upload type and parameters. SFTP/SCP **private keys** are included (in encrypted format) in the automatic file upload preset.
CMS	CMS	Include CMS settings for Kaltura.
AV Studio	AV STUDIO AV5	AV Studio pairing and encoder selection information.
Touch screen	Touch screen	Permitted touch screen use settings.
Output ports	Output ports	All configuration settings for the output ports.

The Factory default configuration preset and Factory reset

Administrators can apply the default factory configuration preset to Pearl, which resets most of the settings in each of the main configuration groups. Applying the factory default configuration preset is similar to a factory reset, but a **Factory reset** is more invasive. This table describes the differences.

Table 31 *Factory default configuration preset vs a factory reset*

Item	Factory default configuration preset	Factory reset function
Deletes all created channels	✓	✓
Deletes all recorded files in channels		✓
Deletes all created recorders	✓	✓
Deletes all recorded files in recorders		✓
Resets network configuration	✓	✓
Resets touch screen configuration	✓	✓
Resets user passwords	✓	✓
Deletes all created configuration presets		✓
Removes Kaltura and Panopto CMS registration information	✓	✓
Removes records for all scheduled and completed CMS events	✓	✓
Deletes all branding files		✓
Resets all Source settings	✓	✓
Resets EDID to factory	✓	✓
Deletes all SCP/SFTP identities	✓	✓
Deletes all LDAP settings	✓	✓
Deletes all Automatic file upload settings	✓	✓

To apply the factory default configuration preset, you can Apply a configuration preset using the Admin panel or Apply a configuration preset using the touch screen and select the **Factory default** configuration preset using either of these procedures. A reboot is required.

To do a factory reset, see Perform a factory reset.

Operators who are assigned certain administrative-level privileges can apply the Factory default configuration preset and perform a factory reset, see Assign administrator privileges to operators.

> Returning Pearl to the factory defaults or performing a factory reset does not delete the registered resource instance in Kaltura CMS. You can reregister your Pearl using the same resource name and take over for the resource instance that is still registered in Kaltura, see **Reassign a registered resource**.

Create a configuration preset

You can create as many configuration presets as you need; however, there's a limit to the amount of space available for configuration presets. A maximum of 256 MB is available for configuration presets and the maximum size of a single configuration preset is 128 MB.

> Before creating and using a configuration preset, read **Configuration preset considerations**.

For each configuration preset you create, you get to name the preset and choose which groups of settings to include. See Configuration groups for which settings are included in each group.

After you're finished configuring your Pearl, it's good practice to save a full backup with all groups selected so that you can restore your full configuration at a later date.
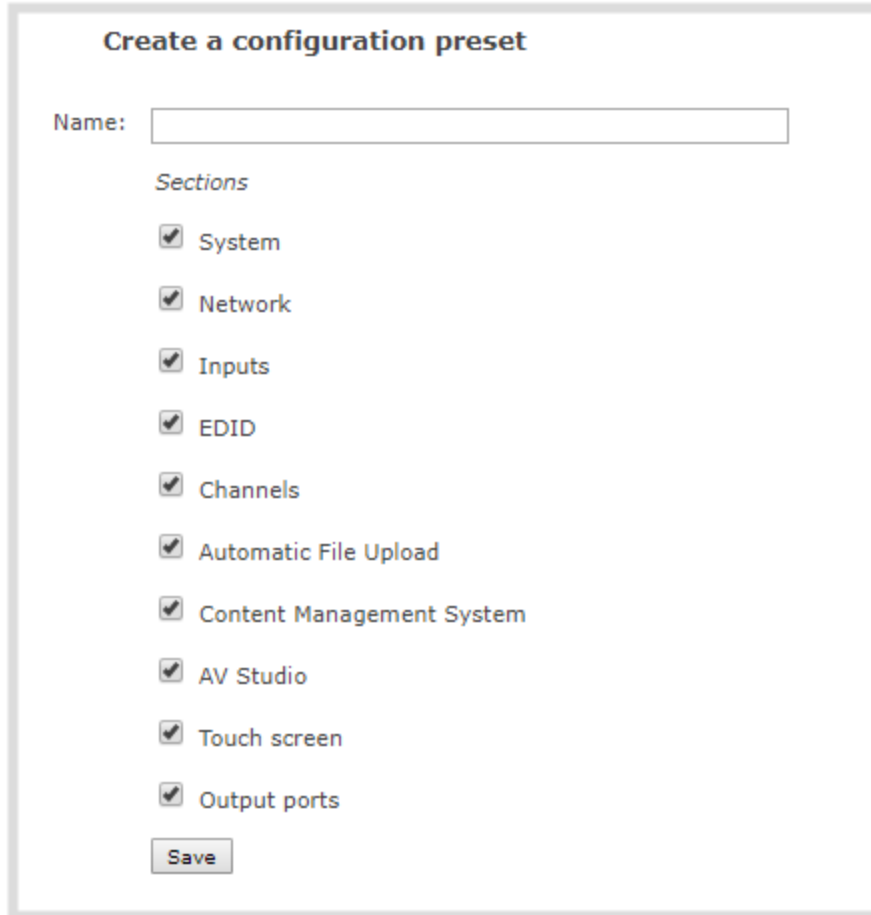
Configuration presets that include **network** or **system** settings require a system reboot when applied.

Important considerations

- If you try to save a configuration preset but one or more of the related image files is missing, an error message is displayed. You'll be unable to save the preset until the missing files are restored or the layouts referencing the missing files are modified to remove the bad references.

- If you try to save a configuration preset but there isn't enough space, an error message is displayed. You'll need to delete some presets before proceeding.

To create a configuration preset:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, click **Maintenance** . The maintenance page opens.

3. In the **Configuration presets** section, enter a name for your configuration preset in the **Name** field.

Create a configuration preset

Name: [   ]

Sections

☑ System

☑ Network

☑ Inputs

☑ EDID

☑ Channels

☑ Automatic File Upload

☑ Content Management System

☑ AV Studio

☑ Touch screen

☑ Output ports

[Save]

4. Check the configuration groups you want to include in the preset. For a full system backup, select all groups.

5. Click **Save**. Your configuration preset appears in the list.

What's next?

You can export the configuration preset to your admin computer and then import it to another Pearl, see Export and import configuration presets, and you can Apply a configuration preset using the Admin panel

Apply a configuration preset using the Admin panel

When you apply a configuration preset, the system settings for all included configuration groups are updated. Other settings on the system are not affected. For example if you apply a preset that includes the configuration groups **channels** and **automatic file upload**, your network settings, passwords, time server,

source configurations, etc are not modified. Similarly, if you apply a configuration preset that has only **network** settings included, only the network settings change.

If you apply a preset that has the **network** or **system** configuration group, a reboot is required. If you apply a preset that has the EDID configuration group, the system may appear unresponsive for a short time while it applies these EDIDs to the video grabbers.

You can verify which configuration groups are included in a preset by looking at the list to the right of the configuration preset name. The term 'all' means all groups are included. Otherwise groups are listed individually.

> You may apply multiple presets one after another. If you apply two (or more) configuration presets that include a particular configuration group, the settings (for that group) from the last applied preset are the active settings. In short, last in wins.

To apply a configuration preset using the Admin panel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, click **Maintenance**. The maintenance page opens.

3. In the **Configuration presets** section, click the **Apply** button next to the configuration preset you want to apply. Click **OK** when prompted. Pearl reboots automatically if the configuration preset includes the **network** or **system** configuration groups.
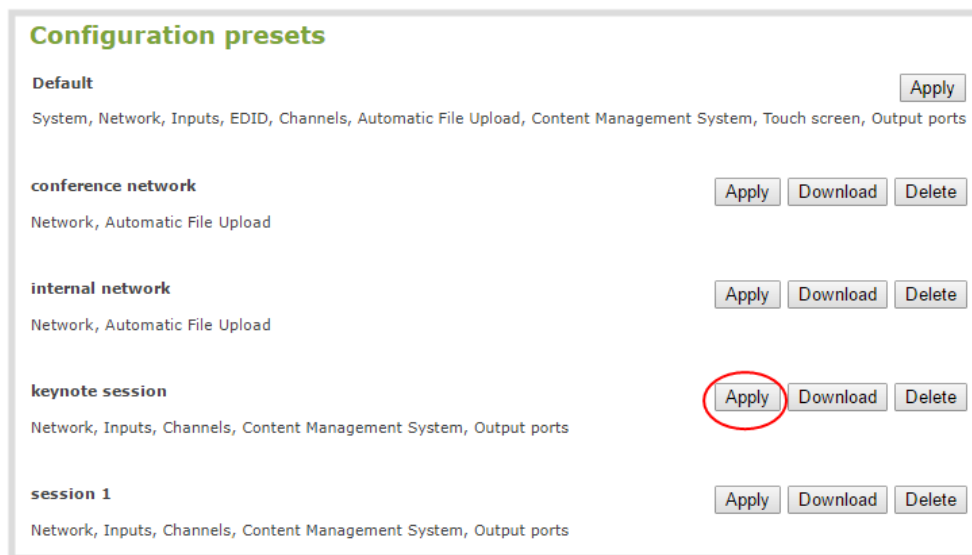
Apply a configuration preset using the touch screen

You can use Pearl's touch screen to apply configuration presets. Configuration presets that only contain the **network** configuration group can also be applied using an alternative method, which is also described in this procedure.

If you apply a preset that has the EDID configuration group, the system may appear unresponsive for a short time while it applies these EDIDs to the video grabbers.

To apply a configuration preset using the touch screen:

1. Tap the **gear** icon to open the System settings screen. If the control icons aren't showing, tap anywhere on the touch screen.
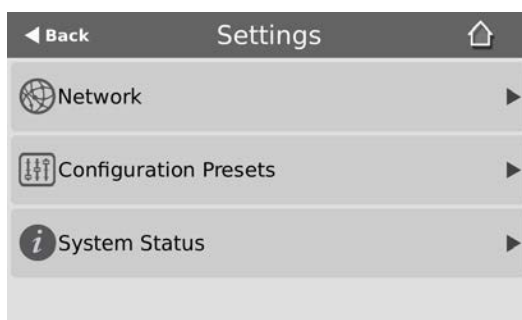
2. Tap **Configuration Presets**. A list of all the saved presets appears. The configuration preset to reset Pearl to the Factory defaults is always listed first.
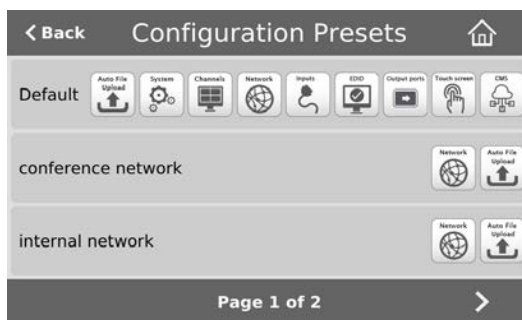
3. Use the arrows at the bottom of the page to navigate through the list and tap the name of the preset you want to apply.
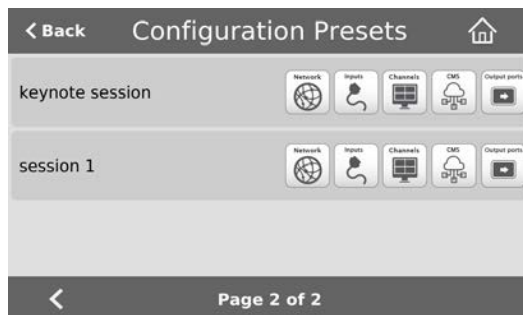
4. Click **OK** when prompted to apply the configuration preset. If the configuration preset includes the network or system configuration groups, a reboot is required.
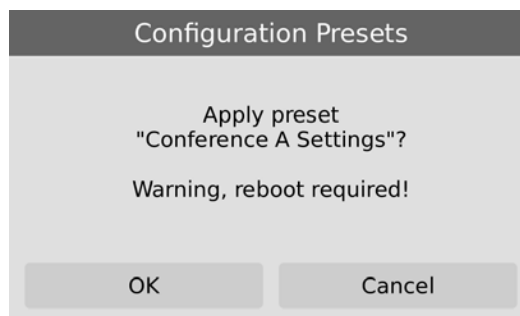
Alternatively, you can apply a configuration preset from the **Settings** when you choose **Network**, and then tap **Network Presets** to display the list of saved configuration presets that you can choose from. Configuration presets that contain only the network configuration group are listed when you use this method.
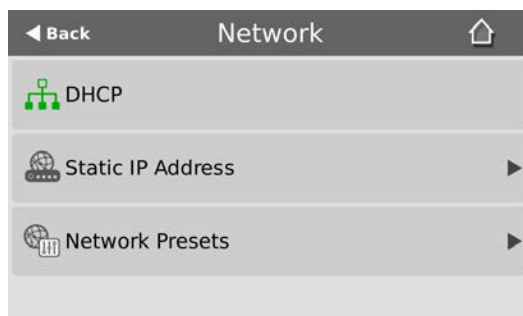
Export and import configuration presets

You can download configuration presets to your local computer, then upload and apply the preset to other Pearl systems or save the configuration preset as a backup of your current configuration. Either way, it's a simple two-step process to download the preset from one system and upload it to another.

> You cannot download/upload configuration presets using the local console on Pearl. Use the web-based Admin panel instead.

Before you begin

Read Configuration preset considerations.

Download a configuration preset

To download or export a configuration preset:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, Click **Maintenance** . The maintenance page opens.

3. In the **Configuration presets** section, click the **Download** button next to the configuration preset you want to export. The configuration preset file (with extension .preset) is saved to your admin workstation (in your browser's download folder).
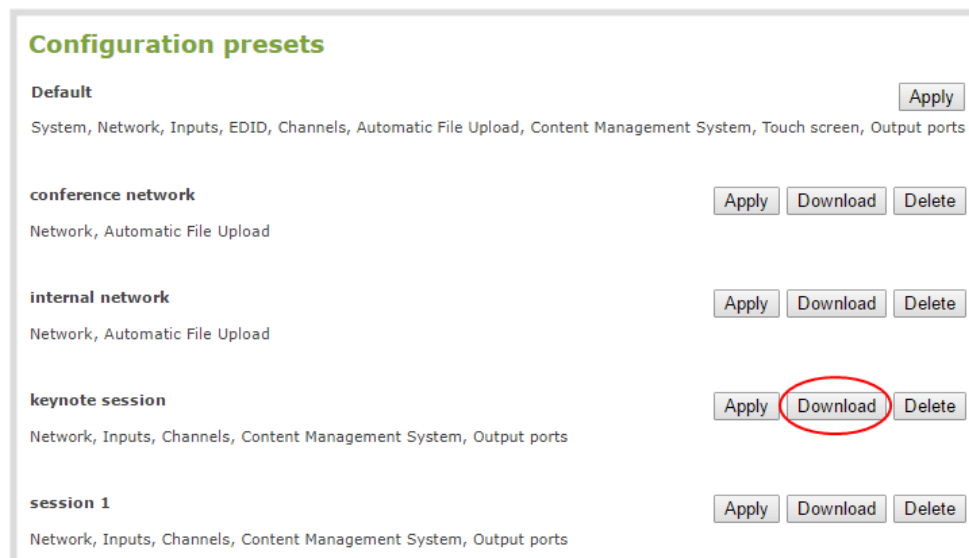
Import a configuration preset

To import a configuration a preset:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, click **Maintenance**. The maintenance page opens.

3. In the **Import configuration preset** section, click **Choose file** and browse to select the file you want to upload (with the extension .preset), then click **OK**.

4. Click **Import**.

Import configuration preset

Import Configuration Preset From File   Choose File test.preset

Import
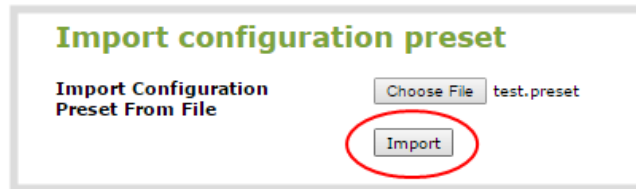
5. If your system already has a configuration preset with the same name as the one you're loading, a warning is shown. Click **OK** to overwrite the existing preset or **Cancel** to cancel the upload.

The page at 192.168.0.129 says: ✕

configuration preset test already exists. do you want to overwrite it?

☐ Prevent this page from creating additional dialogs.

OK   Cancel

What's next
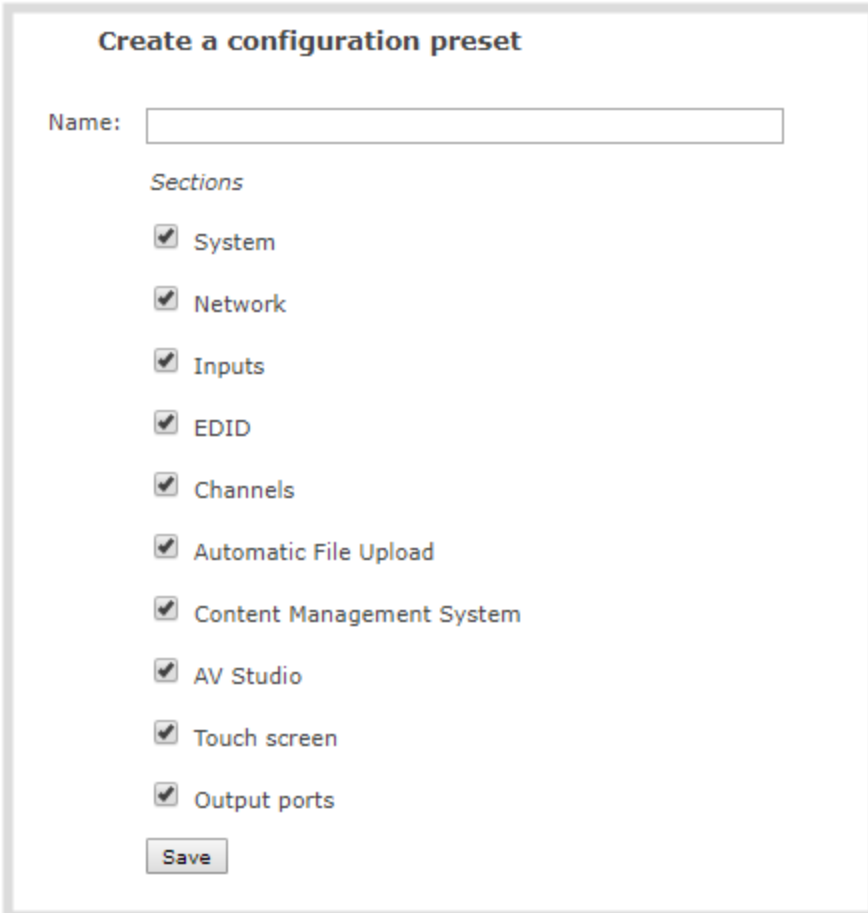
After you upload a configuration preset file, you must apply the configuration preset to Pearl. To apply the configuration preset, see Apply a configuration preset using the Admin panel or Apply a configuration preset using the touch screen.

Update a configuration preset

To update a configuration preset and add or remove different configuration groups using the Admin panel, you simply creating a new configuration preset with the same name so that it overwrites the existing one.

To update a configuration preset:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, click **Maintenance** . The maintenance page opens. All existing configuration presets are listed in the **Configuration presets** section.

Create a configuration preset

Name: [   ]

Sections

☑ System

☑ Network

☑ Inputs

☑ EDID

☑ Channels

☑ Automatic File Upload

☑ Content Management System

☑ AV Studio

☑ Touch screen

☑ Output ports

[Save]

3. Copy the name of the preset you want into the **Name** field and select the configuration groups to include, then click **Save**.

4. Click **OK** when prompted to overwrite the existing configuration preset with the new one.

Delete a configuration preset

You can delete all configuration presets at once by doing a factory reset, or you can delete individual configuration presets from the **Maintenance** page. You cannot delete the Factory default configuration preset.

To delete a configuration preset:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, select **Maintenance**. The maintenance page opens.

3. Click **Delete** beside the configuration preset that you want to delete, and then click **OK** when prompted.
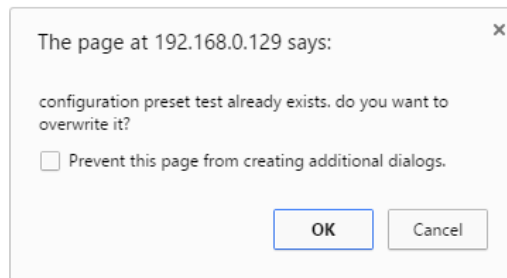
User administration

Pearl has three configured users: admin, operator, and viewer. By default, none of these users have passwords assigned. For higher security, we recommend setting admin, operator and viewer-level passwords on Pearl.

Topics include:

- User types and privileges
- Assign administrator privileges to operators
- Set or change user passwords
- Remove user passwords
- Overcome lost passwords
- Configure LDAP user authentication
- Change the logged-in user
- Restrict viewers by IP address

User types and privileges

There are three Pearl user levels:

- Administrator
- Operator
- Viewer

No password is assigned to these user levels by default and you cannot change the default user names or disable these user levels. When you log in to Pearl, you must log in as one of these three user levels. Private profiles with individually set passwords are not used.

You can set an access password for each user level using the Admin panel.

> **STOP** For higher security, we recommend assigning passwords to at least the Administrator and Operator levels because those have access to the Admin panel and can reconfigure Pearl, see **Set or change user passwords**.

When logged in to the Admin panel, the user level is displayed at the top right corner of the screen.
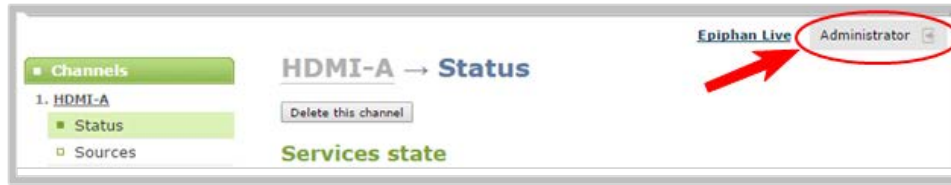
Administrator

The **admin** account is used for all system configuration and has full access to all configuration features with full access to the web-based Admin panel, local console, and Pearl remote login access. The default user name used to log in to Pearl is **admin**.
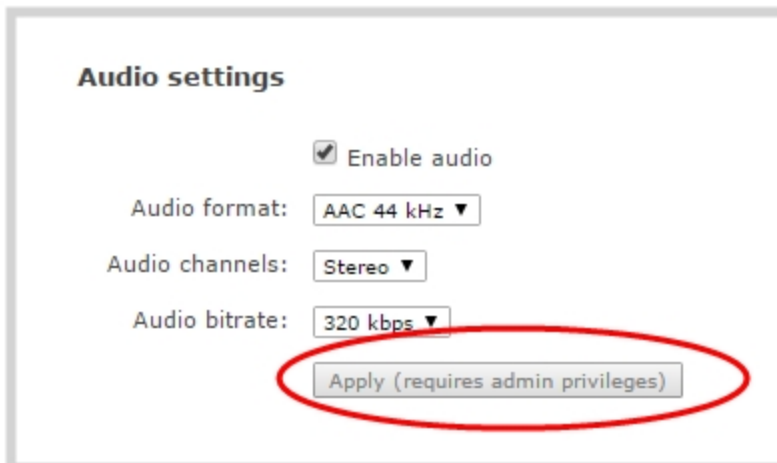
Operator

The **operator** account allows users limited Pearl configuration control with limited access to the web-based Admin panel, local console, and Pearl remote login access. The default user name used to log in to Pearl is **operator**.

Operators can to do the following:

- Configure inputs
- Control recordings (start and stop)
- Rename, download and delete recordings
- Switch layouts while live streaming
- Perform network diagnostics

If an operator does not have the privileges to apply a particular configuration in the Admin panel, the **Apply** button appears grayed-out in color and is not clickable. Administrators can grant operators permission to perform some administrator tasks, see Assign administrator privileges to operators.

Viewer

The **viewer** account is for all users who are permitted to view the streamed channels. The default user name used to log in to Pearl is **viewer**. If no password is assigned, then viewers are not prompted for a user name and password to view a channel. The viewer user name and password prompt appears only if a viewer password is set.

In addition to the global viewer account, each channel can set a viewer password that overrides the global value, see Restrict viewer access to channel streams.

User privileges

The following table outlines the default privileges for each user level. For administrator-level privileges that can be assign to operators, see Assign administrator privileges to operators.

Table 32 *User privileges in the Admin panel*

Action or Menu Option	viewer	operator	admin
View Channel Output	✓	✓	✓
Channel Operations			
View Channel Configuration		✓	✓
Rename a Channel			✓
Configure Stream Channel			✓
Configure Stream Sources			✓

Action or Menu Option	viewer	operator	admin
Publish a Stream			✓
Configure Channel Metadata			✓
Switch Layouts while Streaming/Recording		✓	✓
Add, Duplicate, Configure and Delete Recorders			✓
Start the Stream Recorder		✓	✓
Stop the Stream Recorder		✓	✓
View Recorded Files List		✓	✓
Rename Recorded Files		✓	✓
Download Recorded Files		✓	✓
Delete Recorded Files		✓	✓
Input Source Operations			
View Input Source Configuration		✓	✓
Rename Input			✓
Configure Input		✓	✓
View Input Snapshot		✓	✓
Network Security			
Configure 802.1x			✓
Configure HTTPS			✓
CMS Operations			
Start/stop scheduled events (touch screen)	✓	✓	✓
Create ad hoc events (touch screen)	✓	✓	✓
Enable CMS and register			✓
Disable CMS or deregister			✓
Configure CMS settings and default event			✓

Action or Menu Option	viewer	operator	admin
parameters			
Start/stop scheduled events (Admin panel)		✓	✓
Create ad hoc events (Admin panel)		✓	✓
View the Events page		✓	✓
System Configuration Operations			
View System Configuration		✓	✓
Configure Automatic File Upload			✓
Select External USB Drive Behavior			✓
Cancel USB file transfers		✓	✓
Configure FTP Server			✓
Configure UPnP Sharing			✓
Configure Network Address			✓
Perform Network Diagnostics		✓	✓
Configure Date and Time preferences			✓
Set or Change User Passwords			✓
Configure the Touch Screen			✓
Configure Serial Port Flow Control			✓
Upload Media			✓
Select Branding Template			✓
Enable Remote Support			✓
Backup Device Configuration			✓
Restore Device Configuration			✓
Restore Factory Configuration			✓
Reboot Device (via Admin panel)			✓

Action or Menu Option	viewer	operator	admin
Shutdown Device (via Admin panel)			✓
Configure Time Until Next Disk Check			✓
Perform Disk Check			✓
View Disk Information		✓	✓
Enable/disable AV Studio feature			✓
Upgrade Firmware			✓
View System Information		✓	✓

Assign administrator privileges to operators

Pearl administrators can assign additional administrative-level privileges to operators from the Security menu in the Admin panel. The following table lists the available options and their associated privileges.

Table 33 *Options with additional operator privileges*

Option	Operator admin functions
Channel configuration	Add, remove, and rename a channel
	Configure channel encoder settings
	Create and configure custom layouts for a channel
	Configure, remove, rename, and publish a stream for a channel
	Configure channel metadata
	Add, duplicate, configure, and delete recorders
	Upload, download, and delete media files
Input configuration	Add and rename video and audio inputs
Network configuration	Configure network address
	Add and remove CA certificates
	Reboot Pearl
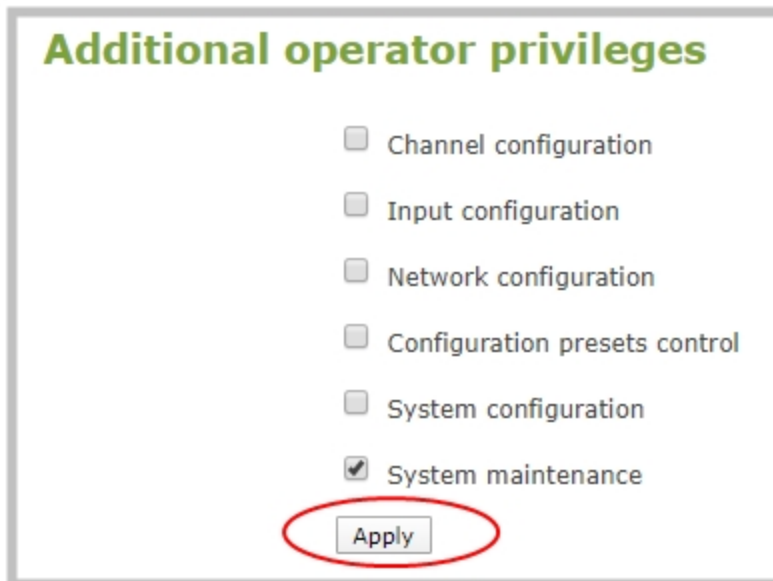
Option	Operator admin functions
Configuration presets control[1]	Create, delete, and apply configuration presets
System configuration	Configure the video output settings
	Enable CMS and register
	Disable CMS or deregister
	Configure CMS settings and default event parameters
	Configure Automatic File Upload (AFU)
	Select external USB drive behavior
	Configure Pearl as an FTP server
	Configure UPnP sharing
	Configure the date and time preferences
	Configure the touch screen
	Configure the serial port flow control
	Enable/disable AV Studio feature for remote control, pairing, and selecting channels
	Video output configuration
Maintenance configuration	Upgrade firmware
	Apply configuration presets[2]
	Enable remote support
	Reboot device (via Admin panel)
	Shutdown device (via Admin panel)
	Restore factory configuration
	Configure the device name, location, and description
	Perform disk check
	Config time until next disk check

[1]Only configuration presets that don't include the System group are allowed.

[2]Allow operators to apply configuration presets that include the System group, as well as apply the factory default configuration preset.

To assign administrative privileges to operators:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, select **Security**. The Security configuration page opens.

3. Under **Additional operator privileges**, check the options to assign those administrator privileges to operators, and then click **Apply**.

Set or change user passwords

The admin, operator and viewer-level users have no assigned password by default. For higher security, we recommend that you assign a password for at least the admin and operator-level viewers as soon as possible. Admin and operator-level users have access to the Admin panel to control Pearl.

> If the admin password is defined and the operator password is undefined, by default the operator must use the admin password.

Passwords are case sensitive and can use all alphanumeric keys in the ASCII range. Your password can be up to 255 characters long, but should not include any spaces. Contact your system administrator for your organization's specific password requirements.

In addition to setting global passwords for viewers, you can also set access passwords and IP restrictions on a per channel basis from the channel's **Streaming** page, see Restrict viewers by IP address.

If you lose the admin password, see Overcome lost passwords.

> **STOP** Setting a user's password causes the user to be logged out. Be ready to log back in with the new admin password or have operators and viewers log in with the appropriate new password. Viewers may need to refresh their browser window or press play in their media player.

> **STOP** Changing the admin password while live streaming disrupts the view of the stream for viewer-level users. Complete any admin password changes when there is no live stream in progress.

To set a user password:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, select **Security**. The Security configuration page opens.

3. Highlight and delete the **current password** for your selected user. Eight dots mask the password regardless of the password's actual length (and appears even if no password is set).

4. Highlight and delete the **confirmation password** for the selected user.

5. Select the user's **password** field and type a new password for the user. The new password must have between 1-255 alphanumeric characters or special characters with no spaces. Passwords are case sensitive.

6. Select the user's **password confirmation** field and confirm the new password.

7. Click **Apply**.

8. If you were logged in as the user whose password you just changed, you are logged out and must log back in with the new password. If you added or changed the viewer's password, all viewer's stream will pause until they log in with the new password.

You can specify multiple account passwords before clicking **Apply**.

Remove user passwords

You can remove passwords for one or more of the user levels using the Admin panel. If you don't remember the admin password, refer to the section Overcome lost passwords. Note that viewer passwords can be set on a per-channel basis.

> 🛑 Clearing a user's password will cause that user to be logged out. Be ready to log back in with the new admin password. If viewers are watching the broadcast when the viewer password is cleared they will be logged out. Viewers may need to refresh their browser window or press play in their media player to trigger the login prompt.

To clear a user's password:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, select **Security**. The Security configuration page opens.

3. Highlight and delete the current password for the selected user level. Eight dots mask the password regardless of the password's actual length (and appears even if no password is set).

4. Highlight and delete the **confirmation password** for the selected user, then click **Apply**.

5. If you were logged in as the user whose password you just cleared, you are logged out and must log back in without a password. If you cleared the viewer's password, all viewer streams will pause until they log in without a password.

To clear a user's password on a specific channel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Channel menu, select a channel and click **Streaming**. The channel's Streaming configuration page opens.

3. From the Access control section, do one of the following:

   a. Clear the **viewer password** field.

   b. Select **Use global settings** from the access control drop down.

4. Click **Apply**.

Overcome lost passwords

If you have lost the password for the operator or viewer account, you can log in to the Admin panel and reset the password using the procedure described in Set or change user passwords.

If you have lost the admin password and you have remote support enabled on the system, contact Epiphan Support to request a remote password reset. If remote support is disabled, you must return the system to Epiphan for password recovery. Contact Epiphan Support.

Alternatively, you can regain access to Pearl if you apply the factory default configuration preset using the touch screen, Apply a configuration preset using the touch screen. The factory default configuration will change the current settings on Pearl, see The Factory default configuration preset and Factory reset.

Configure LDAP user authentication

You can use the Lightweight Directory Access Protocol (LDAP) to authenticate users. Specify user roles by using group DNs for users who log in as an Administrator, Operator, or as a Viewer.

The system has only **one** admin user and **one** operator. LDAP users must log in as either an admin or an operator and do not have their own private profiles. Any LDAP users with the name admin, operator, or viewer are ignored and the local accounts are used instead.

When enabled, LDAP authentication is an **alternative** to the regular system user names and passwords. You may still login as **admin**, **operator** or **viewer** using the passwords for those accounts.

> LDAP replaces the local **viewer** account instead of working side-by-side with it when LDAP is enabled and the viewer account has no password (either there is no global viewer password configured or the channel overrides the global password with a blank password). In this case, the viewer must authenticate with LDAP and **cannot** use the default **viewer** account with a blank password to log in.

> For security reasons, you should configure passwords for the local accounts. See **Configure LDAP user authentication**.

These instructions assume you have a pre-configured LDAP server. The server must support anonymous binding or have a special bind account with search access privileges. Note that Active Directory does not support anonymous binding. LDAP referrals, restrictions and failovers are not supported.

To configure LDAP authentication:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, select **Security**. The Security configuration page opens.

3. In the **LDAP authentication** section, check **Enable LDAP authentication**. Uncheck the check box to disable LDAP authentication.

LDAP authentication:

Enable LDAP authentication	☐
Server address[:port]	
Connection encryption	No encryption ▼
Bind DN	
Bind password	
Base DN	
Search attribute	
Administrators (group DN)	
Operators (group DN)	
Viewers (group DN)	

Apply

4. In the **Server address[:port]** field, enter the server IP address and (optional) port for your LDAP server. For example, 192.168.1.101:389.

5. In the **Connection encryption** drop-down, choose the type of encryption used by your LDAP server (if any is used).

Connection encryption	Description/Default port used
No Encryption	No encryption is used to connect to the LDAP server. The default port is 389.
SSL	SSL encryption is used to connect to the LDAP server. The default port is 636.
TLS/STARTTLS	The connection is initially unencrypted then upgraded to TLS encryption is used. The default port is 389.

6. In the **Bind DN** and **Bind password** fields, specify the fully qualified DN and password for LDAP bind. These fields are only needed if your LDAP server does not support anonymous binding.

7. In the **Base DN** field, specify the baseObject to search for entries. The system will search this object and the whole subtree starting at the base DN.

8. (Optional) By default the search attribute is *uid*, which is suitable for a unix environment. You can specify a different value in the **Search attribute** field, if needed. For Active Directory environments, specify *userPrincipalName*. The value of this attribute must be unique in the Base DN.

9. In the **Administrators (group DN)** field, specify the distinguished name of the group users must be part of to be logged in as the administrator. Users must have the *member* or *unqueMember* attribute for the specified group to be granted Administrator access.
   If left blank, LDAP is not supported for Administrators (but can still be used for Operators and Viewers).

10. In the **Operators (group DN)** field, specify the distinguished name of the group users must be part of to be logged in as the operator. Users must have the *member* or *unqueMember* attribute for the specified group to be granted Operator access.
    If left blank, LDAP is not supported for Operators (but can still be used for Administrators and Viewers).

11. In the **Viewers (group DN)** field, specify the distinguished name of the group users must be part of to be logged in as a viewer. Users must have the *member* or *unqueMember* attribute for the specified group to be granted Viewer access.
    If left blank, LDAP is not supported for Viewers (but can still be used for Administrators and Operators).

12. Click **Apply**.

When a user of the LDAP server next visits the admin or viewer page for the system, the system prompts for use the username and password. For ActiveDirectory servers, the user needs to enter his fully qualified username (i.e. username@domainname) in addition to his LDAP password.

> 🛑 Users are required to authenticate once to the system and one time per channel they view. Therefore users see a prompt to log in to the system (the system name is shown) and a second time to log in to the channel (the channel name is shown).

Change the logged-in user

After you log in to the Admin panel as an Administrator or Operator, your browser remembers this configuration and automatically logs you in using the same user account the next time you log in to Pearl.

To log in using a different user account:

1. In the Admin panel, click the logout icon at the top right corner of the screen. A new login screen appears.

> 📋 Some browsers may require you to click twice before the you are logged out.

2. Enter the credentials that you want to use to log in to the Admin panel.

Restrict viewers by IP address

Pearl permits you to restrict which computers can access broadcasts by building a list of allowed and denied IP addresses. You can do this at a global level for the system and can also override these settings on a per-channel basis. Both global and per-channel configuration procedures are described.

The following table describes what happens when an IP address is added to the allowed and denied IP address lists.

Item	Description
Allow IP's	Users connecting from addresses in this list are permitted to view broadcasts from the system, provided their IP address is not in the Deny IP's list. To allow all except IP addresses in the deny list, if any, leave the field blank. You can use the Allow list by itself, or in conjunction with the Deny IP's list as an exception to a rule in the allow list.
Deny IP's	Users connecting from addresses in this list are not allowed to view broadcasts from the system, unless their IP address is in the Allow IP's list. If a specific IP address is in both lists, access to the stream is denied. You can use the Deny list by itself, or in conjunction with the Allow IP's list as an exception to a rule in the allow list.

If your viewer account has a password, your viewers must connect to the system from a computer (or gateway) with a permitted IP address and must also supply the user name (viewer) and password before they can view the broadcast.

To restrict access by IP address, you need to know the IP addresses or range of addresses for your viewers. By default, all IP addresses are allowed to connect to the broadcast.

If a user attempts to connect to the stream from a disallowed IP address, access is denied. If there's an attempt to connect using a web browser, the message "IP address rejected" is displayed.

Table 34 *IP Based Restriction Options*

If you're not familiar with creating allow/deny lists, see IP restriction examples.

> IP address restriction is valid for the viewer only and does not affect the Admin panel or the mobile configuration interface.

To restrict viewer access to watch streams for all channels by their IP address:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, select **Security**. The Security configuration page opens.

3. Enter the allowed IP addresses or address ranges in the **Allow IP's** field and enter denied IP addresses or address ranges in the **Deny IP's** field. Separate addresses with a comma. To specify a range, use a hyphen (-). Optional spaces improve readability.

4. Click **Apply**.

To restrict viewer access to watch streams on a specific channel by their IP address:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Channels menu, select a channel and click **Streaming**. The channel's streaming configuration page opens.

3. From the **Stream access control** drop-down, select **Use these Settings** to enable local password and Allow/Deny IP lists are enabled.

4. (Optional) Enter a password for the viewer in the **Viewer Password** field.

5. Enter the allowed IP addresses or address ranges in the **Allow IP's** field and enter denied IP addresses or address ranges in the **Deny IP's** field. Separate addresses with a comma. To specify a range, use a hyphen (-). Optional spaces improve readability.

6. Click **Apply**.

IP restriction examples

The following table lists some example allow lists.

Table 35 *Example allow lists*

Example	Description
Allow list with distinct IP addresses	The simplest allow/deny list is to use the list of known IP addresses to craft a list of allowed IP addresses. All other addresses are denied access to the broadcast.
	For example if your system is accessible on your local area network (LAN) and you want to make sure only the CEO's specific desktop, laptop and tablet computers (with IP Addresses 192.168.1.50, 192.168.1.51, and 192.165.1.75, respectively) can connect to the broadcast, construct the following allow list:
	Allow: 192.168.1.50, 192.168.1.51, 192.168.1.75
Allow list with a range of IP addresses	Sometimes you'll want a range of computer IP addresses to connect to your system. This may happen when you have one range of IP addresses assigned to desktop computers (i.e. in the range 192.168.1.1 to 192.168.1.100) and another range assigned to boardroom computers (i.e. the range 192.168.1.200 to 192.168.1.250). If you only want the boardroom computers to connect to broadcasts from the system you can specify the range of boardroom IP addresses rather than needing to type in each

Example	Description
	individual address. The allow list looks as follows: Allow: 192.168.1.200-192.168.1.250 Note that we could have specified two of the IP addresses in the previous example as a range.
Allow list with a range of IP addresses and one or more specific IP addresses	Putting the first two examples together, we want to permit access to IP addresses in the range of boardroom computers (192.168.1.200-192.168.1.250) and also want to add the desktop, laptop and tablet computers of the CEO (IP addresses 192.168.1.50, 192.168.1.51, and 192.168.1.75, respectively). Note the first two IP addresses are consecutive, so they can be added as a second range. Add these IP addresses to the list as follows: Allow: 192.168.1.200-192.168.1.250, 192.168.1.50-192.168.1.51, 192.168.1.75 Your list can have multiple ranges and multiple distinct IP addresses, provided they are separated by commas.
Allow list with a range of IP addresses, distinct IP addresses, and an exception	Building on the previous examples, consider a situation where you want the CEO's computers (192.168.1.50, 192.168.1.51, 192.168.75) and all boardroom computers (192.168.1.200-192.168.1.250) to access the broadcast, with the exception of the public boardroom computer (192.168.1.211). Use both allow and deny lists to create the rule as follows: Allow: 192.168.1.200-192.168.1.250, 192.168.1.50-192.168.1.51, 192.168.1.75 Deny: 192.168.1.211 Both lists can have multiple ranges and multiple distinct IP addresses, provided they are separated by commas.

The following table lists some example deny lists.

Table 36 *Example deny lists*

Example	Description
Deny list with distinct IP addresses	Another simple allow/deny list is to use the list of known IP addresses to list specific denied IP addresses. All other addresses are allowed access to the broadcast.
	For example imagine your system is accessible on your local area network (LAN) and you want to allow any computer on the LAN can access the stream except your publicly-accessible boardroom (with IP address 192.168.1.211). You can use the following deny list (leave the allow list empty) to permit all computers except the boardroom computer:
	Deny: 192.168.1.211
	As with allow lists, your deny list can specify a range of IP addresses, and can specify multiple ranges or distinct IP addresses in a comma-separated list.
Deny list with a range of IP addresses	Consider a situation where you want every computer on the network to access the broadcast, with the exception of the CEO's desktop, laptop and tablet computers. Additionally, boardroom computers should not be permitted with the exception of the cafeteria computer (IP address 192.168.1.222).
	The deny list is an "exception" list for the allow list. So to craft the rule described above we need to allow all the computers in the local subnet, then deny specific sub-ranges including two groups of boardroom computers ensuring the cafeteria computer's IP address is not in the deny list:
	Allow: 192.168.1.1-192.168.1.250 Deny: 192.168.1.200-192.168.1.221, 192.168.1.223-192.168.1.250, 192.168.1.50-192.168.1.51, 192.168.1.75

Status and monitoring

Pearl lets you monitor audio and check the status of your channels, live streams, and recordings.

Topics include:

- Monitoring audio
- Channel monitoring using the touch screen
- View system information using the touch screen
- View system information using the Admin panel
- View device information using the touch screen
- View network status
- View 802.1x network connection status messages
- View channel status and stream information
- View the video output port status
- View AFU and file transfer progress
- View scheduled events and history

Monitoring audio and VU sensitivity

You can connect headphones or external speakers to the 3.5 mm audio jack on the front panel of Pearl. To monitor the audio for a specific channel, just select the channel using the touch screen. The audio you hear depends on which layout is currently live because different layouts can have different audio sources configured. To adjust the volume, tap the headphones icon using the touch screen. See Monitoring audio for details.

A VU meter on the touch screen shows the audio levels for the selected channel. The value is displayed in dBFS (decibels relative to full scale). Colored bars represent the audio level.

Table 37 *Audio VU meter levels*

Color	Decibel range
Red	0 to -9 dBFS
Yellow	-9 to -18 dBFS
Green	-18 dBFS and lower

Channel monitoring using the touch screen

Have complete confidence about what you're capturing, streaming, and recording. Up to 6 channels are displayed in the grid view, depending on how many channels you have configured.

The grid view opens by default when you turn on Pearl. If necessary, tap the touch screen once to turn it on and tap again to display the controls.

Table 38 *Grid view indicators*

Item	Description
	Streaming (left) and recording (right) indicators appear in the top-right corner for each channel:
Streaming and recording indicators	(no dots) Streaming is disabled and recording is stopped.
	Streaming is stopped and recording is stopped.
	Streaming is started and recording is stopped.
	Streaming has an error and recording is stopped.
	Streaming is stopped and recording is started.
	Streaming is started and recording is started.

Item	Description
	⚠ 🔴 Streaming has an error and recording is started. 🔴 Streaming is disabled and recording is started. **TIP**: You stop and start recording from the individual channel view.
Audio VU meter	Each channel has an audio VU meter that uses quasi-peak ballistics with samples averaged every 10 ms. The maximum average audio level in each 100 ms period is displayed using colored bars. • RED = 0 to -9 dBFS • Yellow = -9 to -18 dBFS • Green = -18 dBFS and lower

You can do more monitoring for a specific channel when you select a channel from the grid view. Just tap the channel you want to monitor from the grid view and the channel view opens.
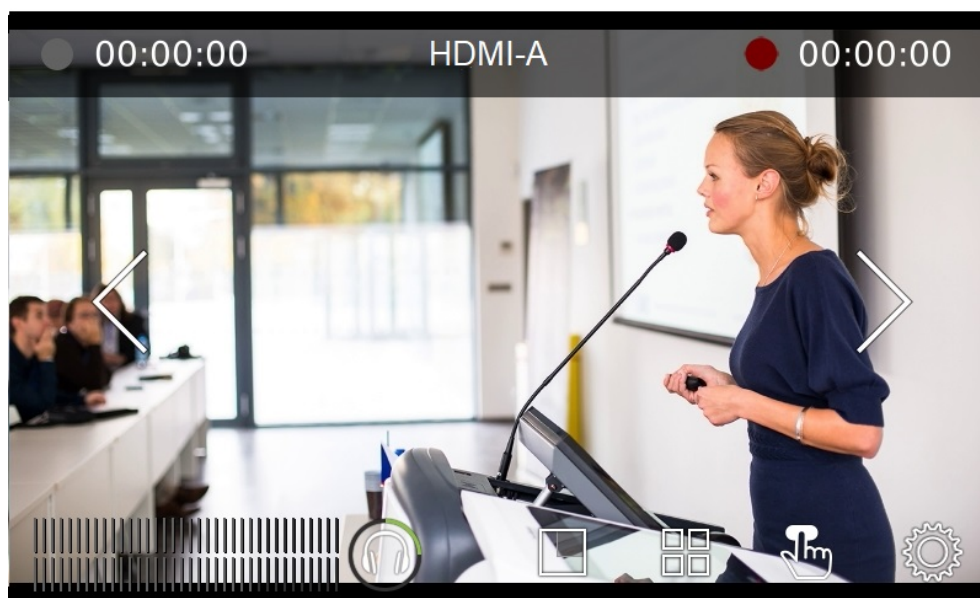

Table 39 *Individual channel view indicators*

Item	Description
Streaming status	Streaming indicator appears in the top-left corner: (no dot) Streaming is disabled.

Item	Description
	Gray means streaming is stopped.
	Flashing blue means streaming is in progress.
	Streaming has an error.
Streaming timer	The streaming timer shows the length of time that streaming has been in progress.
Recording status	Recording indicator appears in the top-right corner: (no dot) Recording is disabled. Gray means recording is stopped. Flashing red means recording is in progress. Recording has an error.
Recording timer	The recording timer shows the length of time that recording has been in progress.
Audio VU meter	Audio VU meter for the channel uses quasi-peak ballistics with samples averaged every 10 ms. The maximum average audio level in each 100 ms period is displayed using colored bars. • RED = 0 to -9 dBFS • Yellow = -9 to -18 dBFS • Green = -18 dBFS and lower

To monitor a different channel, tap the right or left arrows on the channel view to see the next (or previous) channel. If the touch screen controls aren't showing, tap anywhere on the touch screen to make them reappear.

To get back to the grid view, tap the grid icon .

View system information using the touch screen

Find the serial number, check the installed firmware version of your Pearl and more on the System Status screen using the touch screen.

The System Status screen displays basic system information that's useful when first setting up your Pearl.

System Status

Device ①

Serial	TSGC02500
Grabber	D2P290803
Firmware	4.9.0d

Status ③

Date	14-Jun-2019
Time	11:59:17
Uptime	72:08:09
CPU load	9%

Network ②

IP Address	10.2.2.240
MAC	00:05:B7:E6:CF:BF

Storage ④

475.3 free of 475.4 GB

100%

Label	Description
①	Device Information • Serial number • Video grabber number • Firmware version
②	Network Information • IP Address • MAC Address
③	Device Status • System date • System time • Uptime • CPU load (%) and Temperature (°Celsius)
④	Storage Information (when available) • Disk space available • Pictogram of available disk space

To open the System Status screen:

1. Tap the **gear** icon. If the control icons aren't showing, tap anywhere on the touch screen.
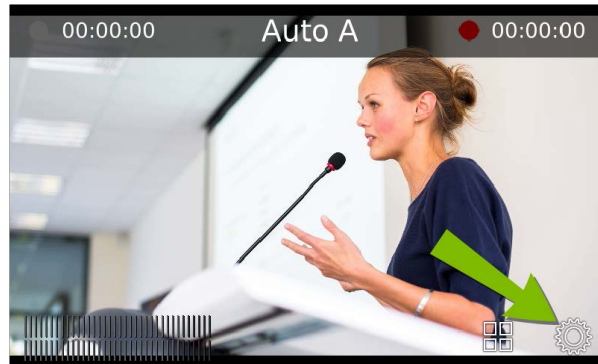
2. Tap **System Status** to see the System Status page.
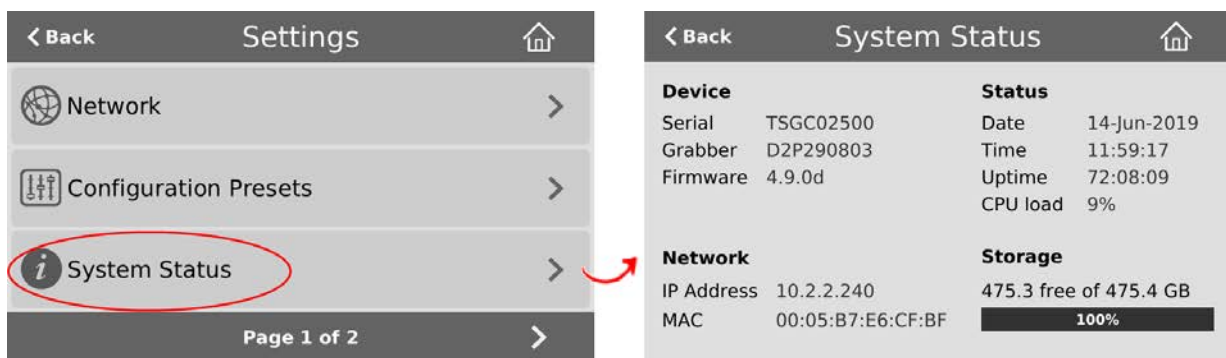
3. Tap **CPU load** to toggle between the operating temperature (°Celsius) and CPU load (%).

4. Tap **Back** to return to the **System Settings** screen, or the **Home** icon to return to the channel view.

> If the system settings control icon won't appear when you tap the touch screen, it may be disabled. See **Configure the touch screen** to enable system information.

View system information using the Admin panel

Get useful information about your Pearl and configured channels on the Info page from the Configuration menu. You can view your current firmware level, the system hardware version (if available), and currently configured channels.

To view system information using the Admin panel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, click **Info**. The system information page opens.

The Bitrate / Actual bitrate values show the total of the video bitrate plus audio bitrate.

View device information using the touch screen

View Pearl's device name, location, and description from the System Status screen using the touch screen.

To view the device information from the touch screen:

1. Tap the **gear** icon. If the control icons aren't showing, tap anywhere on the touch screen.
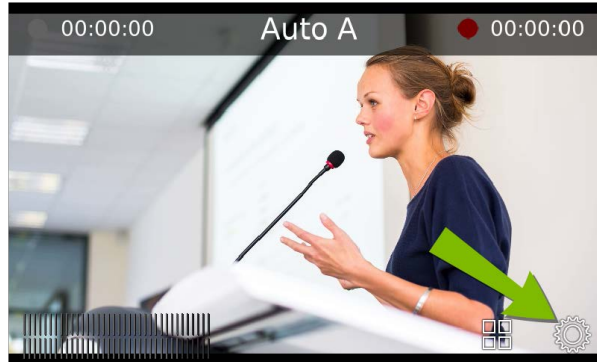
2. Tap **System Status** to see the System Status page.
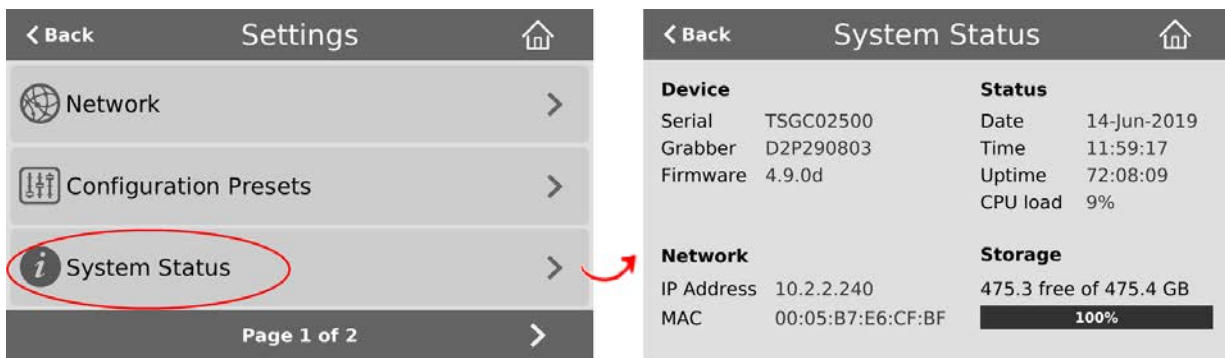
3. Tap below **Device** to show the device information. Tap a second time to show the serial number, grabber, and firmware values again.
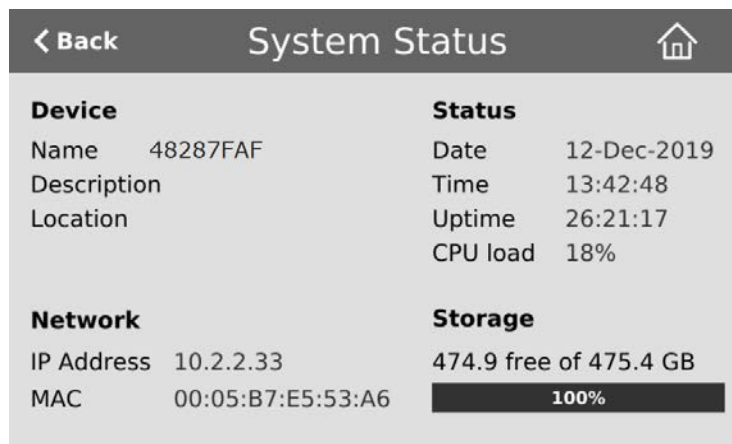
4. Tap **Back** to return to the **System Settings** screen, or the **Home** icon to return to the channel view.

> If the system settings control icon won't appear when you tap the touch screen, it may be disabled. See **Configure the touch screen** to enable system information.

View network status

Get useful status information about your Pearl network connection from the Network configuration page using the Admin panel, including:

- MAC address
- Current IP address
- 802.1x status
- Rated Ethernet link speed (Mbps)
- Sending and receiving speed (Mbps)

To view the network status using the Admin panel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.
2. From the Configuration menu, click **Network**. The Network configuration page opens.
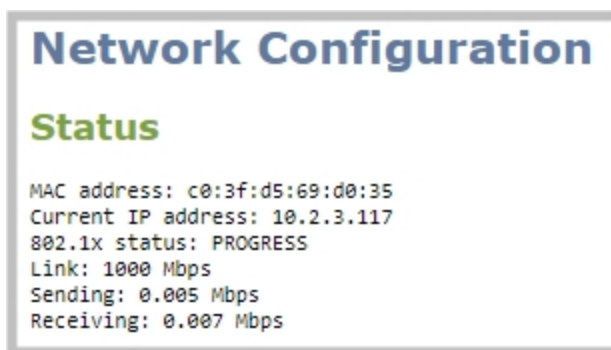
View 802.1x network connection status messages

When you first connect your Pearl to a network, the status of the connection is displayed on the System Status touch screen, see View system information using the touch screen. You can also check the network status from the Network menu using the Admin panel.

Network status messages display in the **IP Address** field on the touchscreen of Pearl while negotiating network authentication. After network connectivity is established, the IP address of Pearl is displayed.

System Status

Device

Serial	D569D134
Grabber	D2P280194
Firmware	3.15.1a

Status

Date	1-Jun-2018
Time	16:18:46
Uptime	2:37:09
CPU load	20 %

Network

IP Address	DISCONNECTED
MAC	C0:3F:D5:69:D1:34

Storage

929.8 free of 929.9 GB
100%

Table 40 *Network status messages*

Status Message	Description
DISCONNECTED	Pearl's IP address is unavailable, for example when 802.1x is not enabled on Pearl.
802.1x: PROGRESS	Connection to the 802.1x network is in progress.
802.1x: PASSED	Pearl has successfully authenticated on the 802.1x network.
802.1x: FAILED	Authentication on the 802.1x network failed.

If you attempt to connect to a network that isn't 802.1x enabled when 802.1x is configured on Pearl, a consistent **802.1x: FAILED** status message appears on the Network Configuration page in the Admin panel.

View channel status and stream information
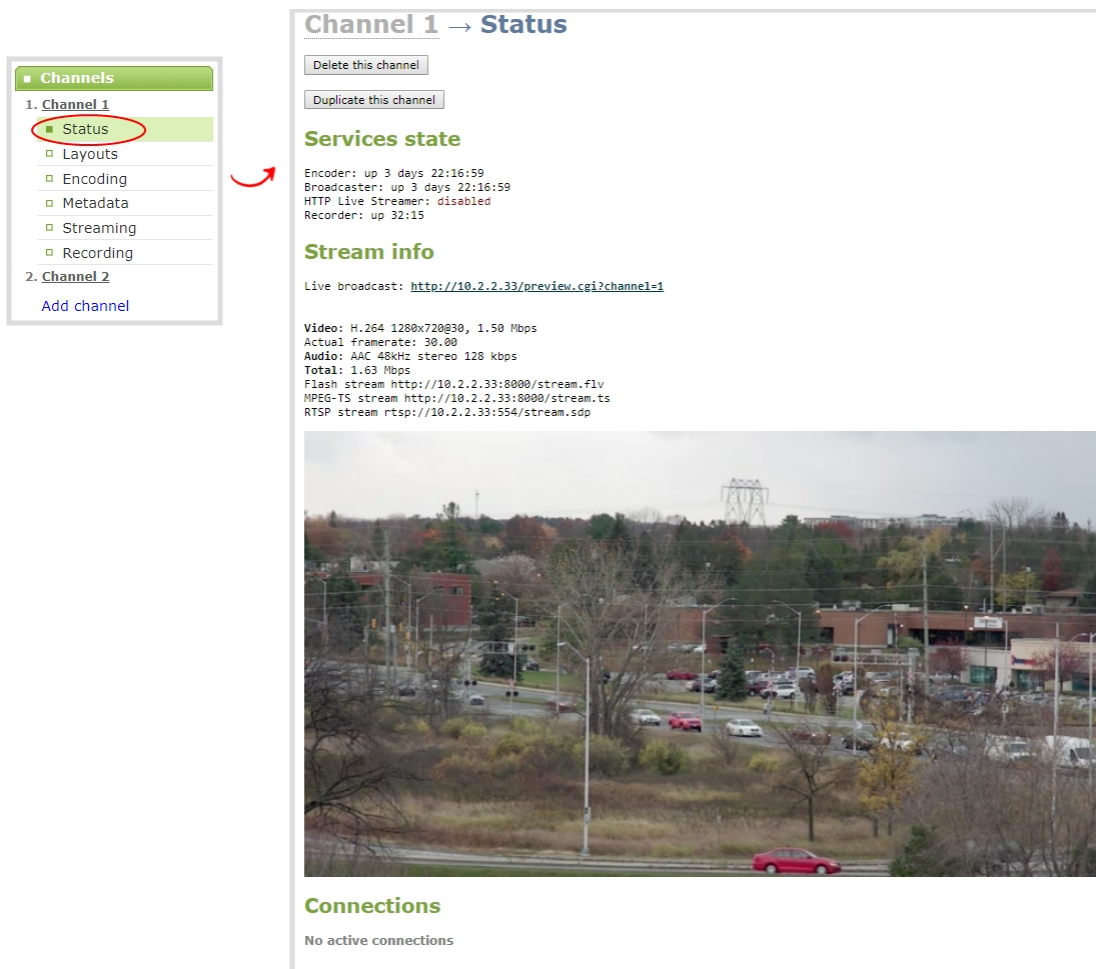
You can see information about the status of a channel on Pearl from the channel's status page using the Admin panel, including:

- The status and uptime of encoder services

- Stream information and URLs

- Channel preview

- Active network connections

More encoder information can be found on the Info page from the Configuration menu, see View system information using the Admin panel

To view the status information for a channel using the Admin panel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

3. From the Channels menu, click a channel to open the status page for that channel.

Active unicast and multicast stream information displays under **Connections**.
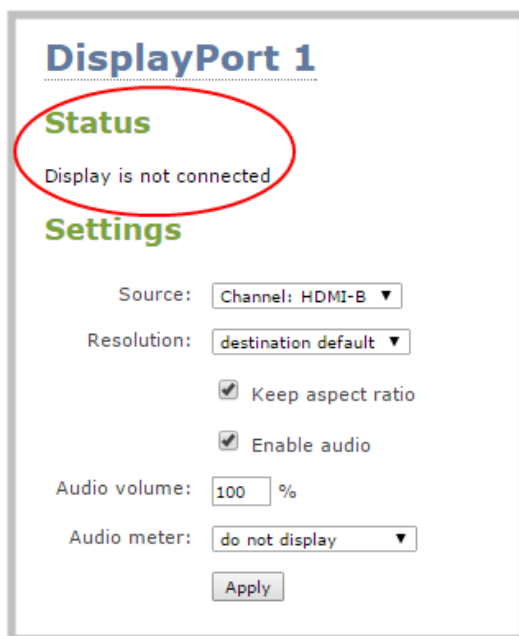
View the video output port status

The current status of the video output port and attached video display appears at the top of the video output port configuration page. You can view the status using the Admin panel.

To view the video output port status:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Output ports menu, click the output port (**DisplayPort 1** or **DisplayPort 2**). The video output port configuration page opens.

Table 41 *Possible video output status messages*

Message	Description
Disabled	This video output port is disabled in the configuration. See View the video output port status.
Display is not connected	There is no display connected to the video output port or the connected display is not powered on or not functioning.
Source is currently unavailable	The video output port is configured to display a channel that no longer exists. Change the source. See View the video output port status.
Starting …	The video output port is configuring the display and will shortly output the first frame.

Message	Description
Running at w×h	The video output port is functioning at the specified resolution.
Output error	There is an error with output. Generally this happens because both video output ports are using passive display converters and are at different resolutions or because passive and active converters are being mixed. See Video output ports.

> You can also view video output status using the Epiphan Live control interface. See **Monitor and setup the output port source and audio** for more information.

View AFU and file transfer progress

You can view basic Automatic File Upload (AFU) and file transfer information from Pearl's touch screen. Information like how many files are in the queue, the total size of the queue, the AFU type, and status are shown.

In this example, AFU is scheduled to occur at specified time intervals so the start of the next scheduled file transfer is shown.
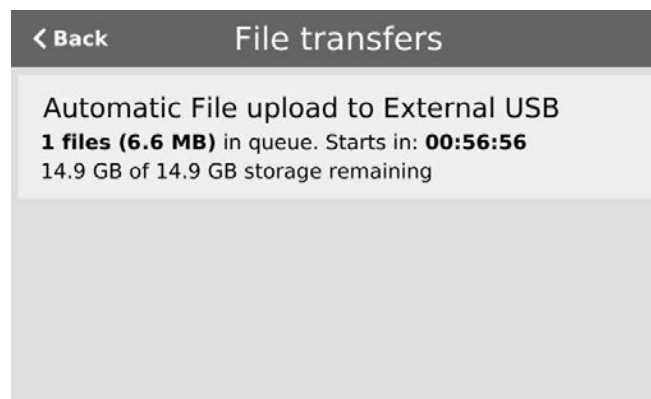
If the Pearl is configured to allow copying recordings to a connected USB drive instead of AFU, the USB drive status displays. If AFU is not enabled, the screen displays **AFU File upload is disabled**.

The Admin panel displays the status plus a history of uploaded files, which displays until either Pearl is restarted or the list is manually cleared. You can also cancel file uploads manually using the Admin panel.
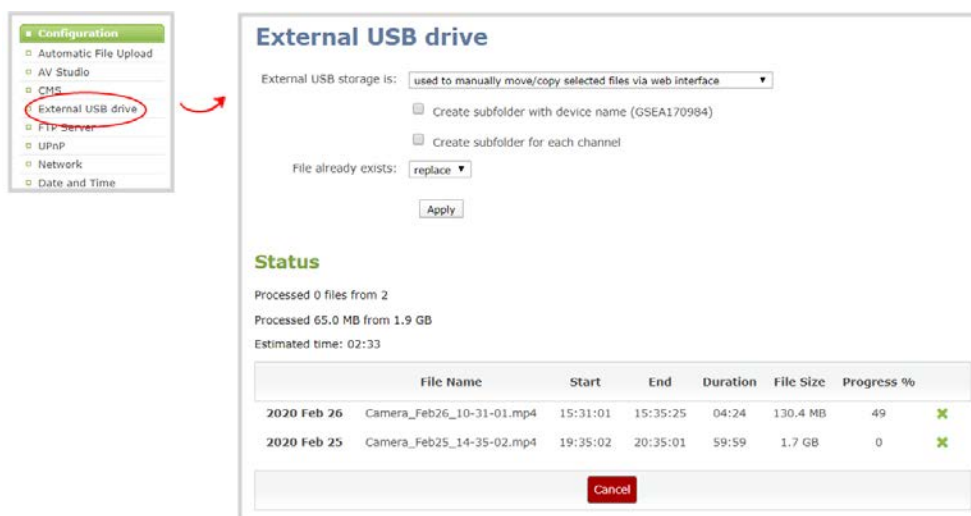
To view file transfer status using the Admin panel, see Manage the AFU queue and Manage USB file transfer queue.

To view file transfer status using the touch screen:

1. Tap the **gear** icon. If the control icons aren't showing, tap anywhere on the touch screen.
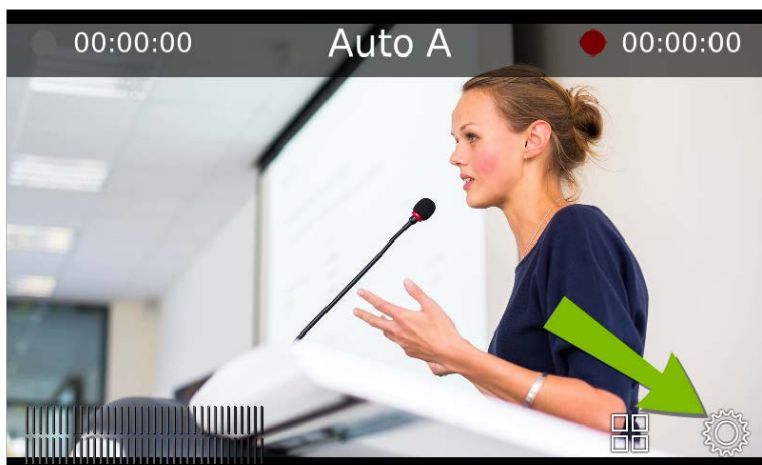
> If the gear icon is not visible on the touch screen, tap the screen once to activate the control buttons. If the system settings button is still not visible, it is disabled in the system's touch screen configuration. See **Configure the touch screen** to enable system information.

2. Tap the arrow icon in the lower-right corner of the screen to go to the second Settings page.
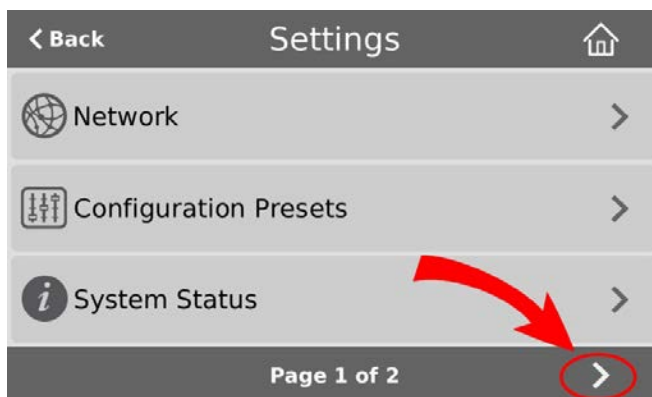
3. Tap **File transfers** to display the AFU Status page.
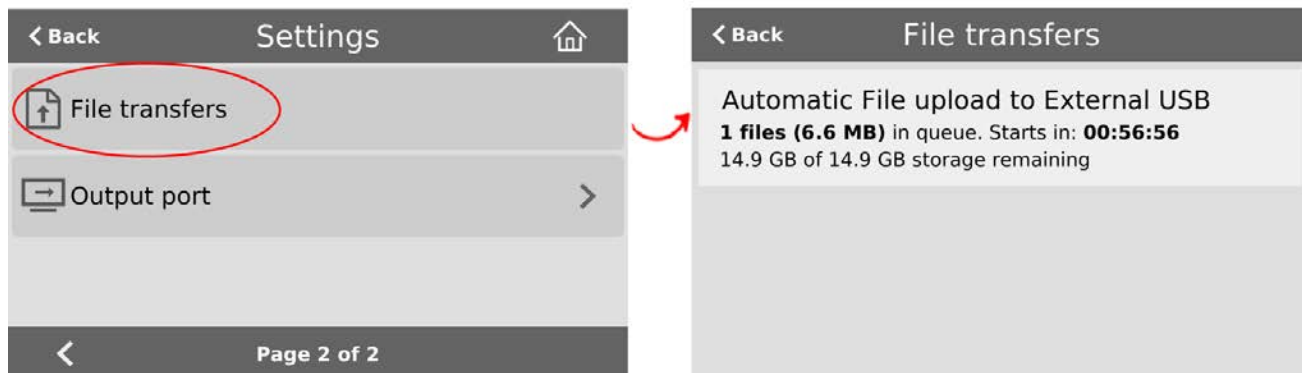
To close the system information screen, tap **Back** in the upper-left corner of the screen to return to the **System Settings** view. Tap the **Home** icon to return to the channel view.

View scheduled events and history

Using the Admin panel, select the **Events** menu to see up to 90 days of upcoming scheduled events and up to 90 days of ongoing and completed events for this Pearl resource. Click the page arrows at the bottom of each list to navigate through multiple pages.

The Events page updates to show new events every hour. Click **Refresh schedule** at any time to manually update the Events page. The Events page only displays when Kaltura or Panopto CMS is enabled on Pearl.

> 🛑 If the time and zone settings of Pearl are out of synchronization with Kaltura's scheduling server, an error appears on the Events page when you refresh the schedule. Configure the time settings on Pearl to match the time and zone of Kaltura's scheduling server, see **Configure date and time**.

From the touch screen on Pearl, you can tap the Scheduled events icon at any time to display the Events screen. The icon only appears when Kaltura or Panopto CMS is enabled on Pearl.

The Events screen displays automatically on the touch screen of Pearl about five minutes before a scheduled event starts.

For events with more channels than can be previewed at the same time on the touch screen, an arrow appears so you can scroll through a carousel of channel previews.

PART 2: Capture

Capturing is the process of taking the signals from your video and audio sources and encoding them so they're ready for streaming and recording. You add the captured video and audio to channels, which you customize for live streaming, switching, and recording.

This section covers how to create channels and add custom layouts so that you can capture, stream, and record exactly what you want - how you want! Whether that's a simple channel with a single video and audio source or channels that have multiple video and audio sources and custom layouts like picture in picture.

Topics include:

- What is a channel?
- Channel layout examples
- About automatic channels Auto A and Auto B
- Channel configuration
- Custom layout configuration
- Video and audio input sources

What is a channel?

Your video and audio sources that are connected to the input ports on Pearl can be combined and added to channels, which you can stream and record. A channel is essentially an encoding instance that you associate with your video and audio inputs to produce outputs such as video recordings and streaming destinations. And you can create multiple channels. For Pearl, we recommend a maximum of four 1080p video input sources used in up to six full HD channels simultaneously for best performance.

You can pick and choose which channels to record, stream, or do both at the same time! You can even choose the output from one channel as the video input source for another channel.

Channels with multiple layouts

There are many creative ways to customize your channels in Pearl. Easily combine multiple video sources to the same layout for picture in picture or side-by-side layouts using the convenient custom layout editor. You can add text overlays and effects, like transparent logos and lower thirds. Customize your channels with images, company information, corporate colors, and time stamps just to name a few possibilities. You can even apply chroma key effects to either one or to all your input video sources at the same time.

When you use the custom layout editor to create multiple layouts in a channel, you can live switch between the different layouts while recording, streaming, and displaying the channel on a confidence monitor. You're not limited to creating single-source **Channels** that are a one-to-one reflection of your **video inputs**. And if you need to output your switched program using multiple encoding settings, you can use the output from one channel as the input source for another channel, then stream and record each channel at different encoding settings.

Each channel can include some or all of your video and audio sources. And you can add the same source to as many different layouts as you want in a channel.

> For example, you could use the same source in all of these situations at the same time:
>
> - in Channel 1 as part of a multi-source layout with picture in picture at 1080p, 30 fps, 6,000 kbps
>
> - as the only source in Channel 2 at 720p, 30 fps, 2,000 kbps
>
> - as the only source in Channel 3 at 1080p, 60 fps, 2,000 kbps

To create custom layouts, see Custom layout configuration and About the custom layout editor.

Important note for channels with multiple layouts

When a channel has only one layout and that layout has only one video source, the default channel name is the same as the name of the video source. So for example, a channel with one layout that has HDMI-A in it is named HDMI-A by default.

When you add a second layout to the channel, the channel name automatically changes to a generic name **Channel X**, where *X* is the channel index number. For example, HDMI-A changes to Channel 1.

Changing the channel name affects system operation.

- If the channel is streaming, the stream is stopped and restarted.
- If the channel's recorder is recording, then recording is stopped and a new file is started.

If you delete all the layouts in a channel until there is only one layout left and that layout has only one video source assigned, then the channel name changes back to the name of the video source. For example, Channel 1 changes to HDMI-A

To avoid channel name changes, we recommend that you rename the channel to a custom name. Changing the channel name to a custom name ensures that no automatic channel renaming happens, see **Rename a channel**.

Channel layout examples

Here are some examples of different layouts you can create using the custom layout editor with just two video input sources and two media image files.

Layout example	Description
	One video source (a slideshow presentation in this case), at the full size of the channel. **To get this look:** Using the custom layout editor, add one video source to the layout, select **keep aspect ratio** and stretch to fill the entire layout area.

Layout example	Description
	One video source (a slideshow presentation in this case), with a green background matte. **To get this look**: Using the custom layout editor, select a background color. Add a video source to the layout and size appropriately, leaving the background matte visible.
	One video source with a logo (.png with transparency) in the bottom left corner. **To get this look:** Upload an image with transparency. Using the custom layout editor, add one video source to the layout, select **keep aspect ratio** and stretch to fill the entire layout area. Then, add the image to the layout and drag it where you want it to appear on screen.
	One source with a text overlay in the bottom right corner. **To get this look:** Using the custom layout editor, add one video source to the layout, select **keep aspect ratio** and stretch to fill the entire layout area. Then, add a text overlay to the layout and drag it where you want it to appear on screen.

Layout example	Description
	Two video sources (one cropped to a new aspect ratioCrop a video source), a background image, and a logo. Make sure the background image has the correct aspect ratio.

To get this look: Upload your background and logo images (you can do this from the Media page or the Layouts page for the channel). Using the custom layout editor, add the background image to the layout and stretch it to fill the entire layout area. Then add your two video sources to the layout, adjusting their size and position as needed. Lastly, add the logo to the layout and move it in to position. For the second video source, use the **Crop tool** to crop the second source to a square aspect ratio. |

Examples including a 4x3 video source.

Layout example	Description
	One 4x3 video source at the full size of the channel.

To get this look: Using the custom layout editor, add one video source to the layout, select **keep aspect ratio** and stretch to fill the entire layout area.

The channel broadcasts in 4x3 if you have **Use current signal resolution as frame size** selected on the encoding page. |

Layout example	Description
	One 4x3 video source in a 16x9 frame with a green background matte. **To get this look**: From the Encoding page for the channel, make sure that the 16x9 frame size is selected. Then using the custom layout editor, select a background color. Add a video source to the layout and stretch to the full height of the screen, leaving the background matte visible.
	One 4x3 video source and a cropped 16x9 video source together with a background image. Make sure the background image has the correct aspect ratio. **To get this look:** Upload your background image (you can do this from the Media page or the Layouts page for the channel). Follow the steps from the first 4x3 example to add the video sources, then use the **Crop** tool to crop the second source to a square aspect ratio.

About automatic channels Auto A and Auto B

To get you started as quickly as possible, Pearl comes pre-configured with two channels: Auto A and Auto B.

Simply plug a source into one of the Row A inputs and a second source into one of the Row Binputs. Pearl automatically configures the channel's frame size to match the source resolution and configures a frame rate and bitrate. Audio, if present, is automatically added to the channel.

Default audio setup for the auto channels is always as follows:

Video Source	Audio Source
SDI	SDI Audio
HDMI (DVI)	HDMI Audio (no audio for DVI)

Video Source	Audio Source
USB video	USB audio
VGA	TRS Audio

You can start viewing the channel immediately on the touch screen or using an web browser on the same LAN or network as Pearl. Browse to the following URL:

> **For Auto A:** http://<serial>.local/preview.cgi?channel=1
> **For Auto B:** http://<serial>.local/preview.cgi?channel=2
>
> **For example:**http://d560515f.local/preview.cgi?channel=2

If Bonjour services, which permits browsing by serial number, are not installed on your admin computer, you can get the IP address of Pearl from the touch screen display and browse to:

> **For Auto A:** http://<IP Address for Pearl>/preview.cgi?channel=1

You find alternate connection streams (i.e. RTSP or MPEG-TS) and can further configure these channels by logging into the Admin panel and accessing Auto A and Auto B using the links under the Channels menu.

Important considerations

- You can delete the Auto A and Auto B channels, but they will re-appear upon factory reset or when loading the default configuration profile.

Which signal is used for Auto-A or Auto-B?

Pearl has video input sensing, which means that it knows when a video signal is received from an attached source.

If you attach more than one video source to a row while Pearl is powered on, the first source you attach has the highest priority. If you attach more than one source to a row before powering on Pearl, the following priority is used:

Priority	Connector Type
1	HDMI (with HDMI Audio)
2	SDI (with SDI Audio)

Priority	Connector Type
3	VGA (with TRS Audio)
4	USB video (with USB audio)

The auto channel uses a source until that source no longer has a signal. Then, it switches to the next highest priority signal.

For example, if you attach an SDI source and then connect a VGA source and TRS audio to Row A of your Pearl, Auto A will show SDI and use SDI audio. If the SDI video signal is lost or you manually select the TRS audio source using the custom layout editor, Auto A will switch to VGA video with TRS audio.

Now, if you connect an HDMI source to Row A (i.e. you have something connected to each video & audio port on Row A) and the VGA signal is lost, Auto A displays HDMI and uses HDMI audio because it is the highest priority signal.

If all the connected sources lose signal at the same time (i.e. for the example above when SDI loses video signal, and no other video signal is found on the VGA source) no change is made and the auto channel continues to use the current source. In this case, a no signal image is displayed for viewers.

You can see which video and audio sources are configured for the channel from the Info page, see View system information using the Admin panel

Channel configuration

Channels let you encode your video and audio sources so they can be live streamed, recorded, and switched if you create multiple layouts using the custom layout editor. Before using a channel, you should check the channel settings. You can fine-tune your channel to maximize the quality of your live streams, minimize the amount of bandwidth used, and ensure your video and audio encoding settings are optimized for your event. You can control exactly how the video is presented and streamed to shared destinations and multiple viewers.

If you're planning to do live switching with your channel, we recommend you set the frame size to a fixed size instead of using the default setting. The default setting automatically sets the channel frame size to match the frame size of the video source. Changing the frame size to a fixed value ensures that you don't experience any stream interruptions if the frame size of the video source changes, like when switching between different layouts that contain a single video source with different frame sizes.

> Channel encoding settings may be automatically overwritten when using Pearl with a Content Management System, see **About Panopto recording and webcasting**

Topics include:

- Configure auto channels
- Create a channel
- Add video sources or a channel as a source
- Add an audio source to a layout
- Duplicate a channel
- Rename a channel
- Delete a channel
- Preview channel
- Add or remove channel metadata
- Configure encoding
- Codecs and file format compatibility
- Configure video encoding
- Configure audio encoding
- Multi-encoding and channel as a source

Configure auto channels

Auto channels are included with Pearl to make setup quick and simple. However if you want to set custom encoding or streaming configuration for the channel, you can configure it like any other channel.

To further configure automatic channels Auto A and Auto B:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

3. From the Channels menu, click Auto A or Auto B. The channel's status page opens
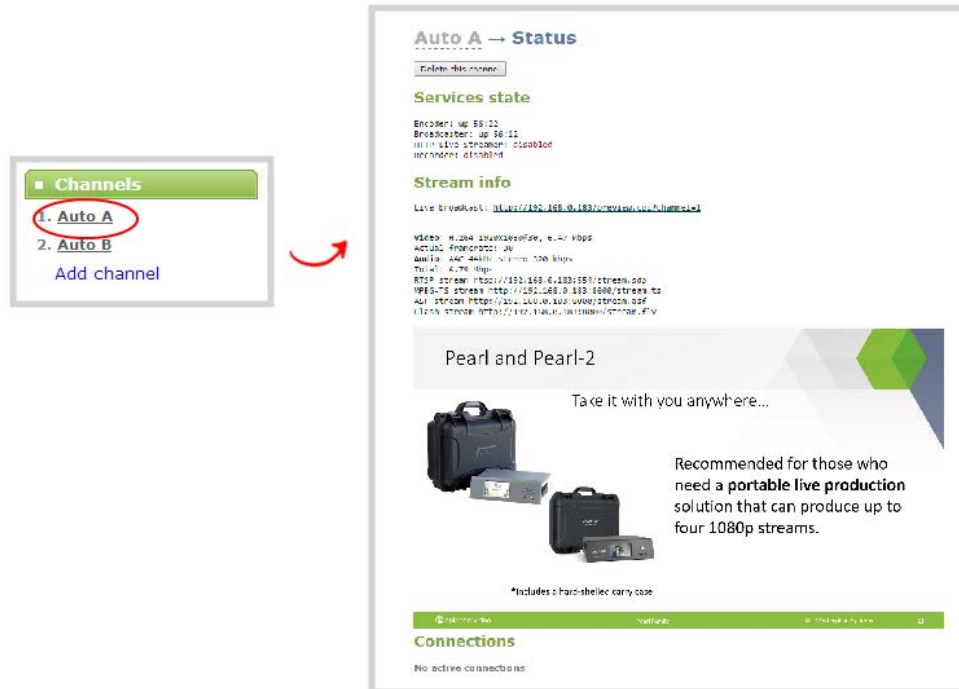
4. Configure the automatic channel as you would any other channel.

> To change the video source for the two auto channels, just select a different video source using the custom layout editor, see **Add video sources or a channel as a source**. The channel name automatically changes to the name of the selected video source if there's only one source in that channel. For important information about changing the channel name, see **Rename a channel**.

Create a channel

You create channels on Pearl using the Admin panel. New channels automatically use the same aspect ratio as the default frame size setting for the channel, which is 16:9. You can change the encoding settings for a channel after the channel is created.

The default encoding settings for a channel are:

- **Video**: H.264, 1920x1080@30 fps, auto bitrate

- **Audio**: AAC, 48kHz stereo, 320 kbps

> If the channel's video source doesn't have a 16:9 aspect ratio, the system automatically detects the correct aspect ratio and updates the layout after you leave and return to the custom layout editor page. This happens because the channel's encoding page has **Use current signal resolution as frame size** selected by default. If you want to change the aspect ratio for your channel, see **Configure encoding**.

Each additional channel and layout consumes additional CPU processing capacity of Pearl, see Optimum CPU performance.

When you create a channel, it's convenient to add your video and audio sources at that time. Channels can have one or more video and audio sources. This procedure includes basic steps to add a single video and audio source.

To create a channel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the **Channels** menu, click **Add channel**. The custom layout editor for the new channel opens and the default layout is selected.

A 16:9 workspace appears in the layout area.
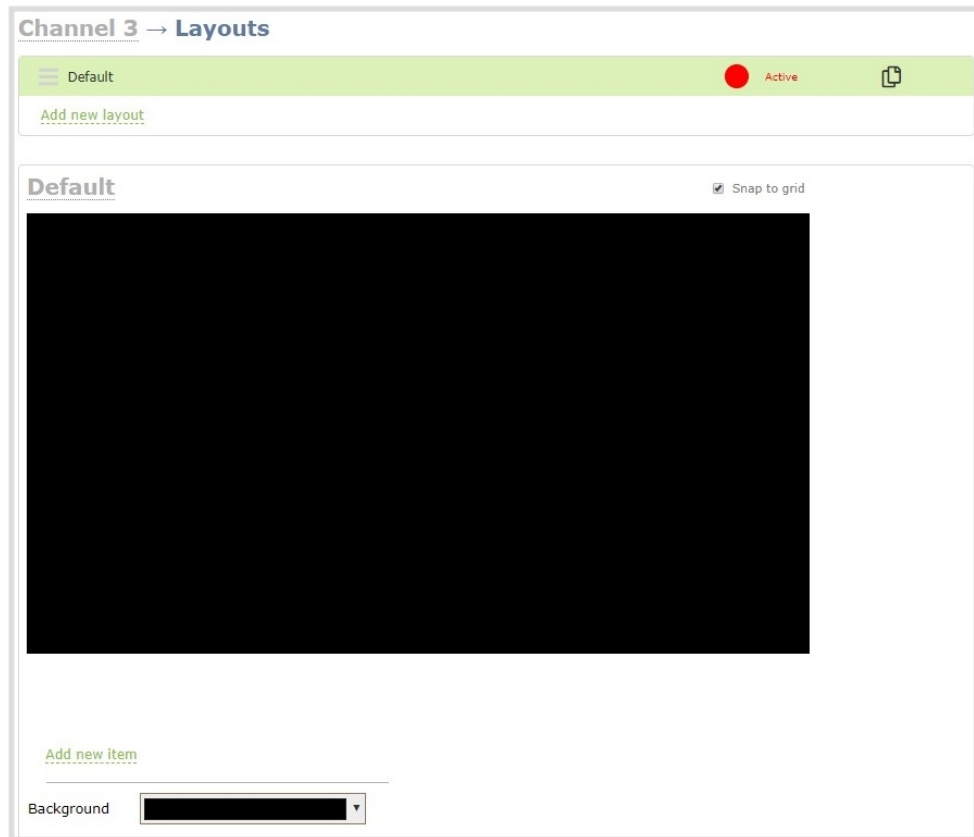
3. Click **Add new item** and select **Video Source**.

4. From the Source settings, select a video source in the **Source** drop down.
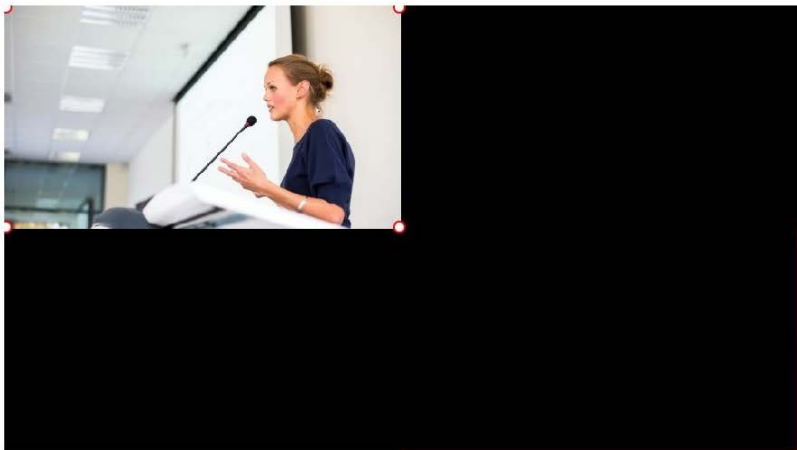
> For best results, **Keep aspect ratio when scaling** should be checked under **Source settings**.

The selected video source appears in the layout area.

5. Click and drag the red and white handles on the corners of the source to re-size it in the layout editor area. For a single source channel, it should fill the entire layout area. Alternatively, you could enter a value in the percentage boxes that are along the side and bottom of the layout editor area to resize the video source.

6. Select an audio source from the list of audio sources.

> ✅ If a channel is selected as a video source, the corresponding audio for that channel is selected by default.

7. Click **Save**. Your channel is ready for basic streaming and recording.

> ✅ Because this is a single-source channel with only one layout, the channel's name is updated to display the source's name next time you view the channel. Click the channel name to refresh. Rename the channel and choose a custom name if you don't want the channel name to change, see **Rename a channel**.

What's next?

The default channel encoding setting should work fine in most cases. To check the encoding settings for the channel, see Configure encoding. There are a lot of creative things you can do next with your channel, including creating more layouts, adding multiple video and audio sources, and customizing layouts to add images and backgrounds, see Custom layout configuration.

Add video sources or a channel as a source

You can add one or multiple video sources to any of the layouts for your channel using the custom layout editor. You can even add the output from another channel as a video input source.

When you add a channel as a video source in another channel, whatever is displaying live in that channel also displays in the other channel. This is useful when you need to stream the same switched program to multiple destinations that have different encoding settings. That's because the encoding settings are set at the channel level.

For example, to stream your switched program to YouTube at 1920×1080 and to Facebook at 1280×720, you could:

1. Set up **Channel 1** as your switched program channel. Add all your custom layouts to Channel 1 and stream this channel to YouTube at 1920×1080.

2. Set up **Channel 2** as your Facebook streaming channel. Configure Channel 2 with a single layout that uses Channel 1 as the video source, and then stream Channel 2 to Facebook at 1280×720.

For instructions to set up multi-encoded channels using the channel as a source feature, see Multi-encoding and channel as a source.

> **STOP** If more than one video source is added to a channel, we recommend configuring the channel encoding to use a fixed resolution as the frame size instead of automatically using the resolution of the video source as the frame size (default). A fixed channel resolution ensures that your channel displays properly at a fixed resolution. Using a fixed channel resolution also avoids unintended resolution changes when switching between multiple layouts if the different layouts happen to have different video sources with different resolutions, see **Configure encoding**.

To add a video source or a channel as a source:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Channel menu, select a channel and click **Layouts**. The custom layout editor opens.

3. In the Layouts list that appears at the top of the page, click a layout's row to select that layout or click **Add new layout**.

4. Below the Layout editing area, click **Add new item** and select **Video Source**. The Source settings appear.

5. From the Source settings, select either a video input or a channel in the **Source** drop down.
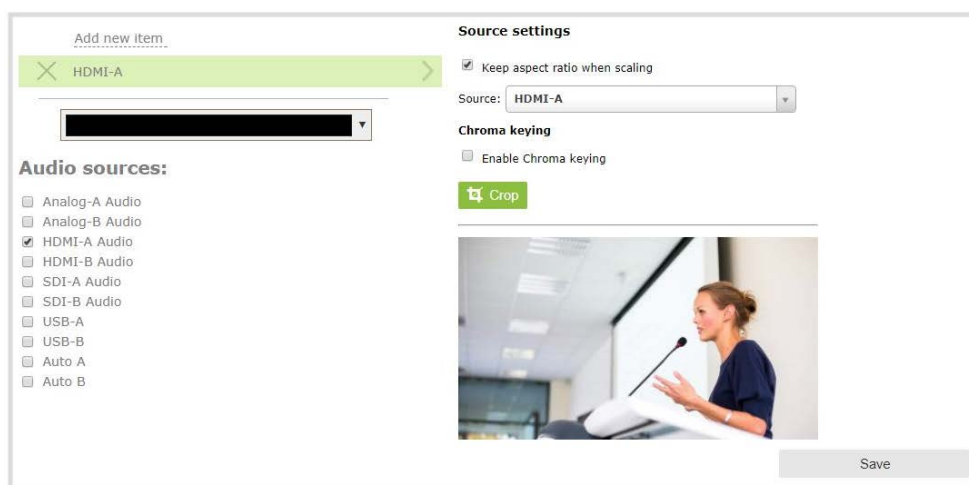
> For best results, check **Keep aspect ratio when scaling** in the **Source settings**.

The selected video source appears in the layout editing area.
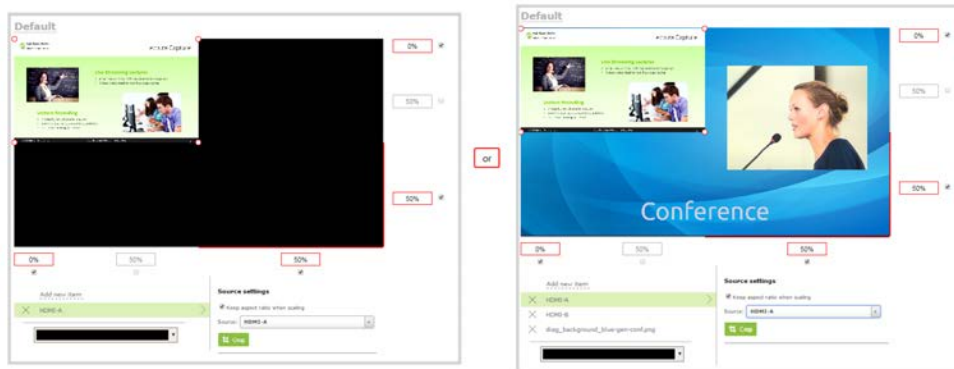
> When adding an RTSP network source, a preview image may not display in the layout area until you Save the layout. The preview can also appear to have no signal if the RTSP source is not currently sending content.

6. Click and drag the red and white handles on the corners of the source to re-size it in the layout editor area. Alternatively, enter a value in the fields along the side and bottom of the layout editing area to resize the selected item. For a channel with only a single video source, it should fill the entire layout area. For a layout that includes multiple video sources, you can move, resize, or crop each video source to exactly how you want them to appear.
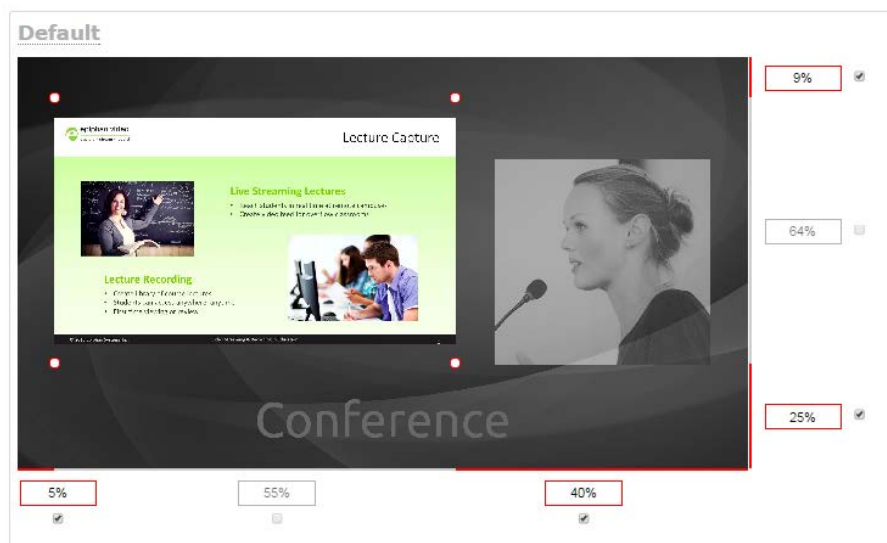
> To layer video sources over top of each other, like for picture in picture, you can click and drag the video sources that appear in the item list beneath **Add new item** and change their order. Items that are higher up the list appear over top items that are lower down the list.

7. Select an audio source from the list of audio sources.

> If a channel is selected as the video source, the corresponding audio for that channel is selected automatically by default.

8. Click **Save**.

A note about item positioning and sizing

There are four ways to position and size items in the layout area

1. using the mouse

2. using the keyboard

3. using the manual positioning values with percents

4. using the manual positioning values with pixels

To use the mouse:

Click and drag to move the item. Click and drag the round, red and white handles to resize an image or video source (for text overlays, just use the padding settings). Using this method you can make quick changes that are in increments of approximately 5% of the width or height of your layout area. For more refined movements, press the Ctrl key on your keyboard while dragging the item with the mouse.

To use the keyboard:

Use the arrow keys on the keyboard to move the item up, down, left or right in the layout. Changes are in increments of approximately 5% of the height or width of the layout area. Press the Ctrl key while using the arrow keys to make more refined movements. To change the size of an image or video source, press the Shift key while using the arrow keys (for text overlays, just use the padding settings). Press both Ctrl and Shift for fine-grained size control.

Using percents:

Specify a whole number, followed by a percent sign (e.g. 4%) in any of the manual positioning fields. See Resize and position items using percents or pixels for more information.

> **Using pixels:**
>
> If you need to specify an exact amount in pixels (rather than percent) you can type a pixel value in any of the positioning value squares followed by the characters px (e.g. 56px). You can mix and match pixels and percents changing only the boxes you want to use pixel values. At any time you can switch back to percents by typing a percent. See Resize and position items using percents or pixels for more information.

Add an audio source to a layout

You can add multiple audio sources to the layouts for a channel using the Admin panel. Each layout can have the same audio sources in them or you can choose different audio sources. By default, audio is enabled for the channel on the channel's encoding page.

An audio source has the same gain no matter how may layouts the audio source is added to, or if you've added just the one audio source or several audio sources to the same layout.

Important considerations

- For SRT and RTSP input sources, there's no need to manually add the audio sources separately to your channel. When the stream is connected to your Pearl as an input source, a corresponding audio source is automatically added to the list of audio sources for your channels, even if there is no audio in the stream.

- If a channel is selected as the video source for a layout, the corresponding audio for that channel is added automatically.

- You can add multiple audio sources to the same layout. However, if the two audio sources share all or some of the same audio signals, then the common audio signals are amplified.

- Selecting multiple loud audio sources in the same layout may cause audio clipping on that layout. Before going live, always check volume levels for the layouts that have a large number of audio sources and adjust the volumes at source to avoid clipping, see Adjust audio gain and delay.

- If audio encoding is not configured for a channel, no audio signal is processed or sent with the video content when recording, streaming, or confidence monitoring, see Configure audio encoding.

- If an audio source is added to a layout and then the audio device is disconnected from the input port on Pearl, some residual noise may be detected in the layout. Remove the audio source from the layout.

To add an audio source to a layout:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Channel menu, select a channel and click **Layouts**. The custom layout editor opens.

3. In the Layouts list that appears at the top of the page, click a layout's row to select that layout.

4. Check the audio source that you want to use for the layout and click **Save**.

What's Next

You can check the audio encoding settings for your channel and ensure that audio is enabled, see Configure encoding.

To adjust the gain for an audio input source, see Adjust audio gain and delay.

Duplicate a channel

You can duplicate any channel you've created. All settings in the channel you duplicate are recreated.

To duplicate a channel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Admin panel, scroll to the Channels menu option.

3. From the Channels menu, click **Status**. The Status page opens.
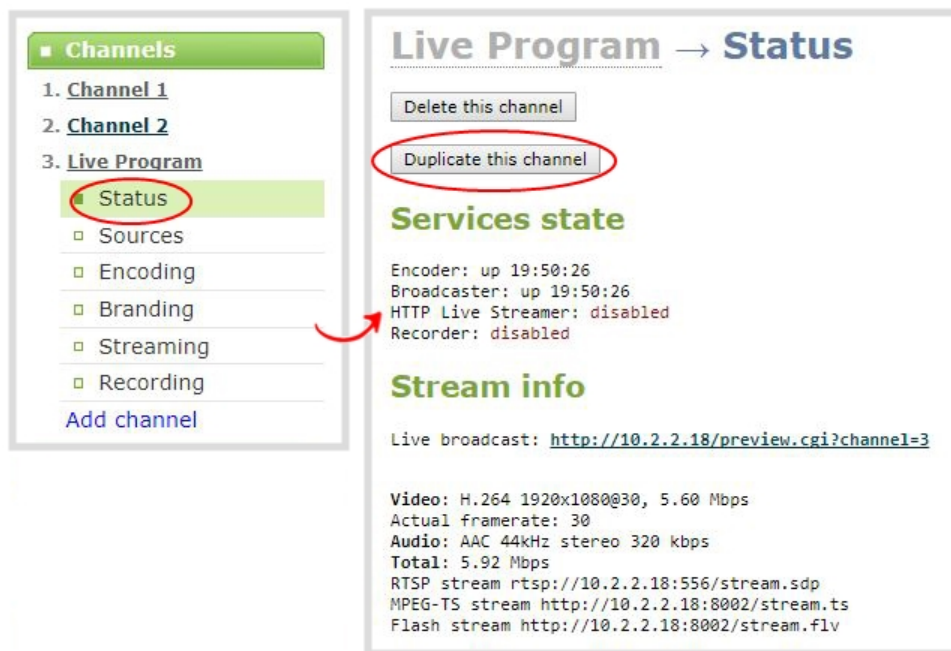
4. Click **Duplicate this channel**. The duplicate channel is created and assigned the next sequential number in the Channel menu.

5. Click **Save**.

Rename a channel

Channels are created with the same name as their video source by default. When a second layout or a second video source is added to the channel, the channel name changes to **Channel X**, where **X** is the index number for the channel. To stop a channel name from automatically changing, you should assign the channel a custom name using the Admin panel.

You can change a channel's name from any of the channel configuration pages or using the custom layout editor.

> Auto channels initially have the channel name Auto A and Auto B, but if you change the source to something other than an automatic source, the name of the channel changes to reflect the new source.

You can include certain international characters in channel names. Pearl supports common character sets for Western and Central European languages, Nordic languages, and Russian. Channel names should not include special characters, slashes, or spaces. For a complete list, see International character support.

> 🛑 Do not include any special currency, mathematical symbols, and other special characters such as slashes or spaces in the channel name. Pearl replaces special characters with an underscore.

To rename a channel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Channels menu, select a channel and click any of menu options for the channel. For example, click **Metadata**.

3. Click on the channel name that appears at the top of the page. The text turns red.

4. Enter the new name using alphanumeric characters. We recommend using underscores to separate words rather than using spaces.

5. Press **Enter** using your keyboard to save the new name.

Delete a channel

You can delete a channel using the Admin panel. Deleting a channel removes all recorded files that are associated with that channel. You cannot recover recordings for a channel after the channel is deleted. We recommend that you stop recording or streaming for the channel before deleting the channel.

> 🛑 If you have multiple configuration presets, deleting a channel removes all recorded files that are related to that channel across all presets. For important information about how channels are indexed in Pearl and how that affects deleting channels when configuration presets are used, see **Configuration preset considerations**.

To delete a channel, follow the steps below.

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Channel menu, select a channel and click **Status**. The Status page for the channel opens.
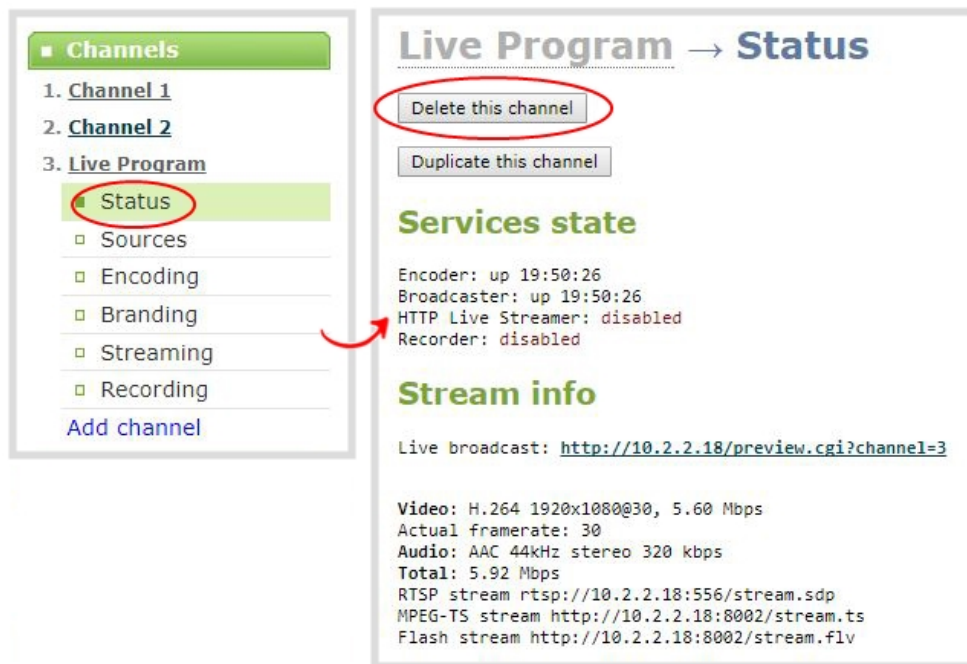
3. Click **Delete this channel** and click **OK** when prompted to delete the channel, or click **Cancel**.

Preview channel

You can open a live preview of a channel in your web browser to see any configuration changes you make to the channel as you make them. Web browsers that support HTML5 and Flash are supported.

There are several ways to preview channels:

- Preview a channel from the Info page

- Preview a channel from the Status page

- Preview all channels at the same time

> You can also preview channels using Epiphan Live, see **Configure Dashboard panels** for more information.

Important considerations

- Some web browsers disable auto playback of videos with audio. In those cases, the audio for the channel being previewed is muted by default.
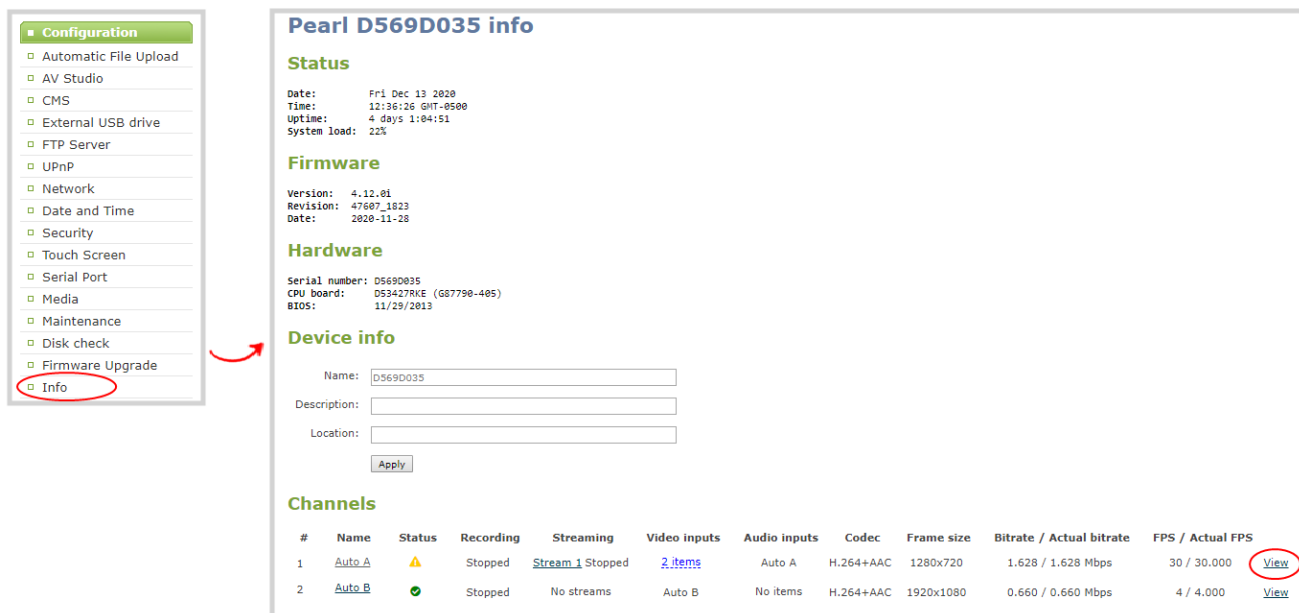
- HTML5 does not support PCM audio encoding. If PCM audio encoding is configured for a channel, audio does not play in the preview link for the channel.

- PCM audio encoding at 48 kHz is not supported. A live broadcast preview link is not provided for a channel that is configured for PCM audio encoding with a sampling bitrate of 48 kHz.

- If HTTPS is configured for Pearl, the live broadcast URL will start with *https* instead of *http*.

Preview a channel from the Info page

The Info page has preview links for all the channels that are configured on Pearl.

To preview a channel from the **Info** page:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, click **Info**. The information window opens .

3. Click **View** for the channel that you want to preview. A preview window opens.

Preview a channel from the Status page

You can use the Admin panel to open a preview link for a channel from the Status page. The Live broadcast preview can be viewed using web browsers that support HTML5 or Flash. You can also see a preview of the channel directly from the Status page itself.

The Status page lists information about the channel, including stream information such as the bitrate, frame size, streaming and preview links, as well the state of the services on Pearl.

> This feature is not available using the local console on Pearl.

To preview a channel from the Status page:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Channels menu, select a channel and click **Status**. The Status page opens and a live preview snapshot appears below the Stream info.
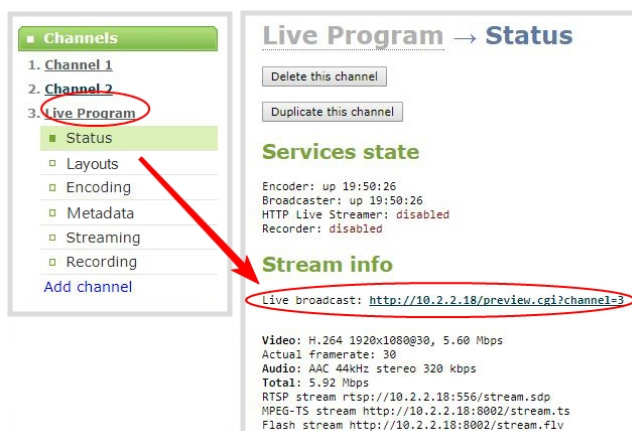
3. Right-click the **Live Broadcast** link and select **Open in a new Tab** or **Open in a new Window**.

Preview all channels at the same time

Pearl has a special preview mode that lets you see all configured channels at once.

> The resulting web page can be very large. You can use your keyboard's zoom keys or the zoom buttons for your web browser to adjust the screen view. Plus many browsers support short cuts, like Ctrl- (control minus) to zoom out and Ctrl+ (control plus) to zoom in.

To preview all channels at the same time:

1. Open a new tab in your web browser on the Admin computer.

2. Go to the following URL to open the preview web page for your Pearl, where *<ip address>* is the IP address of Pearl. To find the IP address of your system, see View system information using the Admin panel or View system information using the touch screen

> http://*<ip address>*/preview.cgi?channels
>
> **For example:** http://172.1.1.10/preview.cgi?channels

To preview a single channel, you can enter the following URL: **http://<ip address>/preview.cgi?channel=X** where*<ip address>* is the IP address of Pearl Mini and *X* is the channel's index number.

Add or remove channel metadata

When you configure metadata for a channel, that metadata is embedded in all channel recordings and streams. You can specify the following metadata that the media player displays for your viewers:

- title of the presentation
- company website
- presenter's name
- copyright date or other labels such as proprietary information, preliminary etc.
- additional information about the broadcast, such as time of the broadcast, or change to the schedule
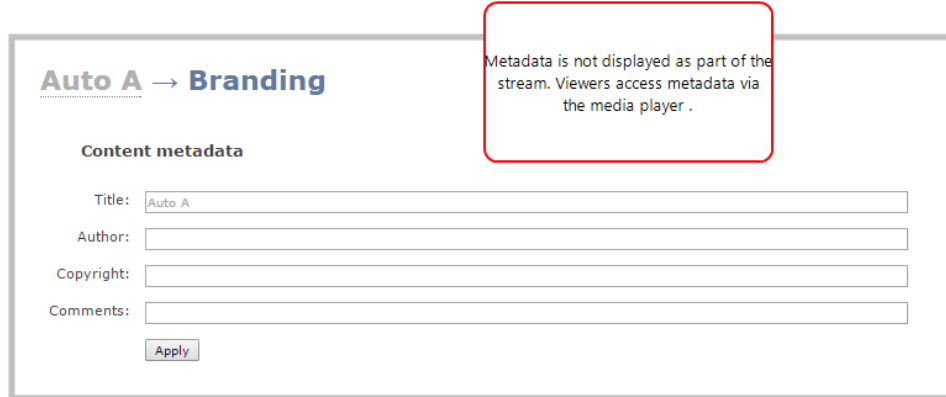
How metadata is displayed depends largely on the media player. For example VLC, stores the metadata in a media information file, while other media players scroll the text horizontally from right to left across the bottom of the media player window.

> **STOP** Use only alphanumeric and diacritic characters in metadata descriptions. The whole metadata string is refused if any special currency or mathematical symbol appears in the description. You must remove the offending characters before Pearl will accept the description.

To add or remove channel meta data:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Channels menu, select a channel and click **Metadata**. The Metadata configuration page opens.

Auto A → **Branding**

Content metadata

Metadata is not displayed as part of the stream. Viewers access metadata via the media player .

Title: `Auto A`

Author:

Copyright:

Comments:

Apply

3. Do one of the following:

    a. To add metadata, simply enter the information in to the fields, such as: title, author (or authors), copyright information, and descriptive comments.

    b. To remove metadata, simply delete the information that appears in the fields.

4. Click **Apply**.

Configure encoding

You can modify the encoding settings for each channel. The encoding settings let you fine tune your channel recording or live stream. You can select a specific frame size, bitrate, audio or video codec, and more.

> Channel encoding settings may be automatically overwritten when using Pearl with a Content Management System, see **About Panopto recording and webcasting**

Topics include:

- Codecs and file format compatibility

- Configure video encoding

- Configure audio encoding

- Multi-encoding and channel as a source

To configure channel encoding using AV Studio, see Configure channel encoding using AV Studio.

Codecs and file format compatibility

Pearl supports the following video and audio codecs.

Table 42 *Supported video codes*

Value	Description
H.264	H.264 is the default video codec configured for the channels on Pearl. This codec provides high quality video while using low bandwidth and is the preferred codec to use with the system.
Motion JPEG	Motion JPEG is suitable for live streaming and video; however, you can experience low quality images while using high bandwidth. Motion JPEG does not support audio.

Table 43 *Supported audio codecs and bitrate guidance*

Value	Description
AAC	AAC is comparable to MP3 and may even provide better sound quality at a similar sample bitrate. Supported sampling bitrate values are: 16, 22, 44 and 48K kHz. Setting the channel bitrate to match the audio source's bitrate provides the best sound quality and avoids audio resampling. Most digital signals (HDMI or SDI sources) use 48 kHz. Most digital signals (HDMI or SDI sources) use 48 kHz

Value	Description
	audio. For analog signals, 44 kHz provides a good quality audio sample.
	The maximum bitrate for mono encoding of a 44 kHz signal is 264 kbps. For stereo, 320 kbps is supported. Note that lower bitrates (e.g. 32 kbps) with a 44 kHz signal may result in distorted audio.
MP3	MP3 provides a common audio format for audio storage. Supported sampling bitrate values are: 22 kHz, 44 kHz and 48 kHz.
	Setting the channel bitrate to match the audio source's bitrate provides the best sound quality and avoids audio resampling. Most digital signals (HDMI or SDI sources) use 48 kHz. For analog signals, 44 kHz provides a good quality audio sample.
	Web browsers that use Flash (FLV) do not support 48 kHz MP3 audio. When selecting this encoding, you must use a web browser that supports HTML5 or a media player to preview your channel.
PCM	Pulse Code Modulation (PCM) is a standard for digital audio in computer and other devices such as, digital telephone systems.
	Setting the level to match the audio source's level provides the best sound quality and avoids audio resampling. Most digital signals (HDMI or SDI sources) use 48 kHz audio. For analog signals, 44 kHz provides a good quality audio sample.
	The Flash (FLV) plugin must be installed for your web browser to play back audio that's encoded as PCM. Web browsers that use Flash (FLV) do not support 48 kHz PCM audio.

Format compatibility

Not all streaming and recording protocols support all combinations of video and audio codecs. The following table lists any video/audio codec compatibility considerations for the supported streaming formats on Pearl.

Table 44 *Video/audio codecs and formats for streaming*

Video Codec selected	Audio Codec selected	RTSP	FLV	MPEG-TS	MJPEG
H.264	No audio codec	✓	✓	✓	
H.264	PCM	✓	✓		
H.264	MP3	✓	✓	✓	
H.264	AAC	✓	✓	✓	
MJPEG	No audio codec				✓

The following table displays the compatibility between the video/audio codecs and the supported recording formats.

Table 45 *Video/audio codecs and formats for recording*

Video Codec selected	Audio Codec selected	MP4 and MP4-Fragmented	AVI	MOV	MPEG-TS
H.264	No audio codec	✓	✓	✓	✓
H.264	PCM	✓	✓	✓	
H.264	MP3	✓	✓	✓	✓
H.264	AAC	✓	✓	✓	✓
MJPEG	No audio codec	✓	✓	✓	✓

Configure video encoding

You can configure the video encoding settings for each channel using the Admin panel. Video encoding settings include:

- **Video codec**: The video codec determines the type of compression and decompression, and also affects the video quality. Options are H.264 (default) and Motion JPEG.

- **Hardware or software encoding**: Hardware encoding is the default setting and is the recommended encoding for use with Pearl.

- **Encoding level**: This can be set to High, Main, or Baseline.

- **Frame size:** The resolution applied to the channel when you stream, record, or output video to a confidence monitor. This can be set to automatically match the input video's resolution or set to a fixed resolution.

- **Key frame interval**: How often a key frame that contains all the pixels is sent when streaming. The longer the key frame interval, the smaller the video file size (and vice versa).

- **Bitrate**: If using the H.264 video codec, you can increase or decrease image quality by increasing or decreasing the channel's **Bitrate** value. Video with a high level of motion and high resolution, such as sporting events, requires a higher bitrate.

> 🛑 By default, Pearl automatically uses the incoming video source frame size as the frame size for streaming and recording when the channel has only one layout with a single video source. If you're channel has multiple video sources or layouts, you must manually set a frame size for the channel.
>
> If you plan to switch layouts during a live stream, a fixed frame rate is recommended. This avoids the stream from stopping and restarting due to frame size changes when switching between single-source layouts that use different frame sizes.

Important considerations

- For optimum system performance, the frame size of the channel should be set to match the frame size of your video input source to avoid scaling, see Optimum CPU performance.

- If you have unchecked all the manual resizing and positioning boxes in the custom layout editor and you downscale the video source using the frame size setting on the **Encoding** tab (for example, select 1280×720 frame size for a full HD video source), then the source appears cropped within the frame instead of scaling to fit the frame.

- If your channel has a custom layout with only one source and your source and stream aspect ratios differ, then your source appears centered in the frame and matte bars are added automatically to the top and bottom (or left and right sides) of the frame to make up the difference. See Remove black bars (matte) from the video.

- The larger the channel's frame size, the more bandwidth is needed for streaming and the recorded files are bigger. Instead of using the same frame size as the original video source, you can configure a smaller frame size for the channel and let Pearl downscale the video. For example, if the input video signal resolution is 1920×1080 (a 16:9 aspect ratio) and the channel's frame size is set to 1280×720, Pearl downscales the video and streams/records the channel at the lower frame size, using less bandwidth and producing smaller recorded files.

You can add black bars around your video source by adjusting the frame size. For example, if your video source has a 16:9 widescreen/HD format but you need a 4:3 frame size on your output, Pearl automatically

adds black bars to the top and bottom of the frame if you choose a frame size for the channel that has a 4:3 aspect ratio.

There is some trade off between video quality and bandwidth size, depending on the encoding settings you choose. The following table lists some additional considerations when choosing video encoding settings.

Table 46 *Video encoding settings*

Setting	Description
H.264	H.264 is the default codec and provides high quality video while using low bandwidth. This is the preferred codec for the system.
Motion JPEG	This codec is suitable for streaming and recording video, however you get lower quality images and it requires a large amount of bandwidth. Motion JPEG does not support audio.
Key frame interval	The key frame interval feature specifies how often a key frame (a frame that contains all the pixels) is sent when streaming the video. This setting also impacts how quickly a video moves through the frames when a viewer uses the search function of their media player. Increasing the number of seconds between key frames can significantly reduce your bandwidth and system resource usage with minor impact to your video quality. A good rule of thumb is to keep the interval between 2 to 3 seconds and decrease the key frame interval as the motion increases. Try different settings and note changes in the video quality. If your video quality is poor and jittery you may need to decrease the interval between key frames. If you have unlimited bandwidth and system resources you can choose an option to stream key frames only.
Frame rate	Frame rate reflects the number of images that are encoded per second. Reducing the frame rate for a channel reduces bandwidth usage, and vice versa. The system's ability to maintain a set frame rate is based on several factors, for example: • overall system load affects the ability for the device to process pixels; • available network bandwidth; • the source and stream frame size (resolution); • the type of motion that is captured; and • number of users accessing the stream.

Setting	Description
	When adjusting the frame rate, you may need to try different values to achieve the best outcome.
Bitrate	In general, higher bitrates mean higher image quality, but more bandwidth is needed for streaming and video recordings are larger. If you're using H.264, then you can set the bitrate to improve the image quality. For example, an HD Blu-ray video is typically in the range of 20 Mbps, whereas a standard-definition DVD is usually 6 Mbps. If you're unsure what bitrate value to use, start at 5000 kbps (slightly less than a typical DVD) and test to see how this looks for your viewers.

To configure video encoding for a channel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

1. From the Channel menu, select a channel and click **Encoding**. The encoding configuration page opens.
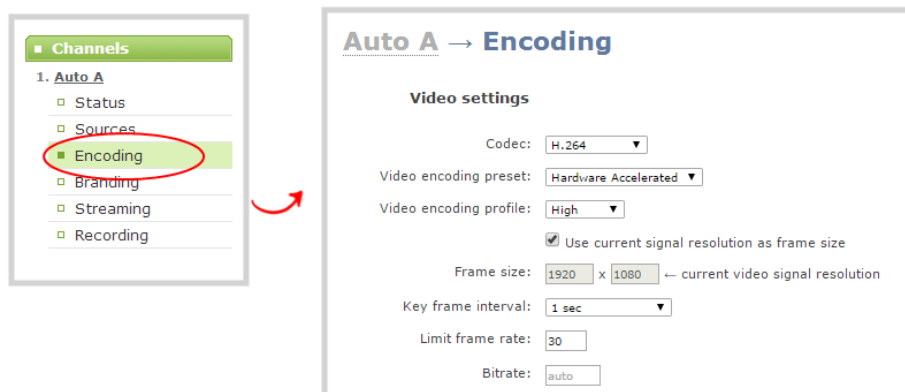
2. Select a video **Codec** and do one of the following:

   a. If **JPEG** is selected, click **Page refresh time** and enter a time in seconds.

   b. If **H.264** is selected, select a **Video encoding preset** and a **Video encoding profile**.

Item	Options
Video encoding preset	**Hardware Accelerated**: This is the default H.264 encoding preset. Choose this setting for best performance. **Software**: This matches the default from previous generations of Epiphan products. **Only** select this if you need software encoding or X.264 encoding to match results created with previous generations of Epiphan products or

Item	Options
	firmware
Video encoding profile	**Baseline**: Choose this option when streaming to an application that requires robustness and cannot tolerate data loss, for example video-conferencing. **Main**: Choose this option for standard-definition broadcasts. **High**: This is the default. Choose this option when video is viewed for broadcast and disk storage applications, particularly for high definition television application such as Blu-ray disk storage format and HDTV broadcast service.

3. Configure the frame size, do the following:

   a. Uncheck **Use current signal resolution as the frame size**.

> Enabling **Use current signal resolution as the frame size** is not recommended if the video input resolution changes frequently. An unstable cable or other disturbance that causes the resolution of the video input signal to change during a live stream can cause the stream to drop. Unchecking this feature helps prevent that.

   b. Select a **Frame size** from the list of options or enter a custom frame size in pixels.

4. Change the **Limit frame rate**. The default should be adequate in most applications. While decreasing the limit may improve system performance, you may need to test different values to balance video smoothness and processing power

5. Change the **Bitrate**. If using H.264 video codec, you can increase or decrease image quality by increasing or decreasing the target **Bitrate** value. Video with a high level of motion and high resolution, such as a sporting event, requires a high bitrate.

6. Click **Apply**.

Configure audio encoding

If your channel includes audio sources in any of the layouts, then **AAC 48 kHz** is set as the default audio codec for the channel. You can choose a different audio codec for a channel using the Admin panel. The following table lists the supported audio codecs and bitrates.
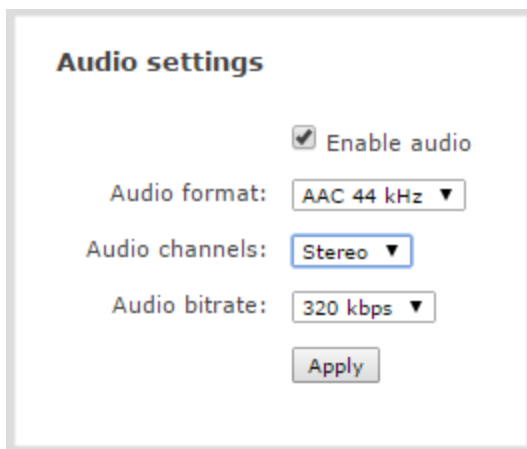
Table 47 *Supported Audio codecs and bitrates*

Value	Description
AAC	The AAC (default) audio codec is comparable to MP3 and may produce better sound quality with a similar bitrate. Supported values are 16, 22, 44 and 48K kHz. Most digital signals (HDMI or SDI sources) use 48 kHz audio. Matching the encoded level with the source level provides the best sound quality by avoiding audio resampling. For analog signals, 44 kHz provides higher sampling. The maximum bitrate for mono encoding of a 44 kHz signal is 264 kbps. For stereo, 320 kbps is supported. Note that lower bitrates (e.g. 32 kbps) with a 44 kHz signal may result in distorted audio.
MP3	MP3 provides a common audio format for audio storage. Supported values are 22 kHz, 44 kHz and 48 kHz. Most digital signals (HDMI or SDI sources) use 48 kHz audio. Matching the encoded level with the source level provides the best sound quality by avoiding audio resampling. For analog signals, 44 kHz provides higher sampling. 📋 Flash (FLV) doesn't support 48 kHz MP3 audio. When selecting this value you'll need to use a media player to preview your channel.
PCM	Pulse Code Modulation (PCM) is a standard for digital audio in computer and other devices such as, digital telephone systems. Most digital signals (HDMI or SDI sources) use 48 kHz audio. Matching the encoded level with the source level provides the best sound quality by avoiding audio resampling.

Value	Description
	✅ Flash (FLV) doesn't support 48 kHz PCM audio. When selecting this value you'll need to use a media player to preview your channel.

To change the audio codec for a channel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Channel menu, select a channel and click **Encoding**. The encoding configuration page opens.

3. In the Audio settings, ensure that **Enable audio** is checked to include audio in the channel.

4. From the **Audio format** drop down, select an audio codec (AAC, MP3, or PCM).

5. From the **Audio channels** drop down, choose mono or stereo (default).

✅ Choose **Mono** to have left and right stereo channels combined so that when you listen to the streamed or recorded audio, the same blended sound comes through both the left and right channels.

If you have only one mono analog input, use the left TRS jack and select mono encoding to have the same sound come from both the left and right channels. (If stereo sound is chosen, the sound will only come through on the left channel.)

6. From the **Audio bitrate** drop down, choose a birtrate. For guidance, see audio bitrates. For stereo audio, we recommend 256 kbps or 320 kbps.

7. Click **Apply**.

Multi-encoding and channel as a source

Pearl lets you easily do multi-encoding so you can record and stream the same content at different encoding settings. This is useful when you want to:

- Record a video at a high bitrate and frame size and live stream the same content at lower encoding settings.

- Record the channel while also sending two (or more) streams of that channel using different encoding settings for CDNs that don't use adaptive bitrates.

- Or record the same channel simultaneously at different resolutions, like full HD and HD.

For example, take a scenario where you want to record a video at 1080p and 8 Mbps, while simultaneously live stream the same video online 720p and 1 Mbps. You can create your custom layouts and do all your switching in one channel (i.e. Channel 1) and then configure Channel 2 to use Channel 1 as a source. That way, both channel's have the identical program. All you need to do now is configure each channel for the encoding settings you want.
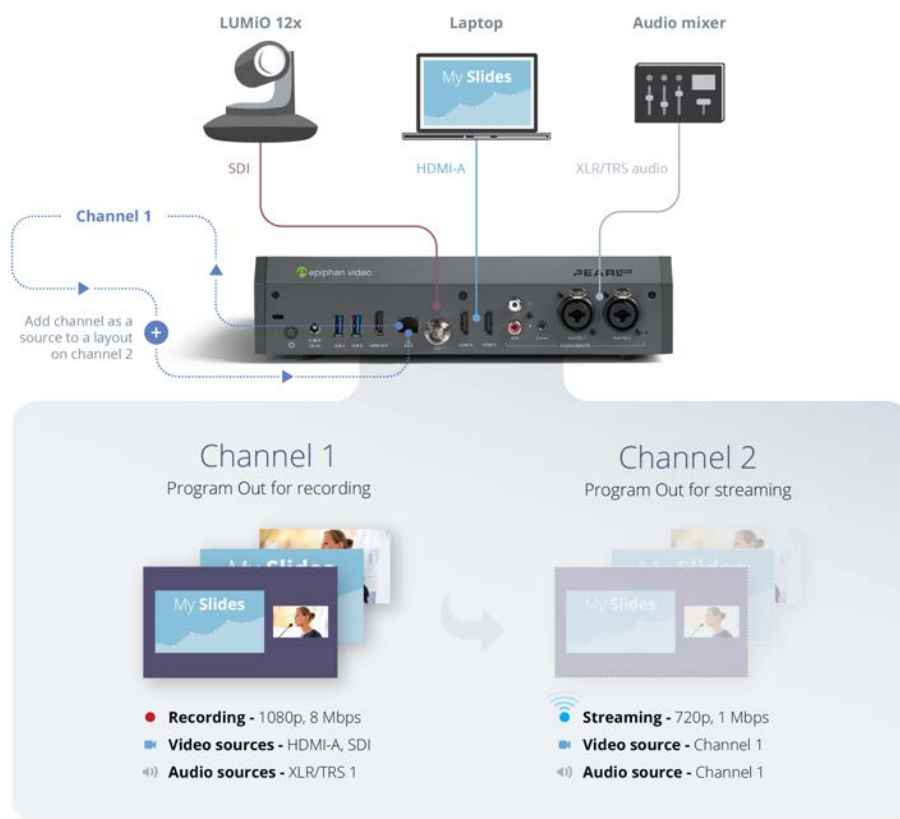
Follow these steps:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. Create Channel 1 with your video and audio inputs. Add all your live switching layouts.

3. Set the **encoding** and **streaming** settings for channel 1.

4. Create Channel 2 for your recording with just one layout and add Channel 1 as the video source. Stretch it to fill the full screen.

5. For Channel 2's **audio source**, choose Channel 1 if not already selected by default.

6. Set **encoding** and **streaming** settings for channel 2.

Using this process, you can again use the same video you're recording on Channel 2, and stream it at a different bitrate and frame size.

For alternative ways to set up multi-publishing, see Stream

Custom layout configuration

Using the custom layout editor, you can create multiple layouts for your channel for completely different looks, like picture in picture or side-by-side video sources. You can add media like transparent images and custom backgrounds to a layout, and then resize and arrange all the different video and media elements the way you want. When you're ready to stream or record, you can switch between the different layouts for a more interesting and dynamic presentation.

Each layout you add to your channel adds overhead to Pearl, and more complex layouts consume more of the system's resources. So, it's a good idea to delete any layouts you're not using.

Topics include:

- About the custom layout editor
- Add or edit a custom layout
- Upload or remove an image using the Media page
- Add an image to a layout
- Crop a video source
- Add a text overlay
- Custom system variables for text overlays
- Set the background color
- Resize and position items using percents or pixels
- Rename a layout
- Delete, move, or duplicate a layout
- Configure chroma keying

About the custom layout editor

Easily edit existing channel layouts or create new ones. The custom layout editor gives you full control of the size and position of images, video sources, and text overlays.

You access the custom layout editor using the Admin panel when you select your channel from the Channels menu and click **Layouts**. To add or delete a layout, see Add or edit a custom layout.

Layout selector

When you open the custom layout editor for a channel, a list of layouts appears at the top. You can create and delete layouts, duplicate layouts, choose which layout to preview and edit, and select the active live layout for live switching.
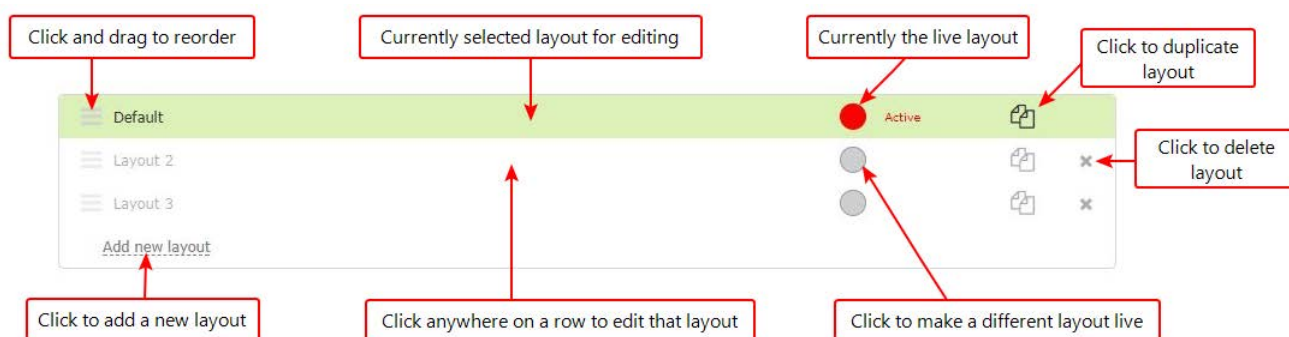
Layout editing

Below the layout list is the layout editing area where you can add images, add and edit video sources, and add text overlays to your layout. You can also choose the background matte as well as crop the images and video.
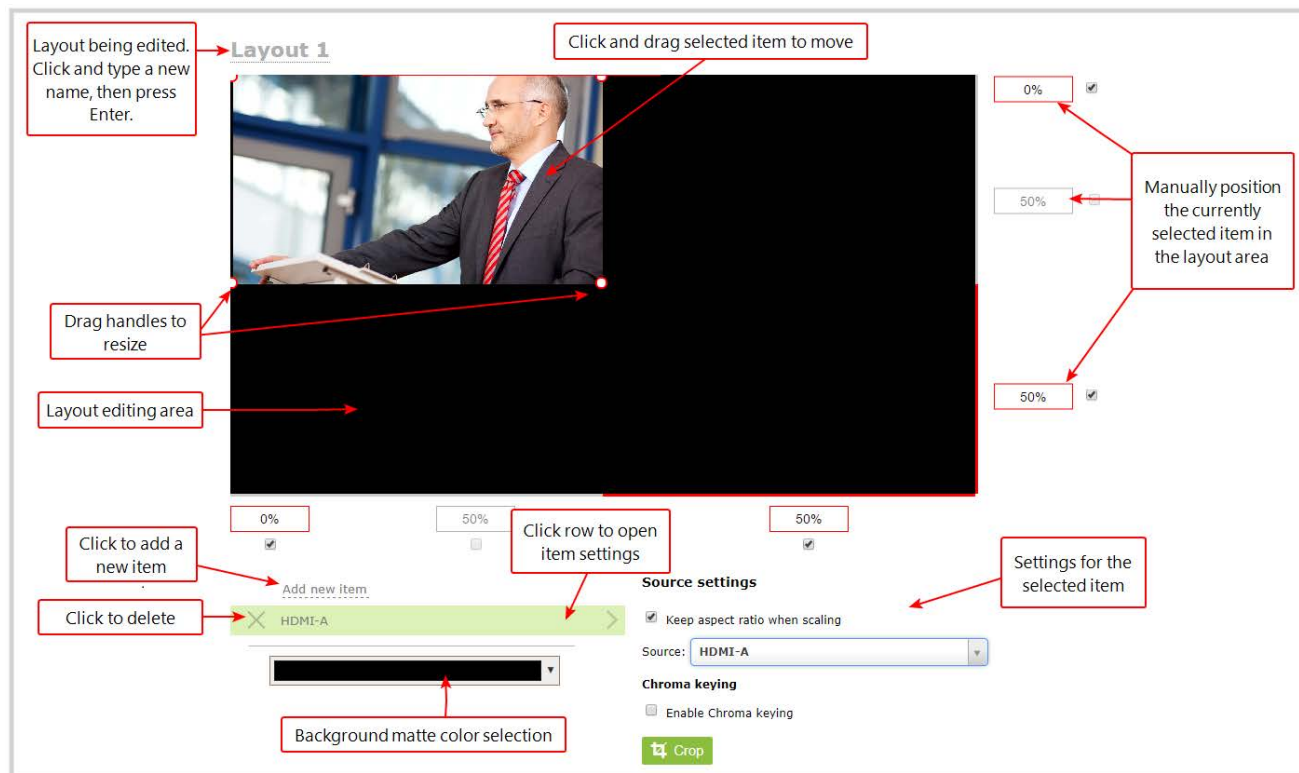
The main layout area has the same frame size and aspect ratio as the encoding setting of the channel. As you add items to the layout, they appear in the layout editing area. The currently selected item is presented in full color. Unselected items appear transparent.

To change the settings for an item, click an item in the item list that appears below the layout editing area. The settings for that item appears.

Move and size items in the layout editing area

To **position** the items in the layout editing area, you can use the mouse to click and drag an item in to position, or you can type values into the fields along the side and bottom of the layout area and manually position the selected item. You can enter values as a percentage of the full layout area (for example, enter **4%**) or in pixels (for example, enter **16px**).

You can **resize** items by clicking and dragging the red and white handles at the corners of an item or by entering values into the fields along the side and bottom of the layout area. To maintain the aspect ratio when resizing an item, make sure you've checked the **Keep aspect ratio when scaling** box for that item.

A note about item positioning and sizing

There are four ways to position and size items in the layout area

1. using the mouse

2. using the keyboard

3. using the manual positioning values with percents

4. using the manual positioning values with pixels

To use the mouse:

Click and drag to move the item. Click and drag the round, red and white handles to resize an image or video source (for text overlays, just use the padding settings). Using this method you can make quick changes that are in increments of approximately 5% of the width or height of your layout area. For more refined movements, press the Ctrl key on your keyboard while dragging the item with the mouse.

To use the keyboard:

Use the arrow keys on the keyboard to move the item up, down, left or right in the layout. Changes are in increments of approximately 5% of the height or width of the layout area. Press the Ctrl key while using the arrow keys to make more refined movements. To change the size of an image or video source, press the Shift key while using the arrow keys (for text overlays, just use the padding settings). Press both Ctrl and Shift for fine-grained size control.

Using percents:

Specify a whole number, followed by a percent sign (e.g. 4%) in any of the manual positioning fields. See Resize and position items using percents or pixels for more information.

Using pixels:

If you need to specify an exact amount in pixels (rather than percent) you can type a pixel value in any of the positioning value squares followed by the characters px (e.g. 56px). You can mix and match pixels and percents changing only the boxes you want to use pixel values. At any time you can switch back to percents by typing a percent. See Resize and position items using percents or pixels for more information.

Audio source selection and saving edits

Select audio source(s) for your channel by adding them to your layouts. The bottom section of the custom layout editor is where you select the audio source for the currently selected layout. It's also where you'll find the **Save** button.

If a layout doesn't have an audio source selected, there will be silence when that layout is selected during live switching, recording, and confidence monitoring.
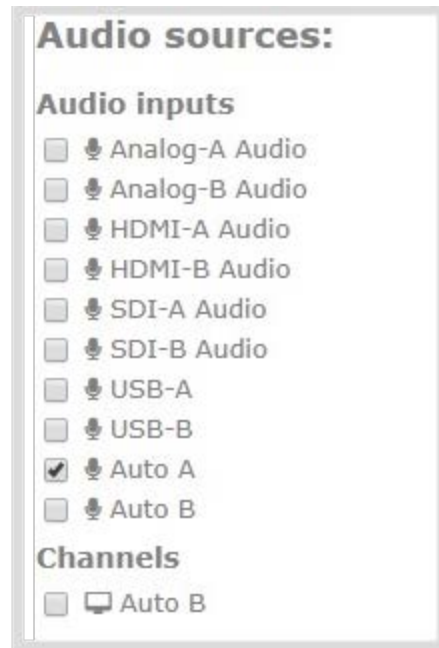
If an Auto channel is selected as a video source, then Auto A or Auto B audio is selected by default.

You can have multiple audio sources in a layout. The audio sources are mixed together at the same volume level as one another.

When setting the audio gain for your channel, add all your audio sources to your layout first, then set level of gain for your audio sources appropriately. When you're done all your changes, click **Save**.

Resize and position items using percents or pixels

You can position and resize layout items (images, overlay text, sources) using the percent/pixel adjustment boxes in a layout using the custom layout editor. See Resize layout items and Position layout items.

There are 3 adjustment boxes along your layout's horizontal axis and another 3 boxes along the vertical axis. You can enter **percent or pixel values** into checked adjustment boxes (bordered with red) to position and resize your item(s).

Percent values are used in adjustment boxes by default, and can be converted to pixels by simply overwriting the percent value in a given adjustment box and replacing it with a pixel value.

When entering **percent values**, ensure the suffix "%" is added to your value (i.e. "20%").

When entering **pixel values**, ensure the suffix "px" is added to your value (i.e. "200px"). A layout item's total pixel dimensions are a reflection of your channel's frame size, as configured in your encoding settings (see **Configure encoding**).

Unchecked boxes are grayed-out in color and are not directly editable but dynamically change their values to reflect a 100% total of either the horizontal or vertical axis, depending on values entered in adjacent adjustment boxes. See the Adjustment boxes for item resizing and positioning table below for more information.
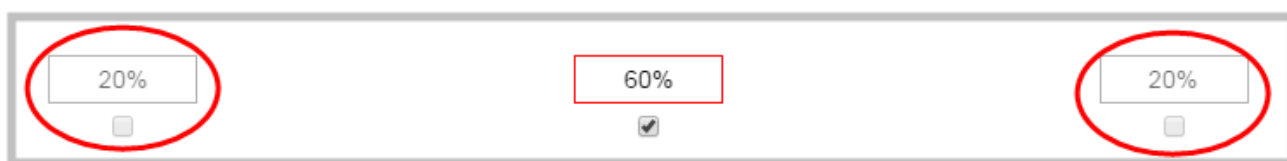
The values contained in checked boxes (bordered with red) are **anchored** and do not dynamically adjust their values.

Table 48 *Adjustment boxes for item resizing and positioning*

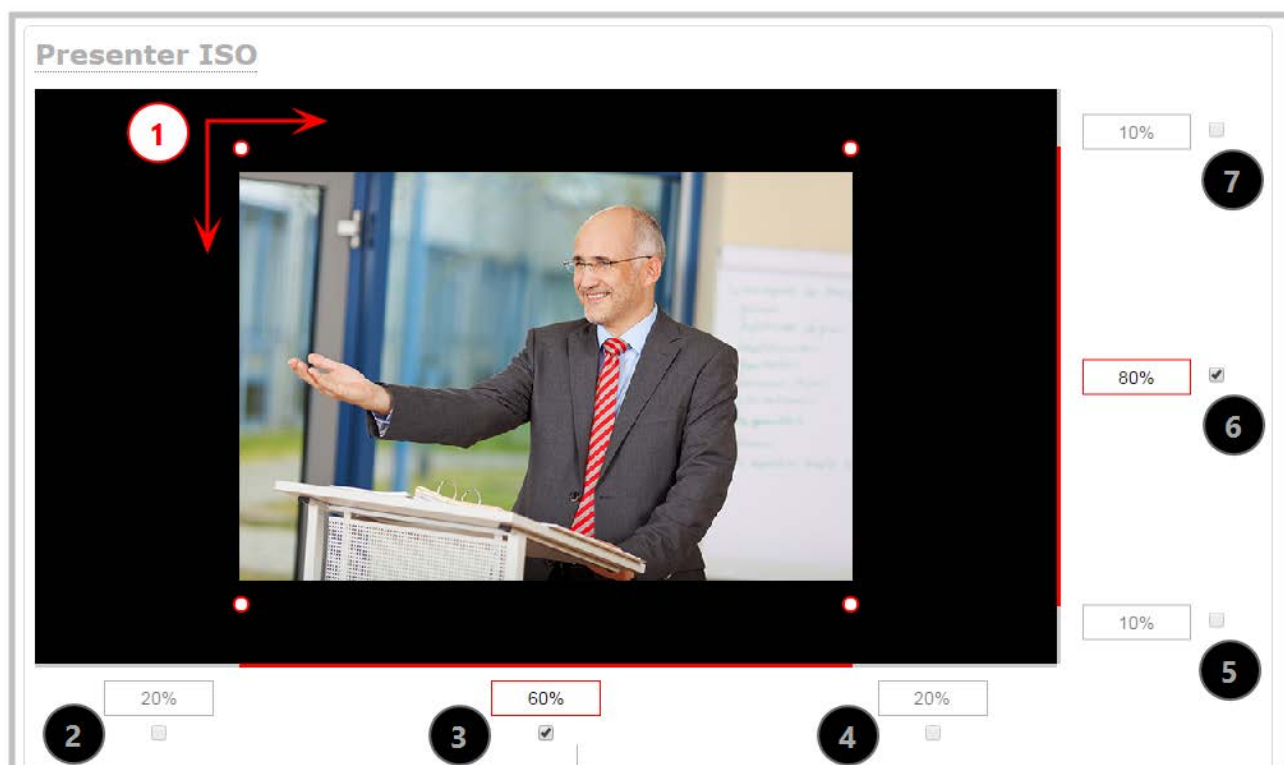| Item	Description
1	The area of your layout item. The 4 red/white dots represent the boundaries of your layout item. There may be some black space between your item and its boundaries if **Keep aspect ratio when scaling** is enabled (see Add an image to a layout).
2	The percentage of blank space (or number of pixels) from **left to right** on the layout's horizontal axis. (I.e. the item is displaced 20%, or 200px, to the right).
3	If using percents, this value is the item's percentage of **total width on the layout's horizontal axis**. (I.e. the item takes up 60% of the layout's width – represented by a thin red bar above the percent box). If using pixels, this value is **the item's width, in pixels**, with a maximum pixel width (i.e. frame size) identified in your channel's encoding settings Configure encoding.
4	The percentage of blank space (or number of pixels) from **right to left** on the layout's horizontal axis. (I.e. the item is displaced 20%, or 200px, to the left).
5	The percentage of blank space (or number of pixels) from **the bottom upward** on the layout's horizontal axis. (I.e. the item is displaced 10%, or 100px, from the bottom up).
6	If using percents, this is the items percentage of **total height on the layout's vertical axis**. (I.e. the item takes up 80% of the layout's height – represented by a thin red bar to the left of the percent box). If using pixels, this value is **the item's height, in pixels**, with a maximum pixel width (i.e. frame size) identified in your channel's encoding settings Configure encoding.
7	The percentage of blank space (or number of pixels) from **the top downward** on the layout's vertical axis. (I.e. the item is displaced 10%, or 200px, from the top down).

Resize layout items

The easiest way to resize a layout item is to use the **center adjustment boxes** (annotated as #3 and #6 in the image above) on each of the horizontal and vertical axes to set your item's width and height respectively. You can also use your mouse cursor to select the corners and manipulate them into the size you want. Hold the shift key while doing so to keep the frame size constant. If you need to **crop** your image, see Crop a video source.
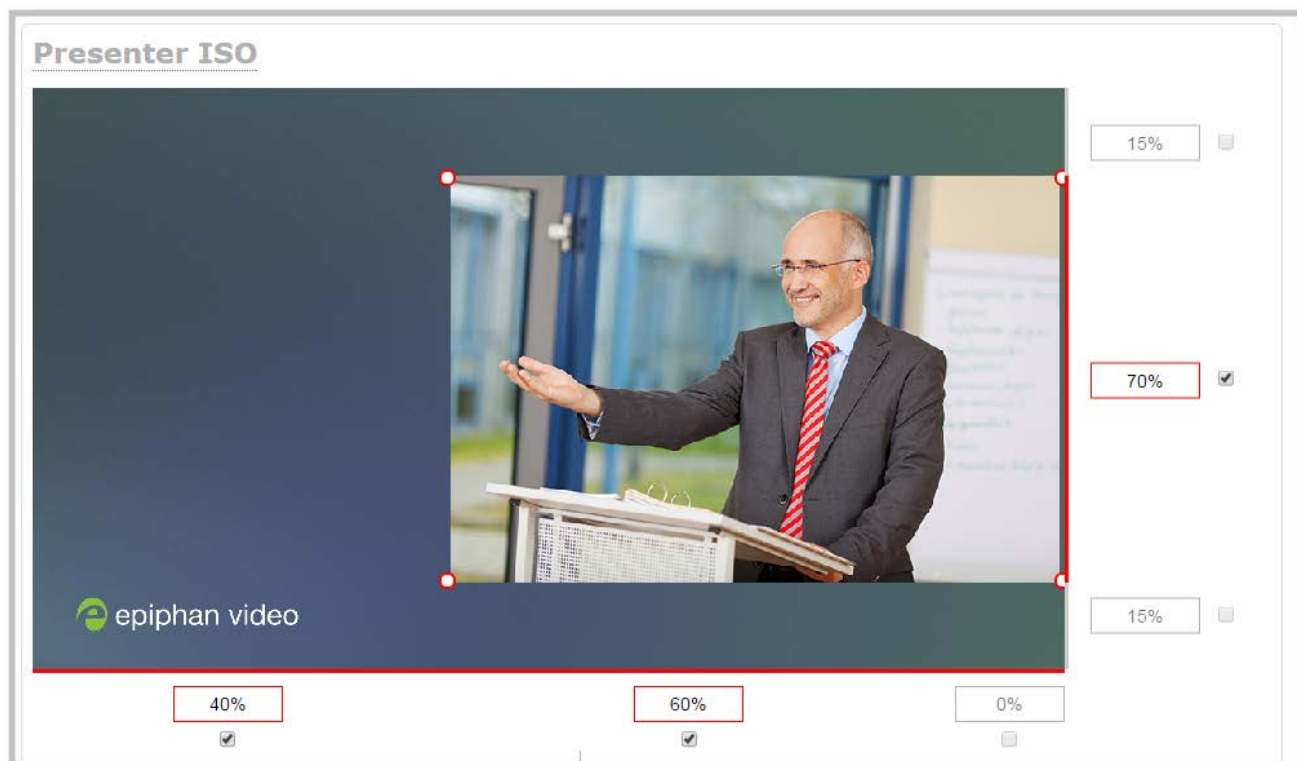
In the example above, the presenter video source is resized to 60% of the layout's width and 70% of the layout's height (with aspect ratio maintained). (Alternatively, pixels could be used to resize the layout item in a similar fashion.)

An important consideration when resizing layout items

Your item will resize automatically if both left and right (or top and bottom) adjustment boxes contain values (percents or pixels) that exceed the total of 100% (if using percents), or maximum pixel count (if using pixels) for the corresponding horizontal (or vertical) axis.

For example, if you originally set the width of an item to 50% of the layout area (or 960 pixels, assuming your item has a maximum width of 1920 pixels in this example) with no values entered in the left and right adjustment boxes (i.e. the left and right boxes are deselected), the item automatically centers itself in the layout area with the left and right percents at 25% each (remember – percents are used by default in the layout editor, even if pixels are used in adjacent boxes). Combined with the 50% (960px) width of the image, these two 25% (480px) values total 100% (1920px) of the layout's horizontal axis.

If you instead decide to enable the left and right percent boxes and change their values to 30% each (instead of the current 25%), then the image's width shrinks from 50% (960px) to 40% (750px) to accommodate the change and maintain a total layout width of 100% (1920px).
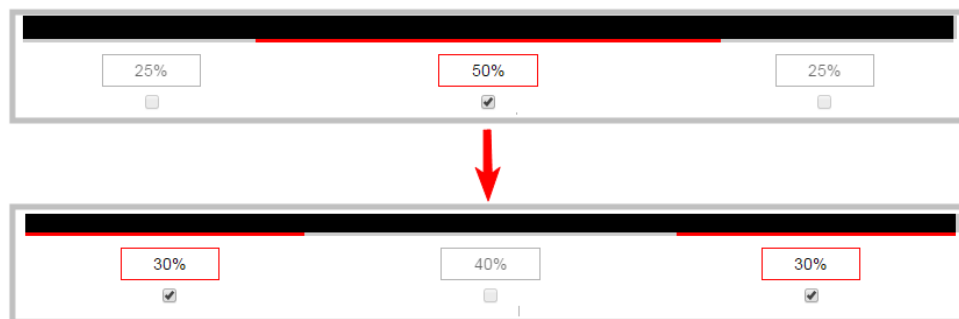
> Setting the left and right (or top and bottom) percent values so the axis total among the three percent boxes exceeds 100% will always result in the center percent box value automatically reducing itself to maintain the 100% total, shrinking your selected layout item in the process.

Position layout items

Items are positioned in a custom layout by entering values into the left/right and top/bottom adjustment boxes (identified as #2/4 and #5/7 respectively in the Adjustment boxes for item resizing and positioning table above). The values entered into these boxes represent a portion of the total percentage (or pixels) of the layout's width or height.

> Alternatively, you can position your layout items using the keyboard by selecting the item with your mouse cursor, and pressing the arrow keys to move the selected item by 5% in any direction.
>
> You can also position your item with additional keyboard precision by **holding Ctrl and pressing the arrow keys** to nudge your item by a very small fraction in the direction of your choice.

Note that there is no one way to move and resize your layout items. The examples below are simply descriptions of one or two ways you might resize and/or position layout items.

Example 1: horizontal positioning using percents

To position your item along the horizontal axis, first resize your items if desired (as described in Resize layout items), then enter a percent or pixel value into either the left or the right adjustment box to shift your layout item.

For example, using **percents** to move a layout item with a 60% width as far to the right of the layout area as possible, you would need to enter 40% into the left percent box to push the item to the right. The layout item originally takes up 60% of the layout width, so this added 40% shift pushes the item as far to the right as possible (I.e. 100% of the horizontal axis).
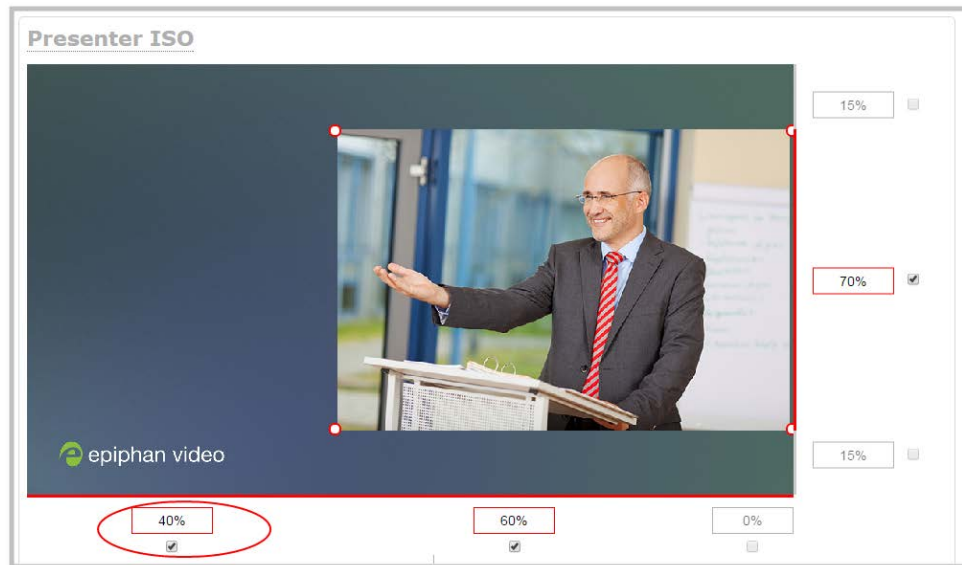
The right adjustment box automatically sets itself to 0% to reflect that there is no more room remaining to maneuver the image along the horizontal axis any further. Alternatively, you could reposition the image in the exact same way by instead setting the right percent box to 0%.

Example 2: vertical positioning using pixels

To position your layout item along the vertical axis, enter a percent or pixel value into either the top or the bottom adjustment box to shift your layout item downward or upward, respectively.

For example, using **pixels** to move a layout item that is set to 756px in height to the top of the layout while leaving a small margin of background (say 25px), you could either enter "25px" into the top percent box (to specify the small margin from the top down) or enter 27% into the bottom percent box (to specify a 27% margin from the bottom up – added to the item's 70% height this leaves a 3% margin above your layout item.)
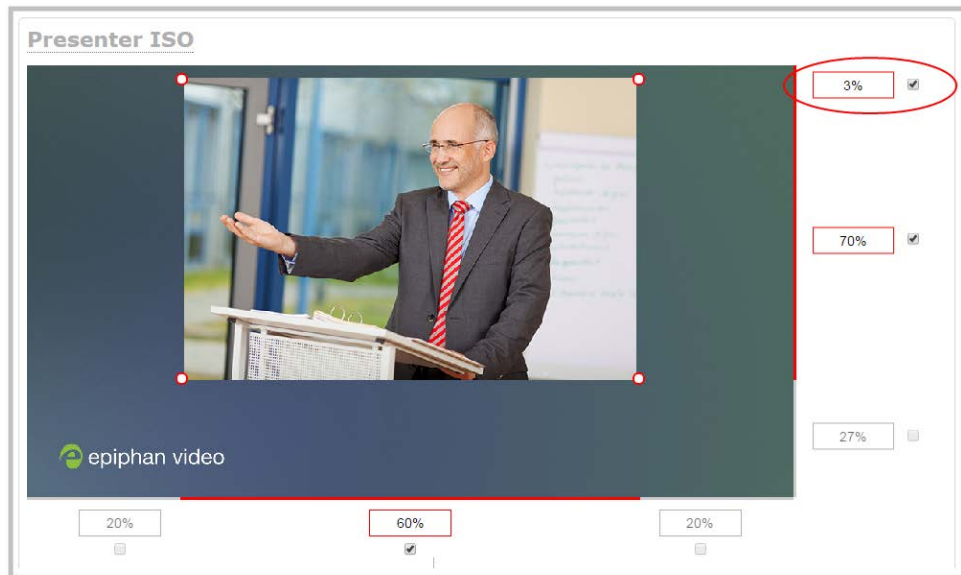
You can manipulate elements to get the custom look that you want using percents, pixels, your keyboard, or any combination. Here's an example of using pixels and percents to created a custom layout with two video sources and a background image.

Open the custom layout editor for a channel

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Channels menu, select a channel and click **Layouts**. The custom layout editor opens.

3. From the Layouts list, select the layout you want to edit. The layout editor updates to display the selected layout and the row for the selected layout is highlighted in green.

   If this is a new or an unformatted layout, the layout area is empty and a black background matte appears.

Add or edit a custom layout

If you want to do live switching on your channel for a more dynamic video presentation, then you need to add different layouts that you can switch between. We recommend that you rename your channel and layouts to something more intuitive rather than using the default names, see Rename a channel and Rename a layout.

Creating layouts gives you full control over what's presented to your viewers. You can do things like change the size and position of images, add custom backgrounds, up scale and downscale your video sources, add multiple audio source and text overlays to mention just a few.

Important considerations:

If you're live switching your channel, we recommend that you set the frame size to a fixed size instead of using the default automatic detection of source frame size. Setting the frame size to a fixed value ensures you don't experience any stream interruptions if the source frame size changes due to layouts that contain a single video source that has a different frame size than those in other layouts, see Configure video encoding.

To add or edit a custom layout for a channel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Channels menu, select a channel and click **Layouts**. The custom layout editor page opens.

3. Select a layout from the layout list or click **Add Layout** to create a new layout. If this is a new channel or layout, the layout area is empty and you see a black background matte. See Add video sources or a channel as a source
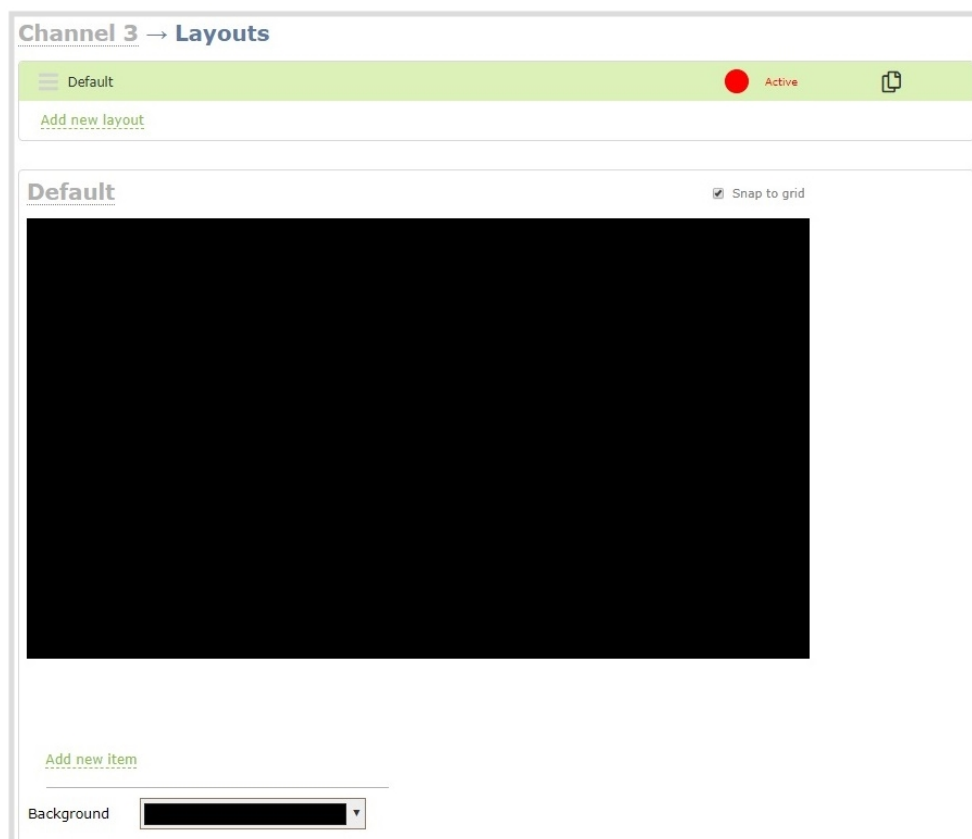
4. Click and drag the red and white handles on the corners of the video source to re-size it in the layout editor area.
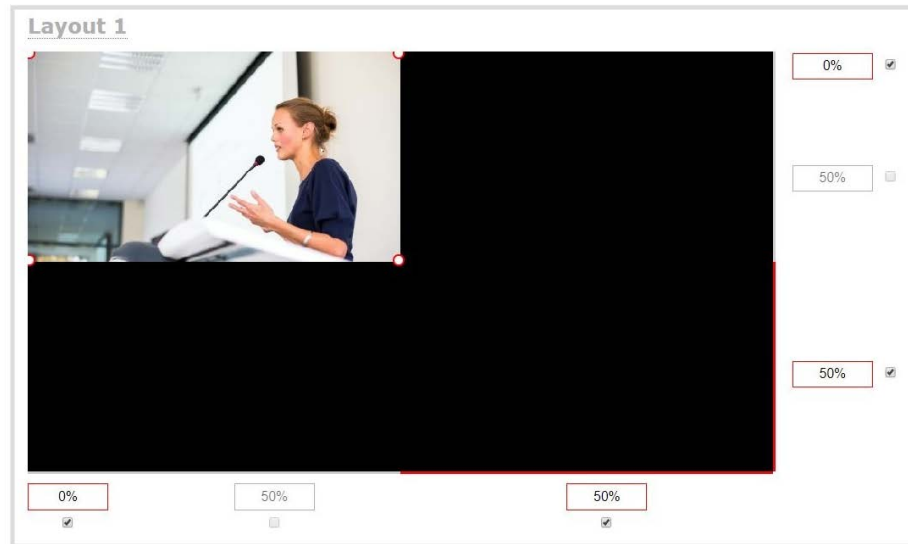
5. Click **Save** when you're done or continue to add additional video sources to the layout, resize and crop each video source to exactly how you want them to appear.

Rename a layout

You can rename any layout, even the currently active layout. Layouts you create are automatically given a default name. The first layout is called Default. You can change the name using the custom layout editor.

> If you're using the touch screen for live switching, consider using shortened names for layouts. Long names get truncated on the touch screen.

You can include certain international characters in layout names. Pearl supports common character sets for Western and Central European languages, Nordic languages, and Russian. For a complete list, see International character support.

To rename a layout:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Channels menu, select a channel and click **Layouts**. The custom layout editor opens.

3. From the layout list at the top of the page, click on the row to select a layout. The layout appears in the layout area.

4. Click the name of the layout. The name turns red.

5. Enter a new name and press **Enter**.

Delete, move, or duplicate a layout

Layouts appear listed in the layouts list in the same order that they are presented on the touch screen. It's simple to re-order, remove, and duplicate layouts using the custom layout editor.

Reorder layouts

To move a layout:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Channels menu, select a channel and click **Layouts**. The custom layout editor opens.

3. In the layouts list, click and drag the icon with the three horizontal bars at the left side of the row to rearrange the order of your layouts.

Delete layouts

You can delete any layout except the currently active layout.

To delete a layout:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Channels menu, select a channel and click **Layouts**. The custom layout editor opens.

3. Click the **X** at the right side of the row for the layout you want to delete. The system prompts you to make sure you want to delete the layout.

4. Click **OK**.

> When using the switcher on Epiphan Live, refresh your browser if you still see a layout that was deleted. The deleted layout should disappear.

Duplicate layouts

If you're planning to use live switching, we strongly recommend you rename the channel rather than using the default channel name, see Rename a channel.

To duplicate a layout:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Channels menu, select a channel and click **Layouts**. The custom layout editor opens.

3. Click the double folder icon at the right side of the row for the layout you want to duplicate. A duplicate of the layout is added at the bottom of the list.

4. Click **OK**.

Important note for channels with multiple layouts

When a channel has only one layout and that layout has only one video source, the default channel name is the same as the name of the video source. So for example, a channel with one layout that has HDMI-A in it is named HDMI-A by default.

When you add a second layout to the channel, the channel name automatically changes to a generic name **Channel *X***, where *X* is the channel index number. For example, HDMI-A changes to Channel 1.

Changing the channel name affects system operation.

- If the channel is streaming, the stream is stopped and restarted.

- If the channel's recorder is recording, then recording is stopped and a new file is started.

If you delete all the layouts in a channel until there is only one layout left and that layout has only one video source assigned, then the channel name changes back to the name of the video source. For example, Channel 1 changes to HDMI-A

To avoid channel name changes, we recommend that you rename the channel to a custom name. Changing the channel name to a custom name ensures that no automatic channel renaming happens, see **Rename a channel**.

Set the background color

You can select the background color to fill any unused space in a layout using the custom layout editor. For example you can add a color from your corporate color scheme.

To set a background color matte for a layout:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Channels menu, select a channel and click **Layout**. The custom layout editor opens.

3. Click the drop down arrow next to the existing (by default black) background color field. The color picker opens.
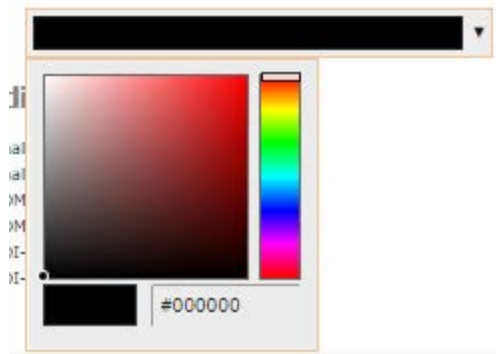
4. Pick a new color or type in an RGB value in the field; the color is updated in the layout area.

5. Click anywhere off the color picker to close the picker.

6. Click **Save**.

Add an image to a layout

You can add images to a layout using the custom layout editor. Use images to create a background for your source, to add your corporate logo, or to add relevant information about the event you're streaming.

Pearl supports png (PNG) and .jpg (JPEG) images. You can upload images that are 16×16 pixels to a maximum image size of 4096×4096; however it's strongly recommended that you upload exactly the size you need to avoid image scaling.

Images can be uploaded in advance from the Media page, see Upload or remove an image using the Media page. Otherwise, you can drag and drop to upload an image using the custom layout editor. Note that no warning is displayed if the image is too large or if an image exists with the same name using drag and drop. The file will be replaced with the new image you upload.

Any image without the proper file extension appears in the layout editor but doesn't display in the actual video output. For instance, a PNG image with the file extension .bmp or an invalid file extension such as .png2 are examples of improper file extensions.

> If your uploaded image does not appear in the list, ensure it doesn't exceed the maximum image size of 4096×4096.

To add an image to your layout:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Channels menu, select a channel and click **Layouts**. The custom layout editor opens.

3. Click **Add item** and choose **Picture** from the drop down. The picture settings appears.

4. Select an image from the **Use image** drop down. To upload the image, drag and drop it from your desktop to the gray **Please select picture** area. For best results, keep the **Keep aspect ratio when scaling** check box selected (default).
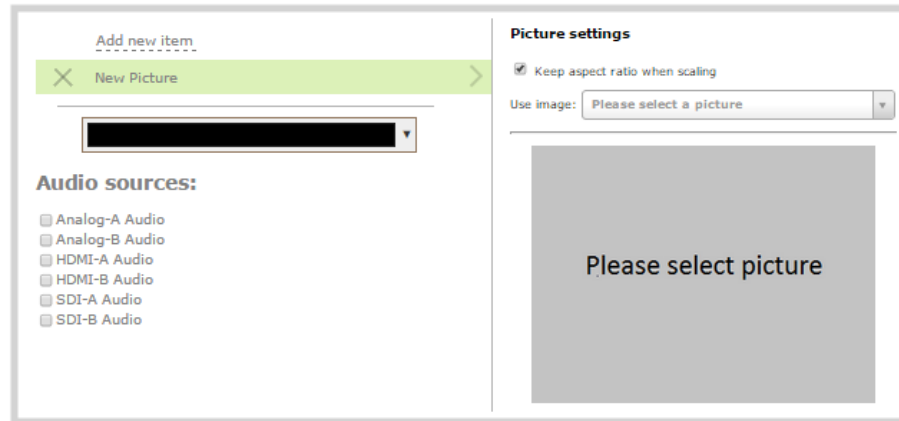
> For best results, check **Keep aspect ratio when scaling** in the **Source settings**.

5. Your picture appears in the **Picture settings** preview and is added to the layout area.
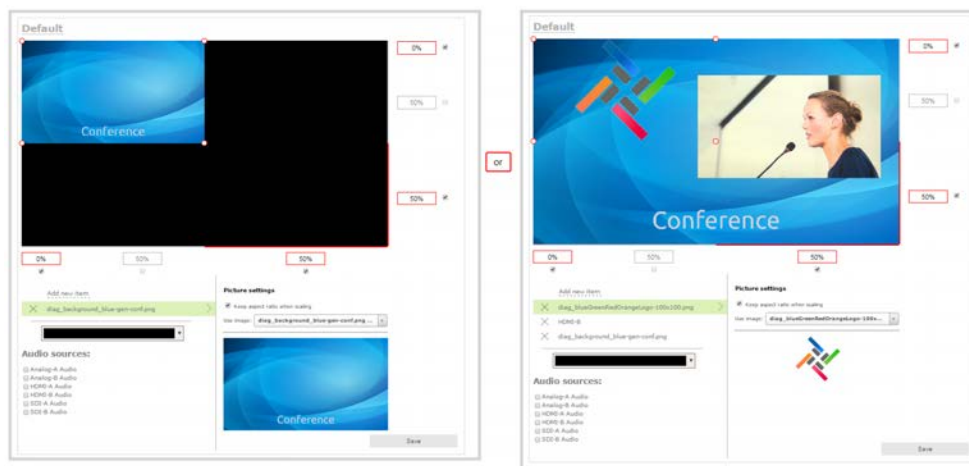
6. In the layout area, use the mouse, the keyboard or the manual position value fields to position and resize your image. For background images, click and drag to fill the full layout area. For more details, see About the custom layout editor.
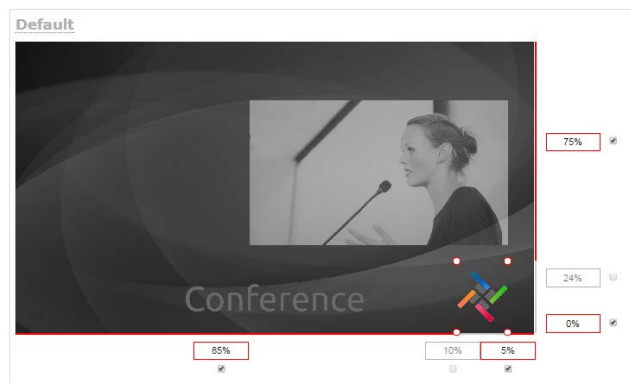
7. Re-order the items in your layout by clicking and dragging items in the item list.

> To layer video sources over top of each other, like for background images or a transparent
> logo, you can click and drag elements that appear in the item list beneath **Add new item**
> and change their order. Items that are higher up the list appear over top items that are
> lower down the list.

8. Click **Save**.

Upload or remove an image using the Media page

You can customize your channels by adding pictures as backgrounds, overlays, or transparent overlays. Image files formats supported include: PNG and JPEG.

The maximum supported image size is 3840×2160. No warning or error message is displayed if your image is too large. Files that exceed the maximum size won't appear in the drop-down list.
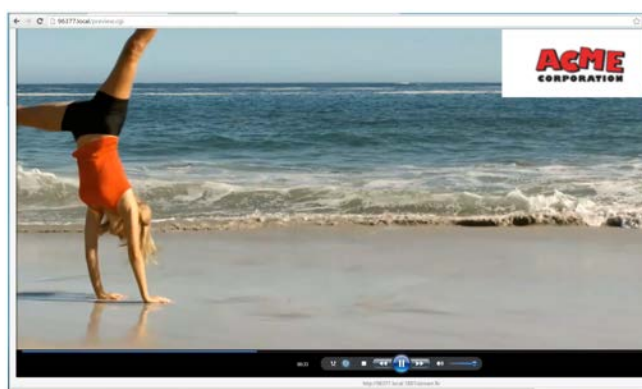
> For best results always upload images that are already the correct size needed in your layout. Background images should match the frame size of your channel (frame size is set in the **Encoding** configuration page).

There are two ways to upload images. You can upload images using the Media page or drag and drop your image in to a layout using the custom layout editor, see Add an image to a layout.

Important considerations

- Media file names should not include special characters, slashes, or spaces.

- Uploading an image of the same name overwrites the existing image.

- Any image without the proper file extension appears in the layout editor but doesn't display in the actual video output. For instance, a PNG image with the file extension .bmp or an invalid file extension such as .png2 are examples of improper file extensions.

To upload or remove an image using the Media page:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, click **Media**. The Media page opens.
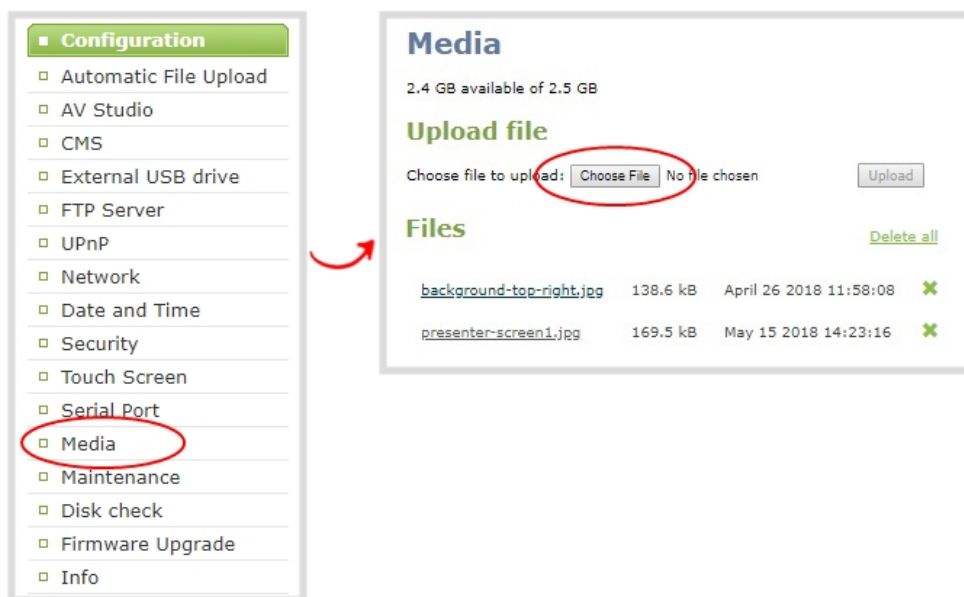
3. To upload a file, click **Choose File** and browse to select the file to upload, then click **Upload**.

4. To remove a file, click **Remove** beside the file name and click **OK** when prompted.

> If you delete an image that is used as part of the layout for any channel, select a different image or no image by using the drop-down list in the **Picture settings** box within that channel's layout before deleting the file using the steps below.

Add a text overlay

Text overlays are useful to add information like a title, location, or the date and time in to layouts in your channel. You can add text to any layout using the custom layout editor. The following tables lists shortcut codes that you can enter and the resulting content that appears on screen.

Table 49 *Overlay text shortcut codes*

Item	Shortcut code	Example
date format: yyyy-mm-dd	%F	2019-01-26
date format: mm/dd/yy	%D	01/26/19
year	%G	2019
month (01)	%m	01
month (Jan)	%b	Jan
month (January)	%B	January
day of the month	%d	26
weekday (Thu)	%a	Thu
weekday (Thursday)	%A	Thursday
time	%T	08:40:45
hour	%k	08
minute	%M	40
second	%S	45
millisecond	%#m	378
channel name	%c	Camera Feed 1

> If you use a non-monospaced font, the size of the text overlay changes as the letters, numbers, and the length of words change. Use a monospaced font to maintain a consistent size for the text overlay (assuming the total number of characters in the text string doesn't change).

You can include certain international characters in text overlays. Pearl supports common character sets for Western and Central European languages, Nordic languages, and Russian. For a complete list, see International character support.

To add a text overlay to your layout:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Channels menu, select a channel and click **Layouts**. The custom layout editor opens.

3. Click **Add new item** and select **Text**. The new item is added to the layout editing area and to the top of the list of items. The Text settings also appear.
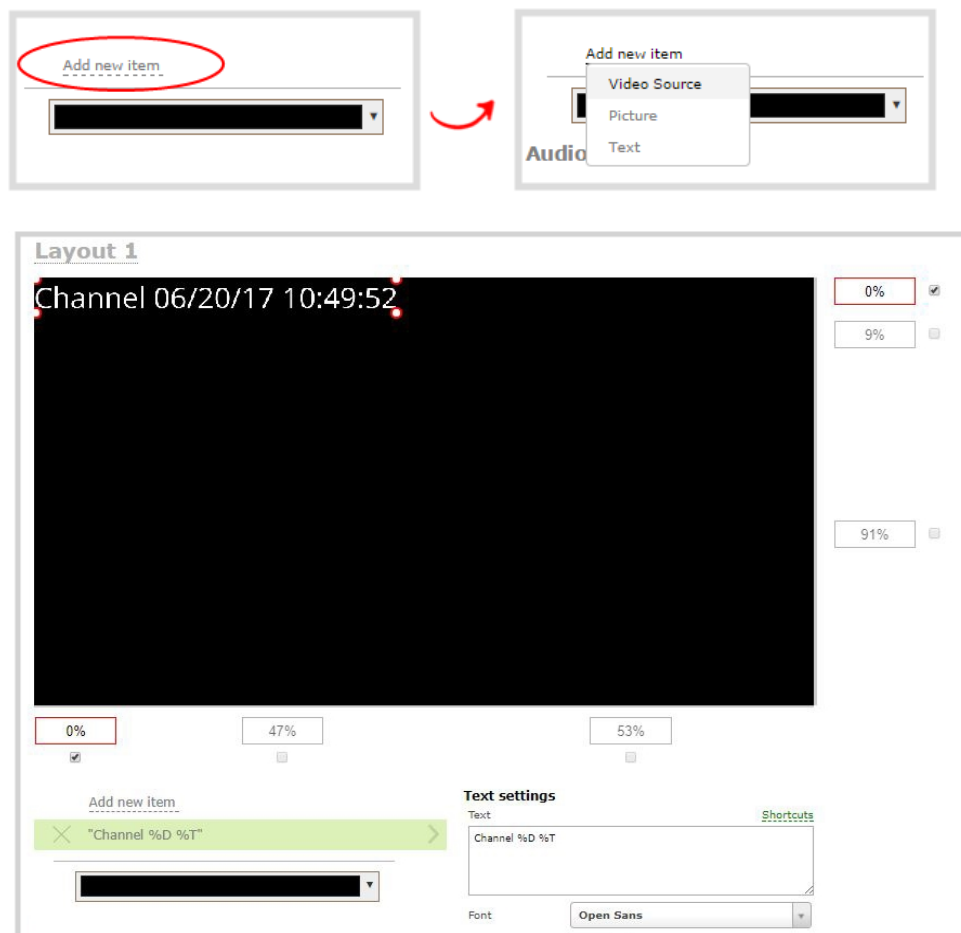
> ✅ You can change the order in which items appear on the layout editing area by re-arranging the order the items appear in the list beneath **Add new item**. Items at the top of the list appear in front, and items lower down the list appear behind.

4. In the **Text** field, type what you want to appear in the text overlay. Include Overlay text shortcut codes as needed. Press **Tab** or click outside the text field to refresh the preview in the custom layout editor.

    For example, if you enter:

    ```
    %A %B %d, %G. Live streaming channel Auto A.
    ```
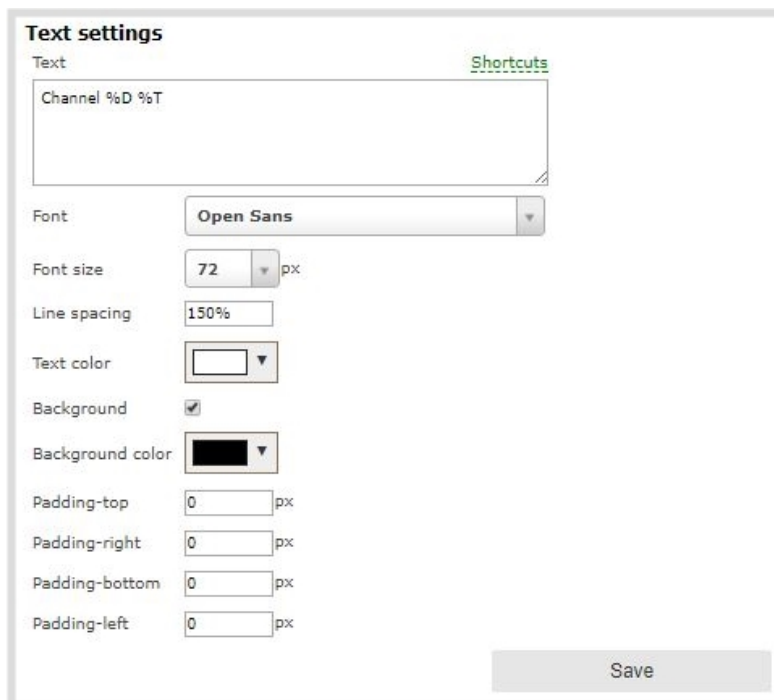
    The resulting text is displayed:

    Friday June 23, 2017. Live streaming channel Auto A.

5. Select the **Font**, **Font size**, and **Text color**. You can also change the default **Line spacing** in percentages. For a mono-spaced font, use Droid Sans Mono.

    > ✅ **Limitations**: The maximum supported text size is 500 px. Padding values must not exceed the frame size. Do not enter negative padding values.

Text settings

Text	Shortcuts

Channel %D %T

Font	Open Sans ▼
Font size	72 ▼ px
Line spacing	150%
Text color	▼
Background	☑
Background color	▼
Padding-top	0 px
Padding-right	0 px
Padding-bottom	0 px
Padding-left	0 px

Save

6. Resize the overlay text box using the padding settings.

> 📋✅ The handles on the corner of the overlay text box are not click-and-drag and do not resize the text box. To resize the text box, use the padding fields to add space above, below, and on either side of the text.

7. In the layout editing area, click and drag to move the overlay text box or enter values in the manual position value fields along the side and bottom of the layout area.

8. Click **Save**.

Custom system variables for text overlays

Using HTTP or RS-232 APIs, you can create your own custom system variables for use in text overlays. This is useful to add custom overlay text that changes throughout the course of your live stream or recorded program.

For example, using the HTTP API you can create a system variable for the current GPS co-ordinates, then use a script to update the GPS co-ordinates in your custom variable as the physical location in your stream changes.

Here's an example custom variable called **gpsvar1** that has a value of `N103 68201 W765 29712`. To insert the custom system variable into a text overlay, simply type **%(gpsvar1)** into the **Text** field.

If you use a non-monospaced font, the size of the text overlay changes depending on the characters in the content and the number of characters. To maintain a consistent size for the text overlay in the layout area, use a monospaced font and make sure the number of characters doesn't change.
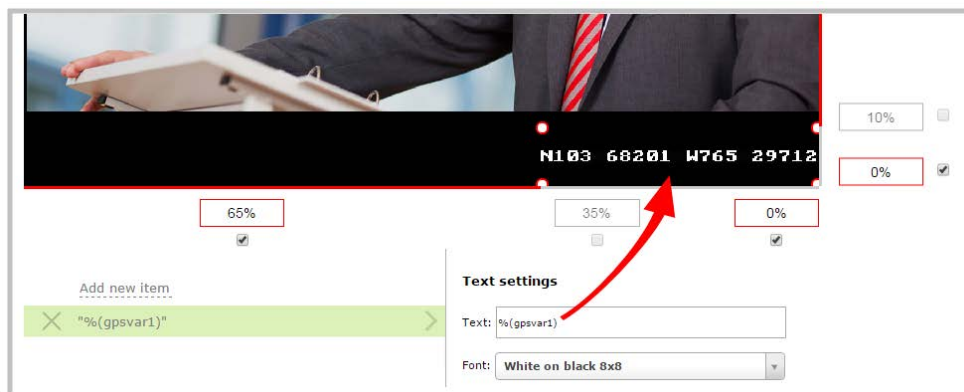
The RS-232 SET command syntax in this case is `VAR.SET.<name>=<value>`, for example:

```
VAR.SET.gpsvar1=N103 68201 W765 29712
```

where *name* is **gpsvar1** and *value* is **N103 68201 W765 29712**.

There are no limits for the frequency of system variable commands using RS-232. However, only one command can be issued at a time.

HTTP system variable commands are issued at a frequency of **5 per second**. You can include up to six variables in a single HTTP SET command. After issuing a SET command, all channels using the specified variables are updated.

> **STOP** System variables are considered volatile and are deleted when the system reboots.

To learn more about global variable command syntax and important considerations when using them, see:

- Controlling Pearl using HTTP/HTTPS commands
- Controlling Pearl using RS-232 / serial port

For more information about sizing and positioning elements in the custom layout editor area, see About the custom layout editor.

Crop a video source

You can crop a video source to change the size and shape of your video as it appears on screen using the custom layout editor. Cropping a source gives you a lot of advantages and can help to conserve the overall amount of processing CPU usage for your Pearl.

To crop a source in your layout:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.
2. From the Channels menu, select a channel and click **Layouts**. The custom layout editor opens.
3. Select a video source from the items list. The **Source settings** appears.
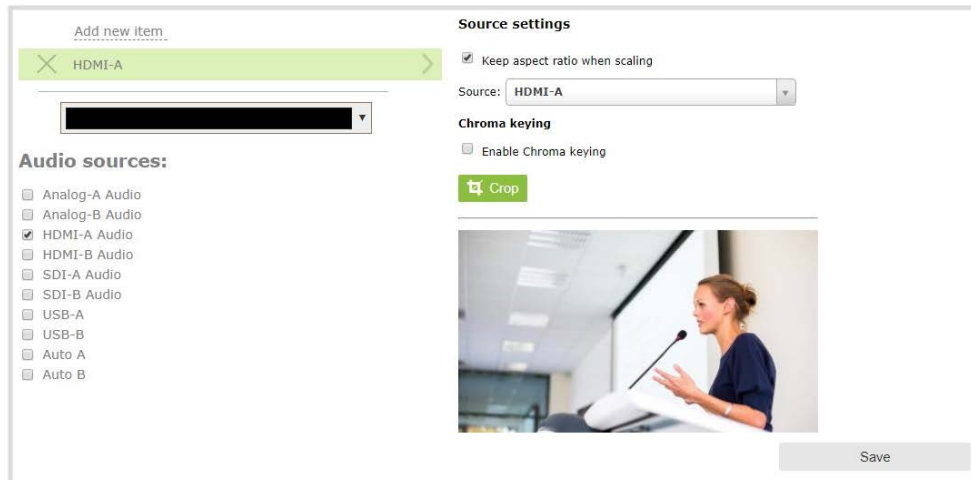
4. Click **Crop**. Your video source appears in a pop-up editing window.
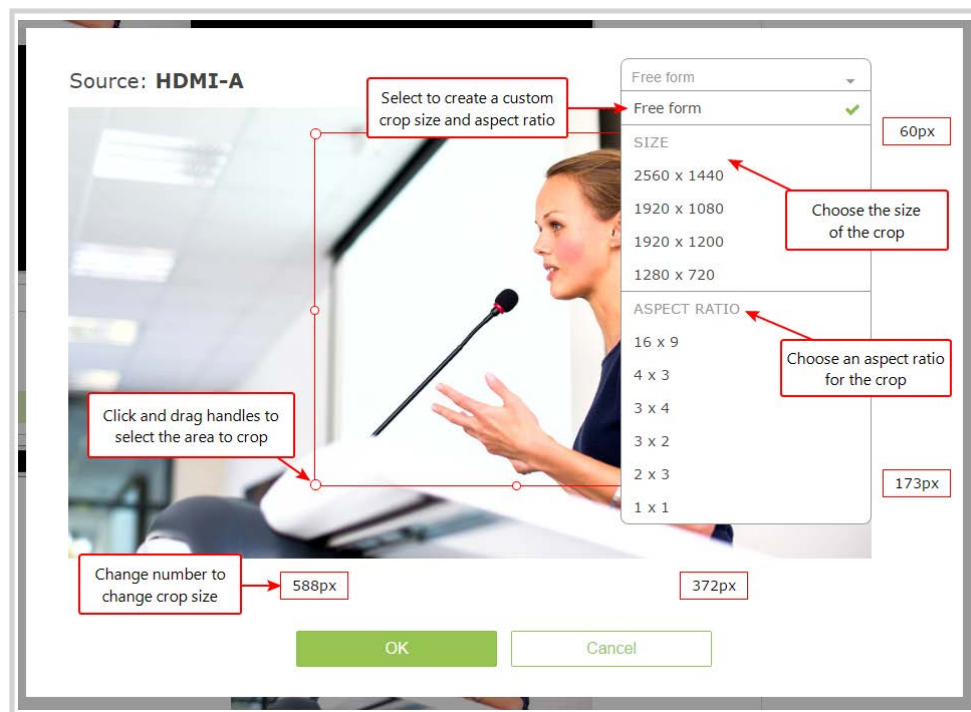
5. The **Crop** window has several tools for creating the best crop possible.

- **Free form** is the default crop mode. In this mode, you can change the size, aspect ratio, and position of the crop with minimal restrictions.

- The red box with click-and-drag circular handles in the corners shows the cropped area that appears in the final layout. Only the content inside the box shows in the layout. In **Free form** mode, you can click and drag the red handles to change the size and ratio of the box, and you can click and drag the box itself to change its position. When you have selected an aspect ratio,

you can alter the size by dragging the red handles. When you have selected a size, you can change its position by dragging the box.

- The number boxes allow you to make precise crops. Click the text boxes and enter a number to determine how many pixels of distance from the edge that line is drawn. You can also erase the "px" after the number and type in "%" to manipulate the box using percentages. For more details on how these boxes work, see Resize and position items using percents or pixels.

- To create a crop with a specific resolution, choose a **Size** from the available list. This creates a box with that exact resolution. Click and drag the box to move it into position. The size cannot be changed except by selecting a different size, or by selecting **Free form** or **Aspect Ratio**.

- Selecting an aspect ratio allows you to create a crop box of almost any size in a particular ratio. After selecting a ratio, you can manipulate the crop area's size and position without changing its shape.

6. Click **OK** to close the crop window.

7. Click **Save**.

You can also manipulate the crop-box using keyboard controls. You can move the crop box using the arrow keys, and holding **Ctrl** or **Shift** while resizing the box keeps the aspect ratio of the box constant. Hold **Shift** and use the arrow keys to move one side of the box while leaving the other in the same location.

Configure chroma keying

Pearl supports chroma keying so you can add special effects to any video source in a custom channel. Add great looking effects such as animated lower thirds using a titler software or add a custom background using green screen. It's easy to get creative.

With chroma keying, you can choose a specific color in your video scene and replace everything of that color with a different image or video.

The most common color used for chroma keying is green. In this example, the original video source shows someone standing in front of a green screen. Using chroma key in Pearl, an image of an office space replaces the green background.

> White, grey, and black are not recommended colors for chroma keying. Those are treated as the same color with a different luminance value. The result in Pearl is that the chroma keying affect gets applied to all shades ranging from white to black.

You configure chroma keying using the custom layout editor, see About the custom layout editor.

Topics include:

- Performance considerations
- What is upstream chroma keying?
- What is downstream chroma keying?
- Set up chroma key for a green screen video source
- Add external titler software effects to Pearl
- Add chroma key titler effects using Microsoft Powerpoint slides

Performance considerations

Chroma keying can impact the performance of Pearl depending on factors such as how many chroma key sources you add, if you scale the chroma key video source using the custom layout editor, and your frame rate.

For best performance, avoid excessive scaling of video sources that have chroma keying enabled. Cropping video sources that have chroma keying enabled helps reduce processing and optimizes the performance of Pearl.

You can monitor the performance of Pearl from the **Info** tab using the Admin panel for the custom channel that has chroma keying enabled. For more information about performance monitoring, see What is Pearl?.

Pearl met our operational performance criteria when tested with three input sources of 1280×720 at 30 fps each configured in a single channel where:

- All three sources are part of the switched program in the channel
- One of three sources in the channel has chroma keying enabled
- Two of the sources are also recorded as separate ISOs

Observe the following:

- For Pearl, we recommend that you enable chroma keying on only one channel.
- Use a source that has an input resolution of 1280×720 at 30 fps for chroma keying rather than an input source at 1920×1080 and downscaling in Pearl.
- Avoid scaling a video source that has chroma key enabled.
- Where possible, crop the video source that has the chroma key enabled to minimize the area that Pearl must process for the chroma key effect.
- Overloading the Pearl processor can cause frame drops.

What is upstream chroma keying?

Upstream chroma keying applies the chroma key effect to a specific video source before it's processed, switched, and broadcast.

For example, you could display the name of a guest using titler software on only the camera that is dedicated for close ups of that person but not on any of your other video sources.

To get an upstream key effect using Pearl, you can create custom layouts for each video source using the custom layout editor. Then set up chroma keying on just one custom layout. Only the video source that appears in the custom layout with chroma key enabled has the chroma key effect applied to it.
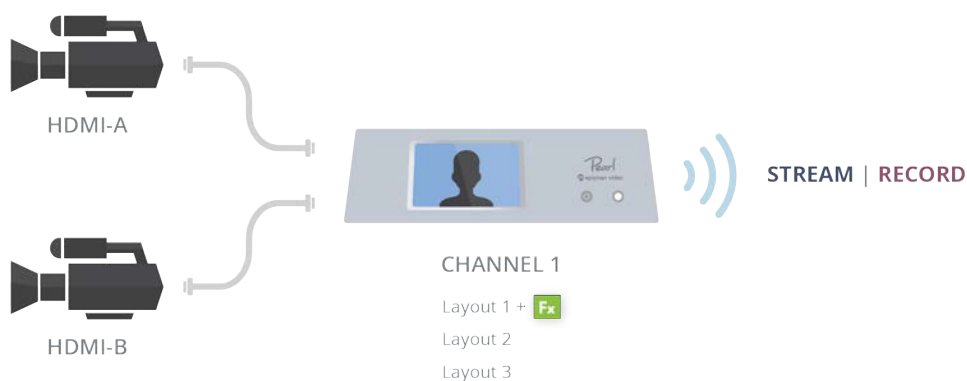
> If you want to apply the chroma key effect to a video source that appears in several different custom layouts, you must enable the chroma key effect in each custom layout where that particular video source appears.

What is downstream chroma keying?

Downstream chroma keying applies the chroma key effect to all video sources you broadcast after they're processed and switched.

A common use of downstream keying is to display a persistent image, like a company logo, so that it always appears on screen.

To get a downstream key effect using Pearl, you can enable the same chroma key effect on all your custom layouts. This way, the same chroma key effect gets applied to everything you stream or record.
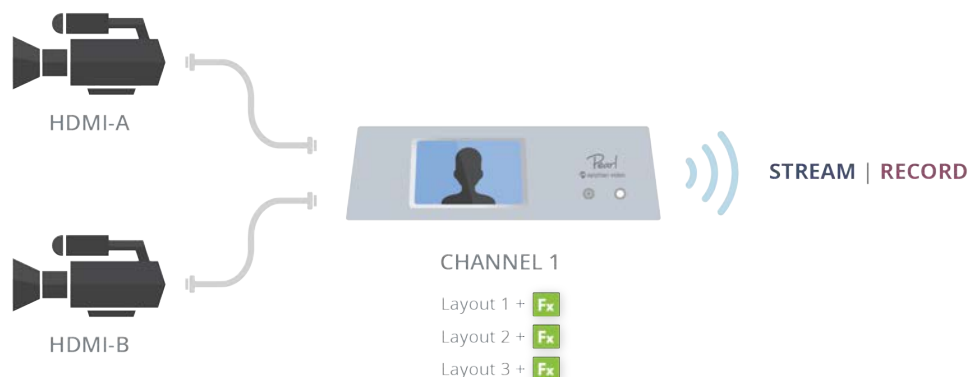
Set up chroma key for a green screen video source

A common use of chroma keying is to use a green screen and then replace the green background with another video or still image.

Your chroma key source can come from a video camera or an effects computer connected to Pearl. The background you use can be from another video source, a still image that you've uploaded to Pearl, or from an effects computer.

This example shows two camera sources connected to Pearl. The green screen appears in the video source connected to HDMI-A and the office background is from HDMI-B.
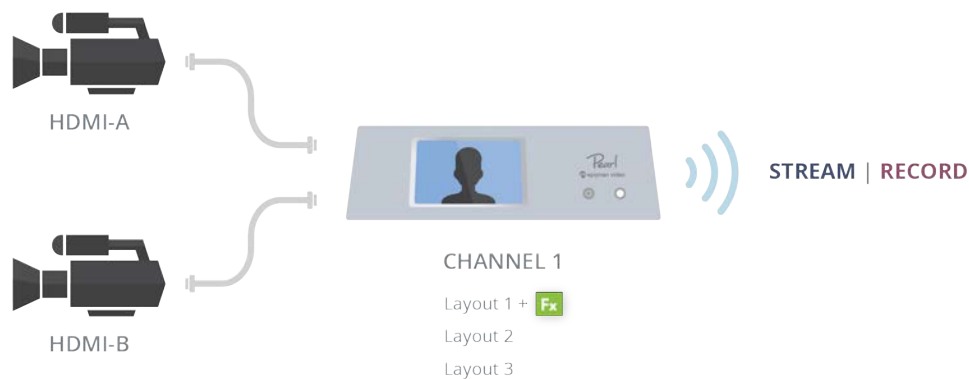
To configure chroma keying for a green screen video source:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. Follow the steps in Add or edit a custom layout to create a custom channel.

3. From the custom layout editor, click **Add new item** and select **Video Source**.

4. Click **Source** and select the video source that you want showing through the background of your chroma key colored areas. For detailed steps, see Add video sources or a channel as a source.

5. In the layout editing area, click and drag to position the video. See the note after this procedure for positioning techniques.

> For best results, select the **Keep aspect ratio when scaling** checkbox from the **Source settings** box.

6. Click **Add new Item** again and add the video source that has the green screen image.

7. Click the **Crop** button and crop your green screen video source in the pop-up crop editing window. For detailed steps, see Crop a video source. Click **OK** when your done to return to the custom layout editor.
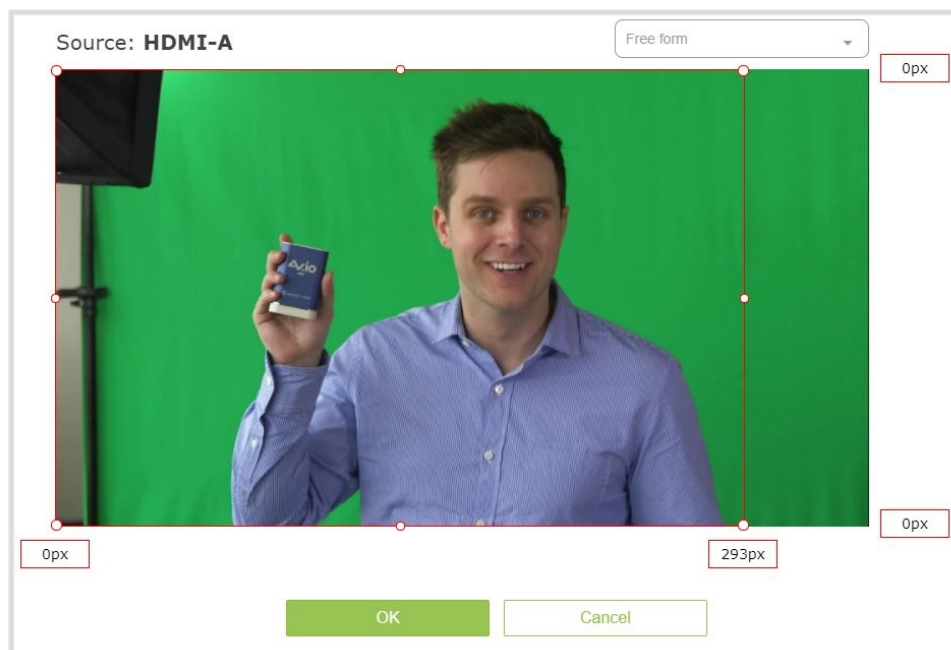
> Cropping the green screen video source helps optimize the performance of Pearl.

8. In the layout area, position the green screen video source over top the other video source. To optimize performance, avoid scaling the green screen video source if you can.
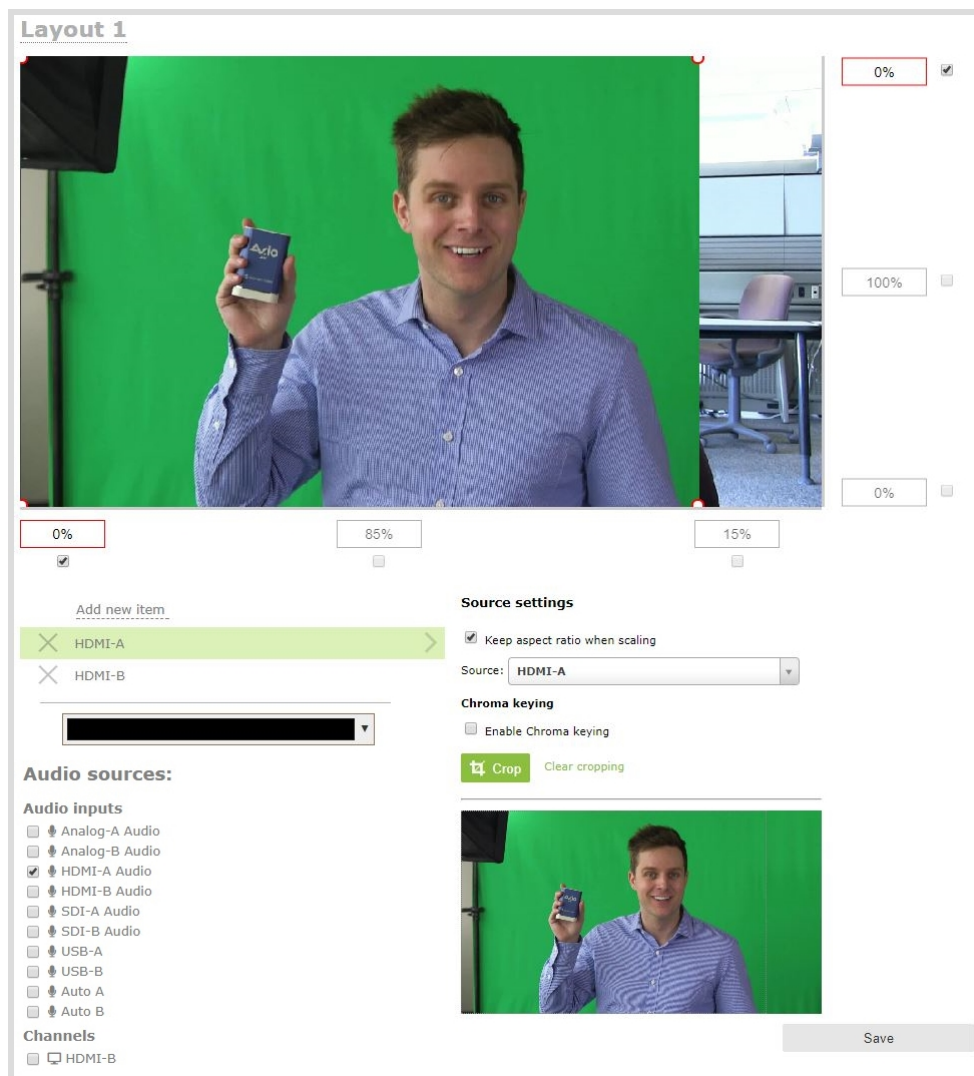
9. With the green screen video source selected, check **Enable Chroma keying** in the custom layout editor. The chroma keying options appear.

> White, grey, and black are not recommended colors for chroma keying. Pearl treats them as the same color with different luminance values. As such, chroma keying affects all shades ranging from white to black.

10. Click the eye dropper and then click on a color in the thumbnail image to choose the chroma key color.

> The background video image shows through all the colored areas on the chroma key video layer that match the color you select as the chroma key.

11. Adjust the chroma color selection and blend the edges to remove unwanted chroma effects or residual color.

   a. Enter a number in the **Key threshold** field to adjust the color selection. A value of 0 equals the original color you selected. A higher value widens the range of the selected chroma color. A lower number narrows the range of the selected chroma color.

   b. Enter a number in the **Edge blend** field to smooth out and adjust the color around the edges in your image.

12. Click **Save** when you're done.

A note about item positioning and sizing

There are four ways to position and size items in the layout area

1. using the mouse

2. using the keyboard

3. using the manual positioning values with percents

4. using the manual positioning values with pixels

To use the mouse:

Click and drag to move the item. Click and drag the round, red and white handles to resize an image or video source (for text overlays, just use the padding settings). Using this method you can make quick changes that are in increments of approximately 5% of the width or height of your layout area. For more refined movements, press the Ctrl key on your keyboard while dragging the item with the mouse.

To use the keyboard:

Use the arrow keys on the keyboard to move the item up, down, left or right in the layout. Changes are in increments of approximately 5% of the height or width of the layout area. Press the Ctrl key while using the arrow keys to make more refined movements. To change the size of an image or video source, press the Shift key while using the arrow keys (for text overlays, just use the padding settings). Press both Ctrl and Shift for fine-grained size control.

Using percents:

Specify a whole number, followed by a percent sign (e.g. 4%) in any of the manual positioning fields. See Resize and position items using percents or pixels for more information.

Using pixels:

If you need to specify an exact amount in pixels (rather than percent) you can type a pixel value in any of the positioning value squares followed by the characters px (e.g. 56px). You can mix and match pixels and percents changing only the boxes you want to use pixel values. At any time you can switch back to percents by typing a percent. See Resize and position items using percents or pixels for more information.

Add chroma key titler effects using Microsoft Powerpoint slides

You can use the chroma key feature on Pearl with Microsoft Powerpoint slides to add animated titles and other Powerpoint effects. The setup is really the same as using a dedicated titling software on an effects computer with Pearl.

This example shows an HDMI camera connected to the HDMI-A port on Pearl and an effects computer that has a Powerpoint presentation loaded on it connected to the HDMI-B port. To the computer, Pearl is treated just like an external display.
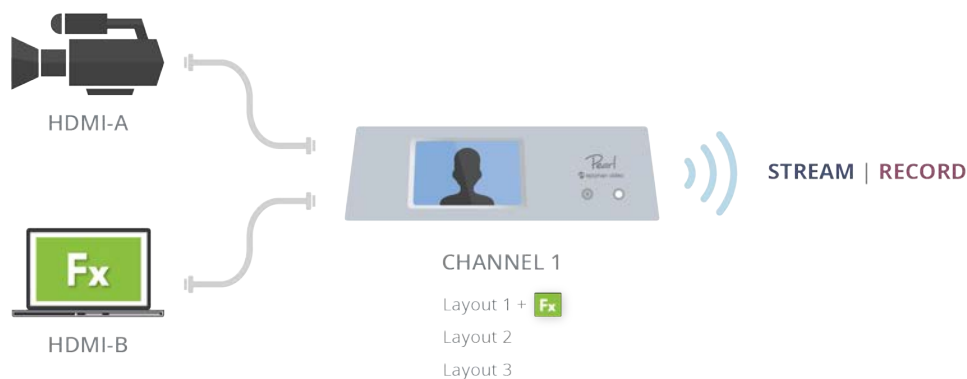
> You can connect the effects computer with the Powerpoint file to any supported port that is available on Pearl.

To apply the chroma key effect to a single video source using Pearl:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. Follow the steps in Add or edit a custom layout to create a custom channel.

3. From the custom layout editor, click **Add new item** and select **Video Source** from the drop down box.

4. Click **Source** and select the video source that you want showing in the background. For detailed steps, see Add video sources or a channel as a source.

5. In the layout editing area, click and drag to position the video. See the note after this procedure for positioning techniques.

> For best results, select the **Keep aspect ratio when scaling** checkbox from the **Source settings** box.

6. Click **Add new Item** again and add the video source from your effects computer.

7. Click the **Crop** button and crop your Powerpoint video source in the pop-up crop editing window. For detailed steps, see Crop a video source. Click **OK** when your done to return to the custom layout editor.
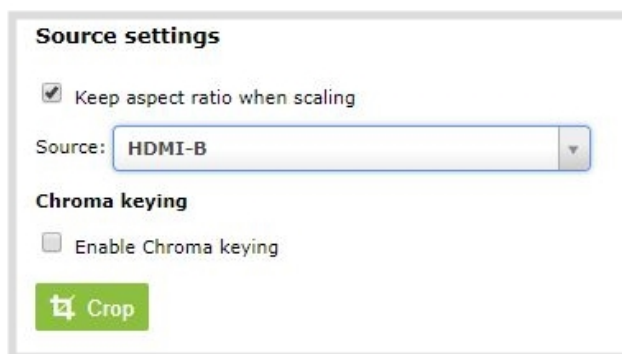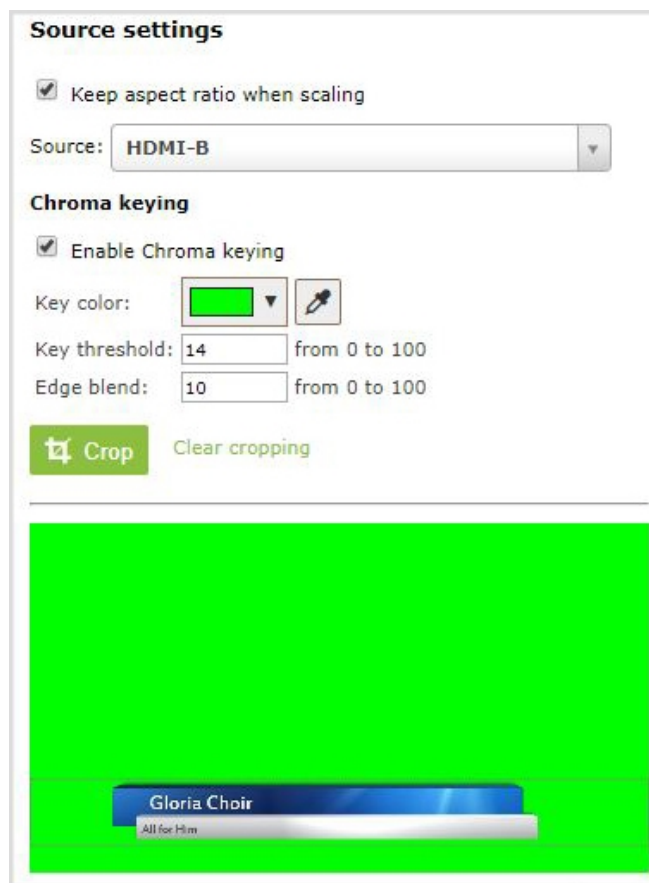
Cropping the Powerpoint computer video source helps optimize the performance of Pearl.

8. In the layout area, position the Powerpoint video source over top the other video source. To optimize performance, avoid scaling the Powerpoint video source if you can.
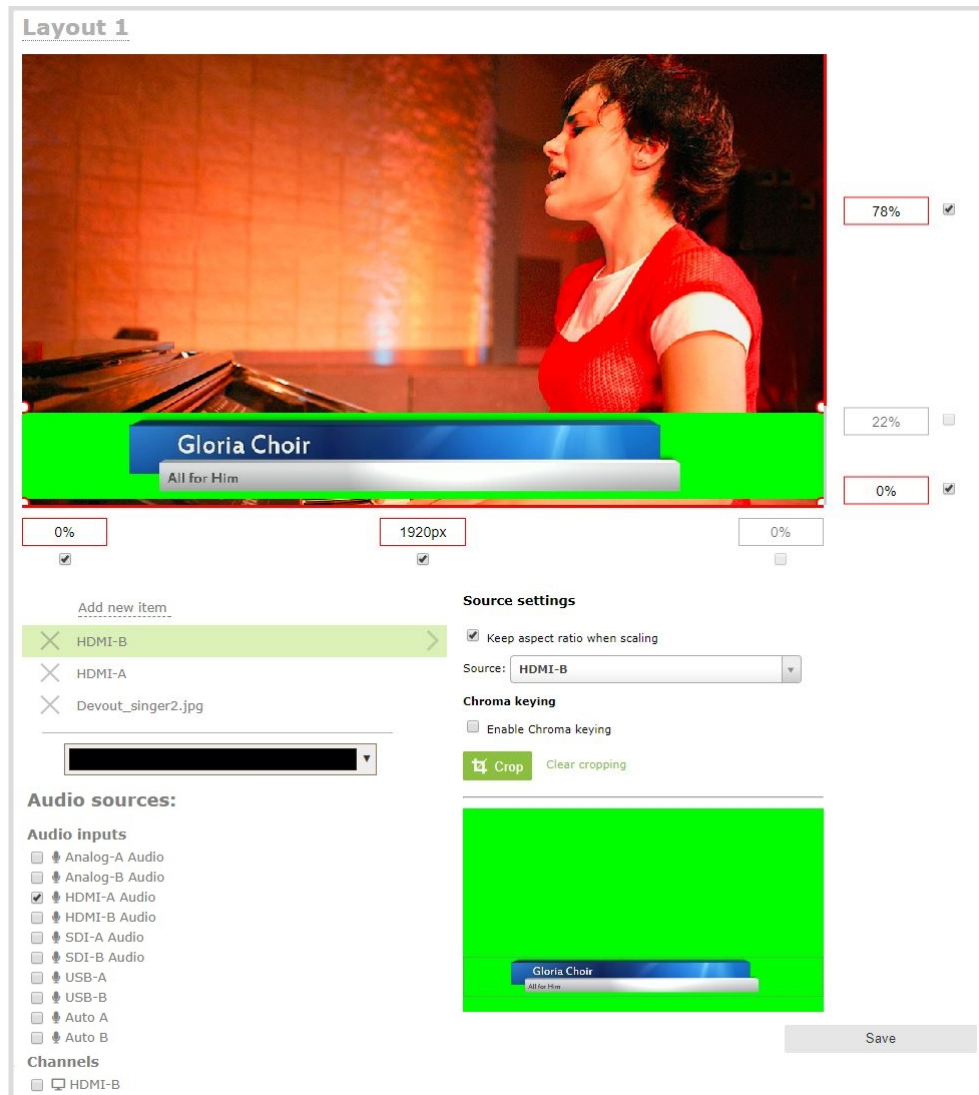
9. With the Powerpoint video source selected, check **Enable Chroma keying** in the custom layout editor. The chroma keying options appear.

10. Click the eye dropper and then click on a color in the thumbnail image to choose the chroma key color.

> The background video image shows through all the colored areas on the chroma key video layer that match the color you select as the chroma key.

11. Adjust the chroma color selection and blend the edges to remove unwanted chroma effects or residual color.

   a. Enter a number in the **Key threshold** field to adjust the color selection. A value of 0 equals the original color you selected. A higher value widens the range of the selected chroma color. A lower number narrows the range of the selected chroma color.

   b. Enter a number in the **Edge blend** field to smooth out and adjust the color around the edges in your image.

12. Click **Save** when you're done.

A note about item positioning and sizing

There are four ways to position and size items in the layout area

1. using the mouse

2. using the keyboard

3. using the manual positioning values with percents

4. using the manual positioning values with pixels

To use the mouse:

Click and drag to move the item. Click and drag the round, red and white handles to resize an image or video source (for text overlays, just use the padding settings). Using this method you can make quick changes that are in increments of approximately 5% of the width or height of your layout area. For more refined movements, press the Ctrl key on your keyboard while dragging the item with the mouse.

To use the keyboard:

Use the arrow keys on the keyboard to move the item up, down, left or right in the layout. Changes are in increments of approximately 5% of the height or width of the layout area. Press the Ctrl key while using the arrow keys to make more refined movements. To change the size of an image or video source, press the Shift key while using the arrow keys (for text overlays, just use the padding settings). Press both Ctrl and Shift for fine-grained size control.

Using percents:

Specify a whole number, followed by a percent sign (e.g. 4%) in any of the manual positioning fields. See Resize and position items using percents or pixels for more information.

Using pixels:

If you need to specify an exact amount in pixels (rather than percent) you can type a pixel value in any of the positioning value squares followed by the characters px (e.g. 56px). You can mix and match pixels and percents changing only the boxes you want to use pixel values. At any time you can switch back to percents by typing a percent. See Resize and position items using percents or pixels for more information.

Add external titler software effects to Pearl

You can use Pearl with titling software that provides chroma key output to add effects like animated lower thirds.

This example shows an HDMI camera connected to the HDMI-A port on Pearl and an effects computer with titler software connected to the HDMI-B port. To the computer, Pearl is treated just like an external display.
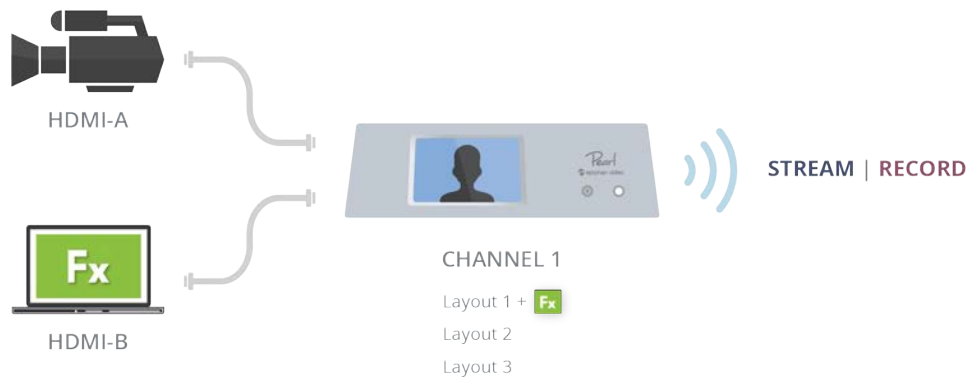
You can connect the effects computer with the titling software to any supported port that is available on Pearl.

To apply the chroma key effect to a single video source using Pearl:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. Follow the steps in Add or edit a custom layout to create a custom channel.

3. From the custom layout editor, click **Add new item** and select **Video Source** from the drop down box.

4. Click **Source** and select the video source that you want showing in the background. For detailed steps, see Add video sources or a channel as a source.

5. In the layout editing area, click and drag to position the video. See the note after this procedure for positioning techniques.

> For best results, select the **Keep aspect ratio when scaling** checkbox from the **Source settings** box.

6. Click **Add new Item** again and add the video source from your effects computer.

7. Click the **Crop** button and crop your effects video source in the pop-up crop editing window. For detailed steps, see Crop a video source. Click **OK** when your done to return to the custom layout editor.
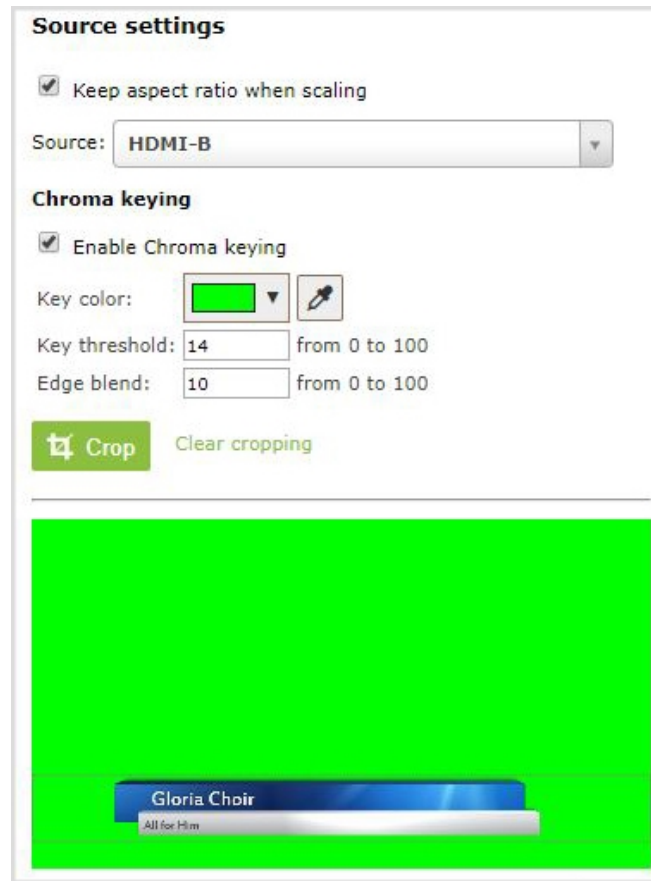
Cropping the effects computer video source helps optimize the performance of Pearl.

8. In the layout area, position the effects video source over top the other video source. To optimize performance, avoid scaling the effects video source if you can.
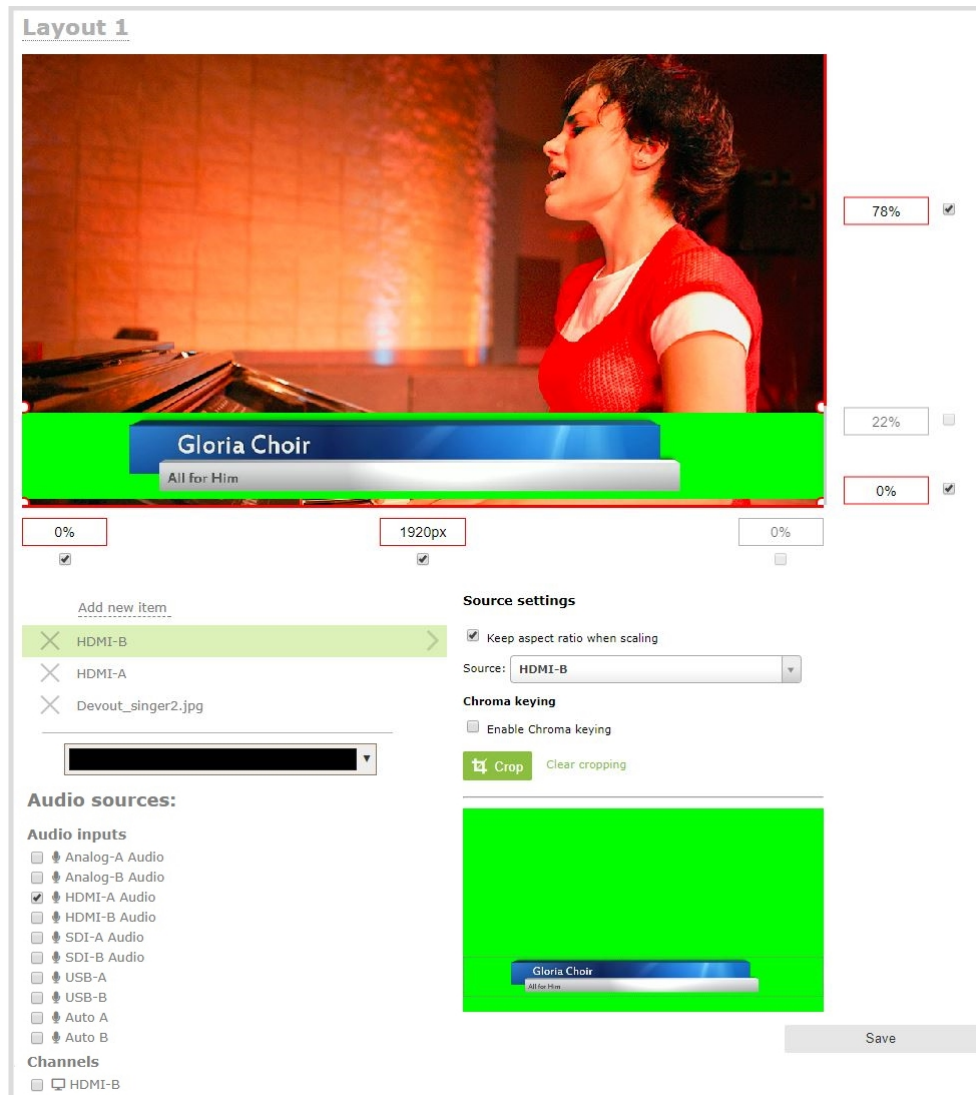
9. With the effects video source selected, check **Enable Chroma keying** in the custom layout editor. The chroma keying options appear.

10. Click the eye dropper and then click on a color in the thumbnail image to choose the chroma key color.

> The background video image shows through all the colored areas on the chroma key video layer that match the color you select as the chroma key.

11. Adjust the chroma color selection and blend the edges to remove unwanted chroma effects or residual color.

   a. Enter a number in the **Key threshold** field to adjust the color selection. A value of 0 equals the original color you selected. A higher value widens the range of the selected chroma color. A lower number narrows the range of the selected chroma color.

   b. Enter a number in the **Edge blend** field to smooth out and adjust the color around the edges in your image.

12. Click **Save** when you're done.

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There are four ways to position and size items in the layout area

1. using the mouse

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3. using the manual positioning values with percents

4. using the manual positioning values with pixels

To use the mouse:

Click and drag to move the item. Click and drag the round, red and white handles to resize an image or video source (for text overlays, just use the padding settings). Using this method you can make quick changes that are in increments of approximately 5% of the width or height of your layout area. For more refined movements, press the Ctrl key on your keyboard while dragging the item with the mouse.

To use the keyboard:

Use the arrow keys on the keyboard to move the item up, down, left or right in the layout. Changes are in increments of approximately 5% of the height or width of the layout area. Press the Ctrl key while using the arrow keys to make more refined movements. To change the size of an image or video source, press the Shift key while using the arrow keys (for text overlays, just use the padding settings). Press both Ctrl and Shift for fine-grained size control.

Using percents:

Specify a whole number, followed by a percent sign (e.g. 4%) in any of the manual positioning fields. See Resize and position items using percents or pixels for more information.

Using pixels:

If you need to specify an exact amount in pixels (rather than percent) you can type a pixel value in any of the positioning value squares followed by the characters px (e.g. 56px). You can mix and match pixels and percents changing only the boxes you want to use pixel values. At any time you can switch back to percents by typing a percent. See Resize and position items using percents or pixels for more information.

Video and audio input sources

The Admin panel automatically discovers all video and audio sources that you connect to the input ports on Pearl and lists them in the Inputs menu of the Admin panel. RTSP sources need to be added manually to display in the Inputs menu (see Connect an RTSP source). When an RTSP source is added, a corresponding audio sources is always added to your custom layout editor even if the RTSP stream actually contains no audio. See Add an audio source to a layout.

You can also connect RTSP sources such as IP cameras and even other Pearl systems to your Pearl over a network using the Admin panel. See Connect an RTSP source.

A source's content can be video, a picture, or music from a connected audio mixer. Content can originate from a camera, computer screen, an imported image in Pearl, or a device that provides a video input signal with audio.

> Video sources are also displayed on the Epiphan Live control interface. See **Monitor video and audio input sources** for more information.

Topics include:

- About connecting video and audio sources
- Tested RTSP-based IP cameras
- Supported web cameras
- Connect an RTSP source
- Connect an SRT stream as an input
- Connect an AV.io video grabber
- Preview a video source using the Admin Panel
- Rename an input port
- Configure a video input source
- Add a custom No Signal image

For instructions to configure an audio input and adjust audio gain or delay, see Audio input ports.

About connecting video and audio sources

You can connect and disconnect video and audio sources while Pearl is powered on and when it is powered off. However, for network video sources connecting via the Ethernet port, the source device sending the stream and Pearl must both be powered on to make the connection.

Connect your video and audio sources to the following input ports on your system:

Table 50 *Cable and port connections*

Source type	Input port
SDI	SDI port
VGA	VGA port
HDMI (HDCP-protected) or DVI	HDMI port
USB video	USB 2.0 port (rear)
Ethernet	RJ-45 port. SRT and RTSP are digital sources you connect to your Pearl via the Ethernet network port.
Audio	Audio input port: TRS or RCA

Changing the video or audio source that is streamed or recorded can cause the recording to stop or the stream frame size to change depending on how your channel is configured. If the frame size changes, viewers may be disconnected and need to re-connect to the stream.

> On portable Pearl or on rackmount models with the audio attenuation pad disengaged, TRS audio source inputs must not exceed 0.707 V RMS. For rackmount models with the audio attenuation pad engaged, audio source inputs may be up to 12.3 V RMS.

> Application of amplified speaker signals to the audio line inputs exceeds the recommended ratings and may permanently damage the device.

Each video input on the back of the system is identified by its row (A or B) and input type (PearlVideoInputs). For example, the SDI input from row A is labeled SDI-A.

When a video source is connected, the system automatically detects and adjusts the image capture settings every 60 seconds. The interval is configurable. Generally no further configuration is needed; however you can fine tune some settings using the Admin panel.

If no video source is connected to an input port or no stream is being transmitted from a source over the Ethernet connection, "No Signal" displays wherever that input is used in your channels and layouts. You can change that to display the default "No Signal" image for Pearl or create your own custom no signal image. See Add a custom No Signal image .

The Admin panel automatically discovers all video and audio sources that you connect to the input ports on Pearl and lists them in the Inputs menu of the Admin panel. Sources coming from the Ethernet network such

as SRT and RTSP need to be added manually to appear in the Inputs menu. When a network source is added as an input, a corresponding audio source is automatically added to the list of audio sources for your channels, even if there is no audio. See Add an audio source to a layout.

You can also connect RTSP sources such as IP cameras and even other Pearl systems to your Pearl over the network using the Admin panel.
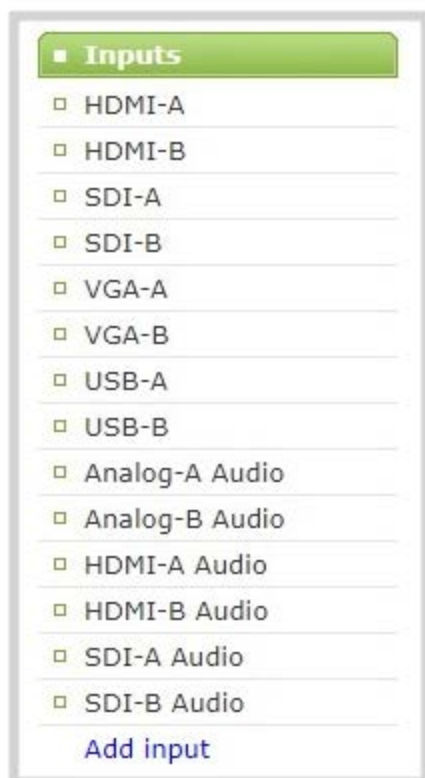
Audio mixers and other line-level audio devices can be connected to the TRS audio input ports on Pearl. Audio from sources connected to the HDMI, SDI, and USB video ports is also supported.

Tested RTSP-based IP cameras

Pearl is compatible with all Ethernet-based IP cameras and other RTSP sources. The cameras listed in the following table represent a sample of common third-party cameras that have been tested to work with Pearl. Information such as URL syntax, default credentials and audio streaming capability specific to each camera is included.

The URL syntax refers to the additional piece of text that needs to be included in the source URL to connect your IP camera to Pearl, see Connect an RTSP source to learn how to connect an RTSP source like an IP camera using the Admin panel.

For example, to connect a Sony SRG300SE camera with an IP address of "192.168.0.160", your source URL needs to be entered as:

"rtsp://192.168.0.160**/video1**"

Or, if using a Q-See QCN8029Z camera, your source URL needs to be entered as:

"rtsp://192.168.0.160**/**"

Table 51 *List of tested IP cameras*

Brand	Model	Image	URL syntax	Audio?	Default username and password
Q-See	QCN8029Z		/	No	admin admin
Sony	SRG300SE		/video1	Yes	admin admin
Panasonic	AW-HE40HPK﹡		/MediaInput/h264/stream_1 (To add a second URL, use: "/MediaInput/h264/stream_2")	Yes	admin 12345
Axis	P1428-E		/axis-media/media.amp	No	root root

Brand	Model	Image	URL syntax	Audio?	Default username and password
Axis	M1034-W		/axis-media/media.amp	Yes	root admin

*During testing, the Panasonic AW-HE40 did not consistently synchronize its time with Pearl.

Supported web cameras

Pearl supports most webcams and USB audio sources, such as USB microphones. The following list of web cameras have been tested for compatibility with Pearl. If your web camera doesn't appear in the list, that just means your model hasn't been tested. It's likely that it will work without any issues.

Table 52 *List of tested Web cameras*

- Logitech HD Pro Webcam C920 (Max video mode: 1920x1080@30)
- Logitech C925e (Max video mode: 1920x1080@30)
- Microsoft LifeCam Studio (Max video mode: 1280x720@30)
- Microsoft LifeCam HD-3000 (Max video mode: 1280x720@30)
- IPEVO Ziggi-HD Plus

> **STOP** For the Ziggi-HD Plus web camera, enable the power line frequency setting in the web camera before connecting the camera to Pearl.

When you **Configure a video input source**, the **Default video mode** is not necessarily achievable for that web camera. For instance, a camera might have a default mode of 1080p but have a **Maximum video mode** of 720p. If no settings are changed, the camera simply outputs video at 720p in this case.

Connect an RTSP source

You can connect RTSP sources such as IP cameras and other Pearl systems to your Pearl over a network using the Admin panel. For a list of tested cameras and their URL syntax, see Tested RTSP-based IP cameras.

RTSP video encoding is supported with H.264 video codec and MP3 or AAC audio formats. We recommend using the hardware acceleration option for improved performance (enabled by default).

Important considerations
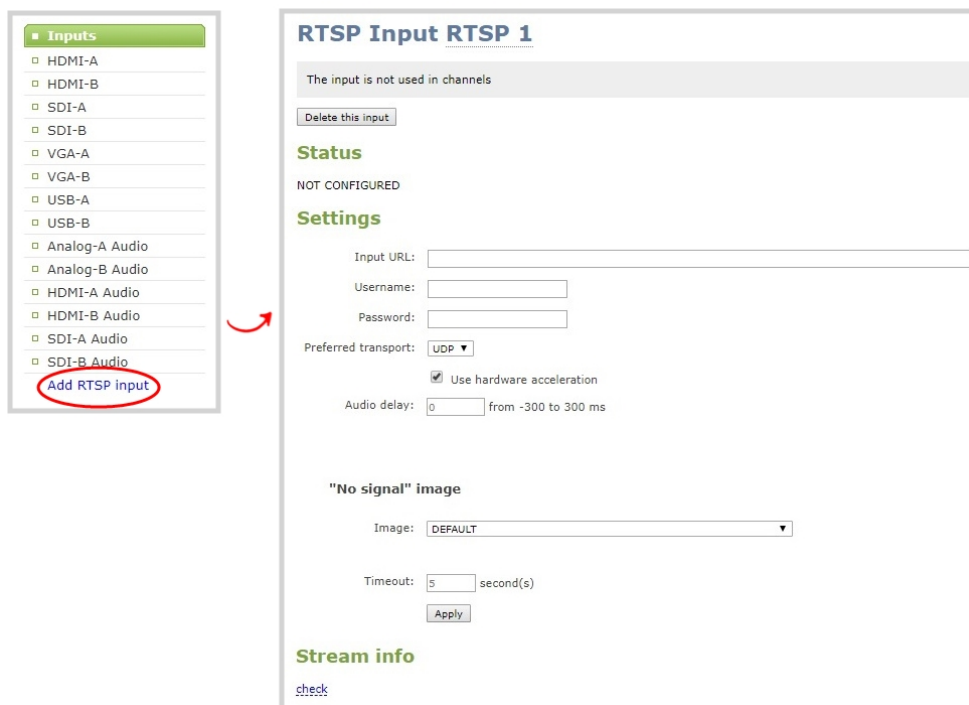
- If an RTSP source is connected but unused in any channel, Pearl decodes only key frames to preserve CPU resources.

- To synchronize timestamps between your RTSP source and your Pearl, the same time synchronization server should be used for both devices. We recommend that you configure an NTP server on your Pearl and use Pearl as a time synchronization server for your RTSP source. See Configure a time server.

> The timestamps of an RTSP source and Pearl tend to gradually go out of sync. If there's a **2500 –3000 ms** difference between the timestamp of your RTSP source and Pearl, a "no signal" image displays and your RTSP source won't stream audio. Re-connect your RTSP source to reset any time synchronization issues.

To connect an RTSP source to Pearl:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Inputs menu, click **Add RTSP input**. The RTSP input page opens.

3. Enter the **Input URL**, **Username** and **Password** for your RTSP source and select either **UDP** or **TCP** as the Preferred transport. If you're using another Pearl as an RTSP source, see Share a live broadcast

stream (HTTP, HTTPS or RTSP).

4. (Optional) Select **Use hardware acceleration** for improved performance (default).

5. (Optional) Rename the RTSP source, see Rename an input port.

6. (Optional) Configure a custom "No signal" image, see Add a custom No Signal image .

7. Click **Apply** to save your settings and connect your RTSP source.

After your RTSP source is connected, you can view basic video and audio signal information and packet loss statistics for the source under the **Status** header at the top of the page. Any warnings or errors associated with your RTSP stream are also displayed on this page.

Alternatively, you can view stream connection information when you click **check** at the bottom of the page.

Connect an SRT stream as an input

Secure Reliable Transport (SRT) is a low-latency protocol used to stream over the Internet to SRT destinations (decoders), such as CDNs and other SRT decoders such as a Pearl.

You can configure Pearl as an SRT destination (decoder) and ingest SRT streams as video inputs that you can add to custom layouts for switching, recording, and streaming.
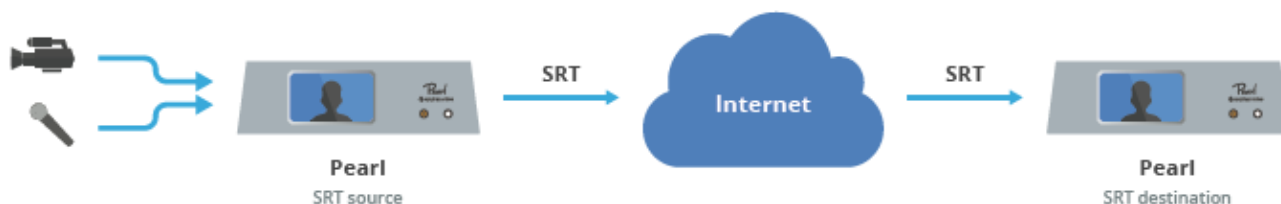
Up to two of the video inputs configured for Pearl can come from SRT sources.
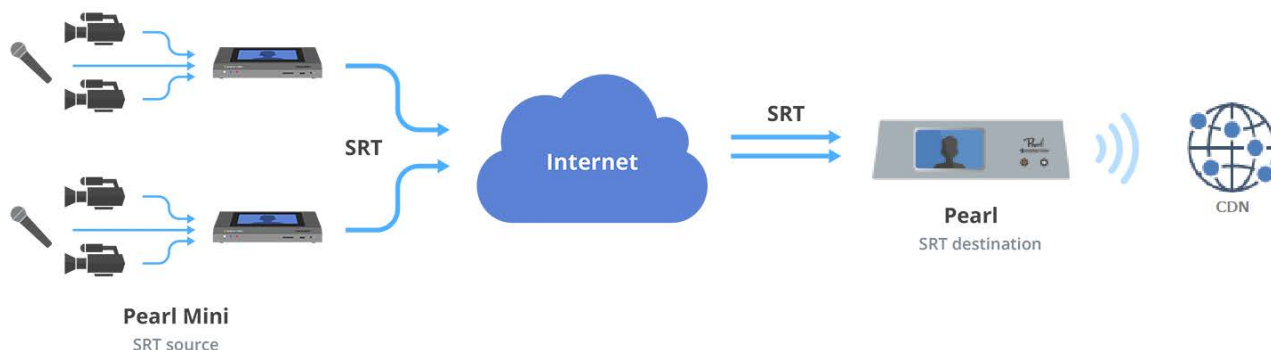
When adding an SRT input on Pearl, be sure to select the correct SRT mode. For example, if the SRT source stream is using rendezvous mode, ensure you set the SRT input on Pearl to rendezvous mode. If the SRT source stream is using caller mode, then set the SRT input on Pearl to listener mode. For more information about SRT modes, see About streaming using SRT.

What's needed for this setup

- The IP address and SRT port of the SRT source (encoder) is needed for caller mode and rendezvous mode.

- For rendezvous mode, you must configure the SRT input on Pearl to use the same port value as the SRT source. For an example SRT stream using rendezvous mode, see Set up an SRT stream using rendezvous mode.

- For caller/listener modes, you must know which mode the SRT source uses and configure the SRT input on Pearl to use the corresponding mode. For example, if the SRT source is in caller mode, then the input

must be in listener mode. For an example SRT stream using caller/listener modes, see Set up an SRT stream using caller and listener modes.

- If AES encryption and a passphrase is required. Consult your IT administrator for this information. Pearl supports 128 bits, 192 bits, and 256 bits AES encryption. Special characters are not supported in the passphrase.

> If AES encryption and a passphrase is configured, ensure this information is provided to the SRT source. The SRT stream from the source must use the same AES and passphrase values, see Set AES encryption and a passphrase for SRT.
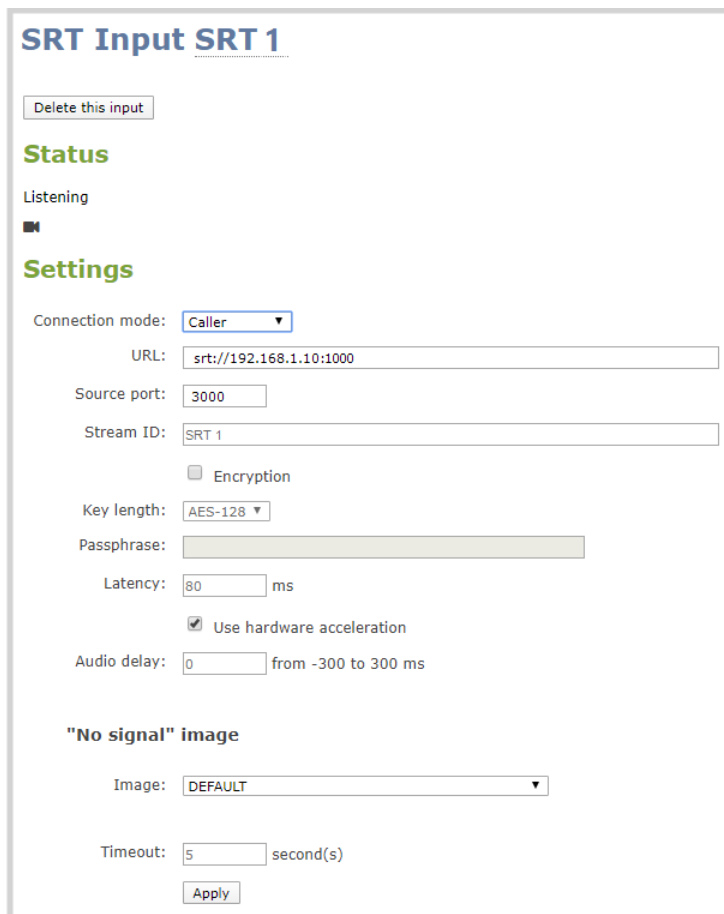
To add an SRT stream as an input using the Admin panel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Inputs menu, select **Add input** and select **Add SRT input**. The SRT input configuration page opens.
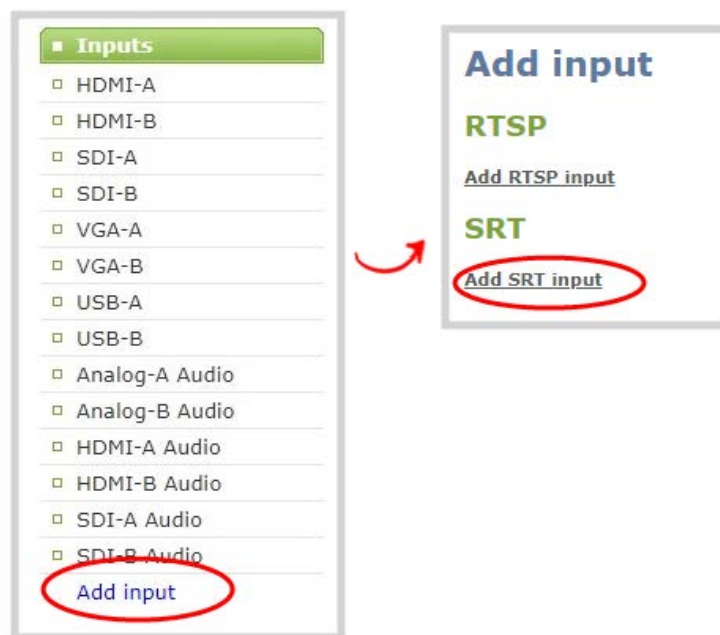
3. In the **Connection mode** field, select the SRT mode to use for this input.

   a. If **Caller** mode is selected, do the following:

      i. Enter the **URL** of the SRT source (encoder) using the format *srt://<encoder-ip-address>:<port>*, where the *<encoder-ip-address>* and *<port>* could be another Pearl device sending an SRT stream.

      ii. (Optional) In the **Source port** field, enter the port number for this device to use for SRT traffic.

  b. If **Listener** mode is selected, enter the **Port** number for this device to use for SRT traffic. See Network ports used by Pearl to determine available ports.

  c. If **Rendezvous** mode is selected, enter the **URL** of the SRT source (encoder) using the format *srt://<encoder-ip-address>:<port>*, where the *<encoder-ip-address>* and *<port>* values are provided by the SRT encoder device such as a second Pearl.

4. (Optional) Check Encryption and choose the AES key length if the SRT destination requires AES encryption. These settings must match the encryption settings of the destination device.

5. (Optional) If a security **Passphrase** is required along with AES encryption, you can enter that here.

6. Click **Apply**.

We recommend using the default latency value for an initial test stream. After you perform a test stream, you can determine the Quality of Service (QoS) and calculate the latency requirements. To set the SRT stream latency, see Adjust latency and view the SRT stream status.

Connect an AV.io video grabber

You can connect an Epiphan AV.io frame grabber to a USB input port just the same as you would connect a web camera. Pearl supports connection of a single UVC (or UAC) device at a time using one of the USB ports.

Pearl treats the video source from the frame grabber just like any other video source.

Use AV.io frame grabbers to connect extra HDMI, DVI, VGA, or SDI sources.

You can set up and operate frame grabbers using the same Configure a video input source

- **AV.io HD**: https://www.epiphan.com/userguides/avio-hd/Content/Home-AVioHD.htm
- **AV.io SDI**: https://www.epiphan.com/userguides/avio-sdi/Content/Home-AVioSDI.htm

Preview a video source using the Admin Panel

You can preview the images captured from your video sources in the Admin panel. You can also preview your sources using the Epiphan Live control interface, see Monitor video and audio input sources.

To preview an input source using the Admin panel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. Ensure a source is connected to the input port.

3. From the Inputs menu, click the **source name**. The configuration page for the source opens. A preview appears at the bottom of the page.
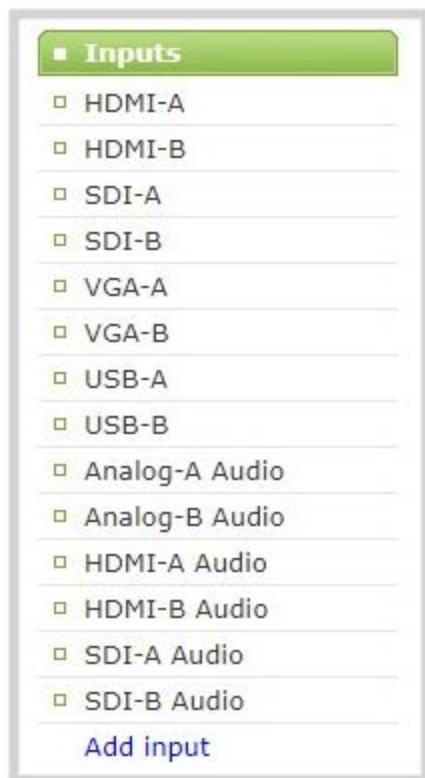
Rename an input port

The input port names are used when adding your video and audio sources to channels. A channel that has only one source is automatically assigned the same name as the input source by default. If you change the name of the input source, the channel name will update automatically to match.

Sometimes it's helpful to configure the input port name to match the data it's capturing so that it's clear what the channel is capturing. Alternately you can change the channel's name, see Rename a channel.

You can include certain international characters for video and audio input port names. Pearl supports common character sets for Western and Central European languages, Nordic languages, and Russian. The name should not include special characters, slashes, or spaces. For a complete list, see International character support.

To change an input port name:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Inputs menu, click the **source name**. The configuration page for the source opens.
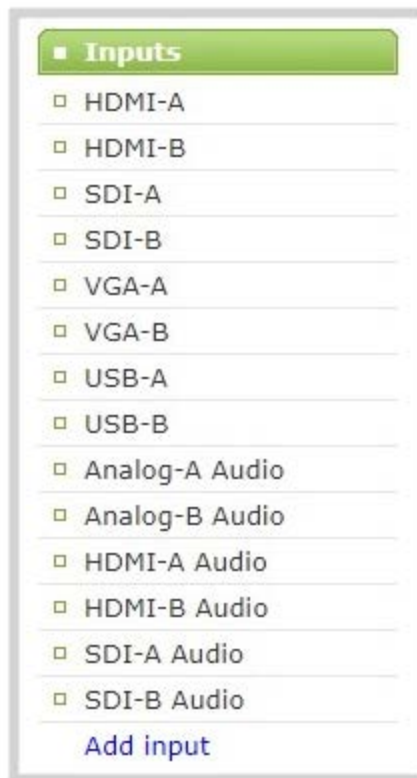
3. Click on the input port's name that appears at the top of the page. The text turns red.

4. Enter the new name using alphanumeric characters. We recommend using underscores to separate words rather than using spaces.

5. Press **Enter** using your keyboard to save the new name.

Configure a video input source

The captured video source doesn't usually need configuration, but you can change some of the settings using Admin panel.

To open the configuration page for an input source:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. Ensure a source is connected to the input port, see About connecting video and audio sources.

3. From the Inputs menu, click the **source name**. The configuration page for the source opens.
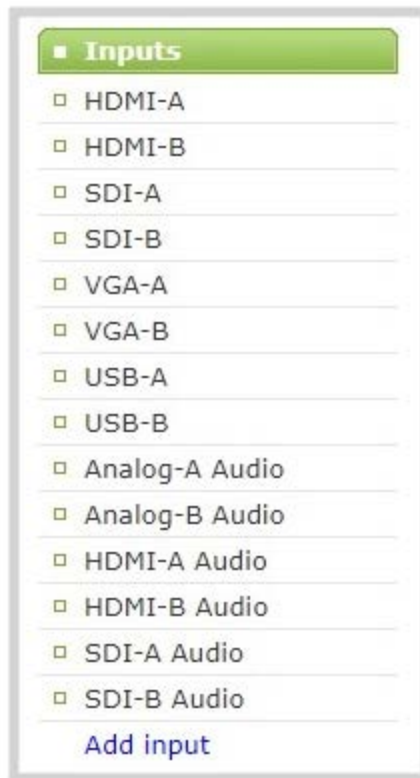
For details to configure network sources, see the following topics:

- Connect an RTSP source

- Connect an SRT stream as an input

DVI and HDMI signals

The following options are available for DVI and HDMI signals via the HDMI port:

Value	Description
Enable deinterlacing	Enable this feature to convert an interlaced source signal to a non-interlaced signal.
Image	This menu allows you to choose a custom no-signal image for the channel. The drop-down list gives you the option to choose the default image or any image you have uploaded through the Add a custom No Signal image
Timeout	The timeout represents the number of seconds after losing the signal that the no-signal is displayed. You may change this number to adjust how soon you wish the no-signal image to appear after the signal disappears.

VGA signals (coming in via DVI port)

The following values are configurable for VGA signals coming in via a VGA/DVI port.

Value	Description
Autoadjustments interval (sec)	When a source is setup, the system automatically detects and adjusts the image capture settings at start up and continues to adjust every 60 seconds during operation. To change the number of seconds between update, enter a value, or 0 to disable the feature, otherwise the default of 60 seconds is set.
Vertical shift	When an image is not aligned in the window, use this feature to move an image up or down on the screen. The values range from 20 (moves the image up) to –20 (moves the image down).
Horizontal shift	When an image is not aligned in the window, use this feature to move an image left or right on the screen. The values range from -999 (moves the image to the left) to 999 (moves the image to the right).
Phase	Specifies phase adjustments for VGA signals. Generally not used unless value is provided by Epiphan support.

Value	Description
PLL adjustment	Changing the value adjusts the horizontal resolution of the image. Adjust the value using small increments until the image is sharper. The value ranges from 0-999 to 999.
Offset	The Offset and Gain parameters function as contrast control for an image. The Offset controls the darker parts of the image and the gain controls the bright parts of the image. Adjust both values to optimize image quality. Adjust the values using small increments until the image is sharper. If you set Offset to a high value, set a high value for the gain to balance the two.
Gain	The Gain and Offset parameters function as contrast control for an image. The Gain controls the bright parts of the image and Offset controls the darker parts of the image. Adjust both values to optimize image quality. Adjust the values using small increments until the image is sharper. If you set Offset to a high value, set a high value for the Gain to balance the two.
Aspect Ratio	Sets the aspect ratio of the captured image. The default is 4:3. Set the value to Wide mode when capturing images that have a wide aspect ratio. Using the incorrect setting causes the image to be distorted or stretched.
HSync threshold	Adjust horizontal sync detection.
VSync threshold	Adjust vertical sync detection.
Rotate	*Temporarily Excluded 4.3.0*This feature is useful when a source captures video that is rotated 90º or is displayed upside down. Choose one of the following values to change the video orientation while streaming: • No rotation • 90º clockwise • 90º counter clockwise • 180º Note that rotating a source can result in "No Signal" if the rotated image is outside the bounds of the display.
Enable deinterlacing	Enable this feature to convert an interlaced source signal to a non-interlaced signal.
Image	This menu allows you to choose a custom no-signal image for the channel. The drop-down list gives you the option to choose the default image or any image you have uploaded through the Add a custom No Signal image process.

Value	Description
Timeout	The timeout represents the number of seconds after losing the signal that the no-signal is displayed. You may change this number to adjust how soon you wish the no-signal image to appear after the signal disappears.

Value	Description
Enable deinterlacing	Enable this feature to convert an interlaced source signal to a non-interlaced signal.
Image	This menu allows you to choose a custom no-signal image for the channel. The drop-down list gives you the option to choose the default image or any image you have uploaded through the Add a custom No Signal image
Timeout	The timeout represents the number of seconds after losing the signal that the no-signal is displayed. You may change this number to adjust how soon you wish the no-signal image to appear after the signal disappears.

USB signals

The following options are all potentially available for signals via the USB port. However, some apply only to certain types or brands of camera, and not all options are available or needed for all cameras.

Value	Description
Capture mode	This feature is useful for simultaneously dictating the resolution and fps at which the camera is captured. The drop down list of available resolutions and frame rates changes depending on the attributes of the connected device.
Brightness	The brightness of the video can be adjusted by entering a numerical value from 0 to 100. Estimate values and view the result in the preview area until desired result

Value	Description
	is achieved.
Contrast	The contrast of the video can be adjusted by entering a numerical value from 0 to 100. Estimate values and view the result in the preview area until desired result is achieved.
Vertical shift	The vertical positioning of the video can be adjusted by entering a numerical value from -64 to 64. Estimate values and view the result in the preview area until desired result is achieved.
Horizontal shift	The horizontal positioning of the video can be adjusted by entering a numerical value from -64 to 64. Estimate values and view the result in the preview area until desired result is achieved.
Saturation	The saturation of the video can be adjusted by entering a numerical value from 0 to 100. Estimate values and view the result in the preview area until desired result is achieved.
Sharpness	The sharpness of the video can be adjusted by entering a numerical value from 0 to 100. Estimate values and view the result in the preview area until desired result is achieved.
Powerline frequency	The powerline frequency of the video can be adjusted by selecting the desired output from a drop-down list of frequencies available to your source.
Image	This menu allows you to choose a custom no-signal image for the channel. The drop-down list gives you the option to choose the default image or any image you have uploaded through the Add a custom No Signal image
Timeout	The timeout represents the number of seconds after losing the signal that the no-signal is displayed. You may change this number to adjust how soon you wish the no-signal image to appear after the signal disappears.
Audio input gain	You can add audio gain to your source from this page by selecting the % gain from the drop-down list. Estimate values and check the result in the preview area until desired result is achieved.
Audio delay	If your audio is not synchronized with your video, it can be adjusted from -300 to 300 ms. Estimate values and check the result in the preview area until desired result is achieved.

Add a custom No Signal image

By default the system displays a No Signal image when there is no video signal coming in to any of the video input ports on Pearl. You can customize this image to display a different message to your viewers. For example if a viewer logs in early, or if you are experiencing delays you could indicate the start time (or expected resolution time) using the no signal image.

Before you can specify a custom No Signal image for an input port on Pearl, you must upload it, see Upload or remove an image using the Media page.

To set the no signal image for an input port:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Inputs menu, click the **source name**. The configuration page for the source opens.

3. In the **"No signal" image** section, select an image from the **Image** drop down list.
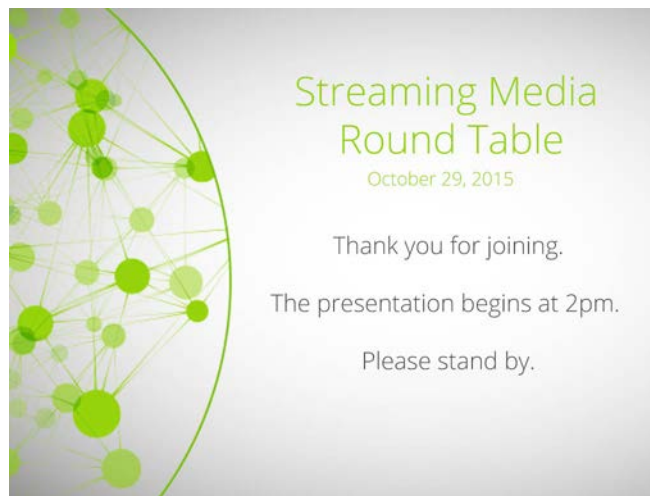
4. In the Timeout field, enter the number of seconds before the No Signal image is displayed. If no manual value is entered, the default time to display is 5 seconds.

5. Click **Apply**.

6. Test that the No Signal image is correctly applied by disconnecting your source and previewing the channel(s) containing said source, see Preview channel.

PART 3: Stream

Streaming is a powerful way to deliver live video content to your viewers. Stream to viewers, servers, and media players. Using the Admin panel, you can configure streaming in multiple formats to multiple destinations and devices, such as web browsers, media players, set-top boxes, Smart TVs, and Content Distribution Networks.

Pearl is flexible, easy to setup, and supports all the standard codecs, as well as the most common media players. Streaming options include: unicast, multicast, SRT, HLS, MPEG-DASH, RTMP, SAP, UPnP, and more.

Topics include:

- What is streaming?
- Viewing a channel's live broadcast stream
- Directly share channel stream URLs with viewers
- Suggested stream settings
- Streaming a channel direct to viewers
- Streaming to servers, CDNs, and other devices
- Streaming to a media player or smart TV

For instructions on how to use Pearl's touch screen to start/stop scheduled webcasts and authenticate with a CMS to create unscheduled ad hoc events, see CMS event controls using the touch screen.

For information about streaming to Content Management Systems (CMSs) like Kaltura and Panopto, see CMS recording and webcasting using the Admin panel.

What is streaming?

After you connect your camera, audio source, and set up a channel with your switched program, it's time to stream your content live and share that with your viewers.

Pearl provides many different streaming options and supports a variety of streaming protocols. Probably the easiest way to stream a single Pearl channel directly to viewers on the same local network is to share the channel's live broadcast URL. Various stream types are available so users can watch using their favorite devices, including: HTTP/HTTPS, HTTP FLASH (.FLV), MPEG-TS (HTTP), and RTSP.

At the same time, Pearl can stream to a multicast server or CDN and reach viewers across the globe. Pearl can even stream to smart TVs in overflow rooms using SAP or UPnP. The streaming method you choose depends on factors like the number of viewers of your stream, are you broadcasting live over a local TCP-based network or streaming to a CDN over the Internet, how much bandwidth do you have available, and is live streaming security a concern?

Pearl can stream to a CDN or media server using any of the following streaming protocols:

- SRT (push)
- HLS (push)
- MPEG-DASH (push)
- RTMP/RTMPS (push)
- RTSP

Each Pearl channel supports multiple streams. That means you can stream a channel to multiple destinations using different streaming protocols. Unicast and multicast streams are also supported.

Pearl makes it easy to start and stop streaming using One touch control from the touch screen, see Specify channels for One Touch streaming. You can also control streaming from the Admin panel or using Epiphan Live from a mobile device or tablet, see Control streaming and recording.

In addition to streaming out from Pearl, the following streaming formats are supported as input sources that Pearl can ingest:

- SRT
- RTSP announce
- RTMP push

Pearl also comes with APIs so you can setup third party tools to control streaming, see Controlling Pearl using HTTP/HTTPS commands and Controlling Pearl using RS-232 / serial port.

Additional considerations

- Are you streaming live video or recorded video?

- Do you need to stream the content to one client (peer-to-peer) or deliver a single stream to multiple clients (multicast)?

- Do you need to provide web-based streaming that multiple clients can access using a Content Distribution Network (CDN), such as YouTube or Facebook Live?

- Do you need to encrypt your live stream for higher security?

- Streaming to a Content Management System (CMS) like Kaltura or Panopto? See CMS recording and webcasting using the Admin panel

To start/stop scheduled streams and authenticate with a CMS to create unscheduled ad hoc events using the touch screen, see CMS event controls using the touch screen.

Streaming to a CDN or multicast streaming

A Content Delivery Network (CDN) relies on geo-diverse CDN servers to receive and disperse web content to the CDN server closest to the user. The closer the server is to the user, the faster the content is delivered. Streaming your content through a CDN allows you to stream any time, anywhere, regardless of the viewing device and you don't have to worry about maintaining your own video streaming servers on site.
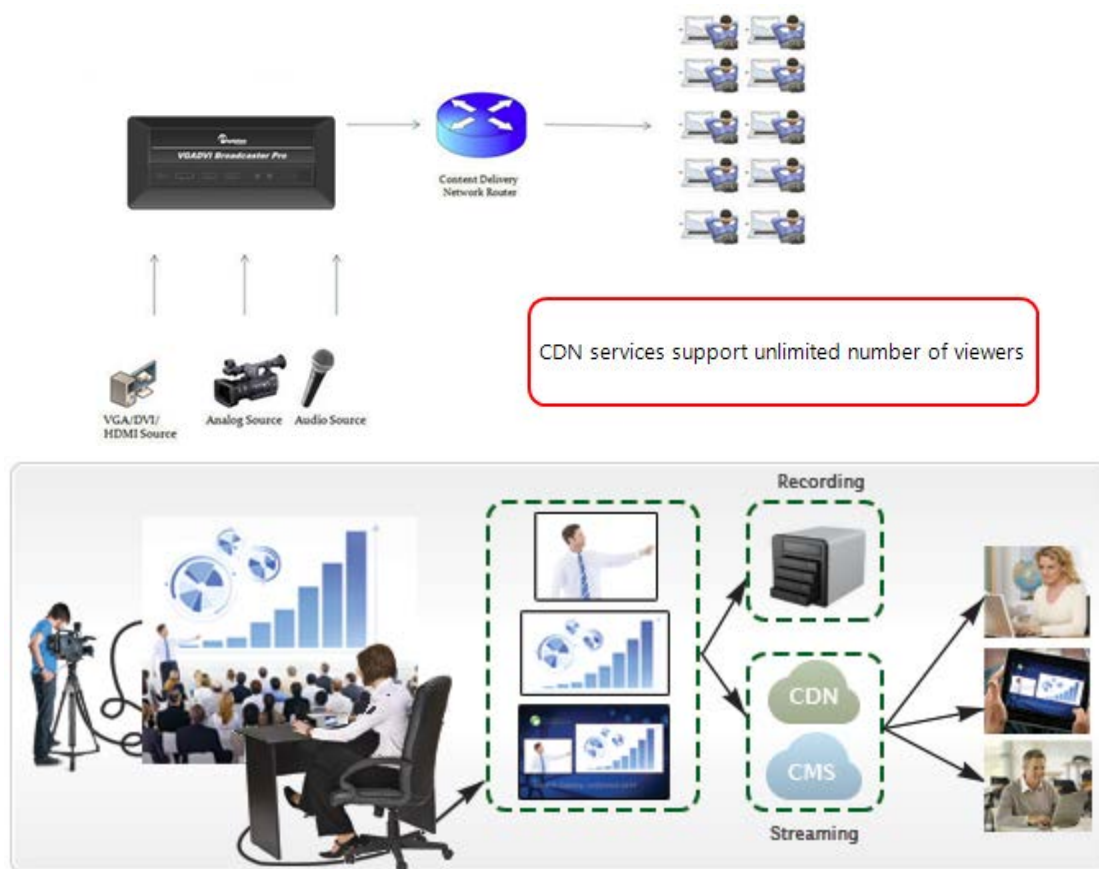
Streaming content to a multicast IP address lets you directly share the stream with multiple viewers on the same LAN. All viewers receive the same stream at the same time. Similar to turning on a radio station where all listeners hear the same music at the same time. Multicasting is useful for training sessions when there is a specific timeframe for the audience to view the content live.

With Pearl, you can publish to several different CDNs or other streaming destinations simultaneously. Streaming a channel to CDNs and multicast streaming is available only when the H.264 codec is configured as the channel encoding, see Configure video encoding.

Publishing Options	Use this option to...
Content Distribution Network (CDN)	Stream web content to many viewers on different Content Delivery Networks simultaneously to any geographical location. Using a CDN to host your broadcast is highly scalable and saves you from having to purchase and maintain your own servers to host and deliver video content. Using one or more CDNs to stream live content allows you to reach a large geographically diverse audience and because CDNs perform format conversion, the stream is platform independent. Streaming protocols supported include: SRT (push), HLS (push), MPEG-DASH (push), RTMP/RTMPS.
Multicast Streaming	This delivery method relies on network equipment that supports multicasting and is usually used on high bandwidth corporate LANs and not on Internet-based architectures. Multicasting is what's typically used to stream video and audio to an IP TV or set-top box playlist. If you're streaming over a Gigabit Ethernet network to a 10/100 Mbps set-top box that is dropping frames, you can limit the stream's bandwidth, see Set up traffic shaping. Multicast streaming protocols supported include: MPEG-TS USP, MPEG-TS RTP/UDP, and RTP/UDP. For more information about using multicasting for streaming your content, see Multicast streaming

To stream video outside of your LAN, use a CDN or configure port forwarding on your router. Consult your Network Administrator to set up port forwarding.

You can even use an XML profile to setup streaming if the CDN supports that. By default, no streaming is configured for the channels configured on Pearl.

In addition to streaming, Pearl can ingest streams as input sources. The following ingest streams formats are supported:

- SRT (push)

- RTSP announce

- RTMP (push)

Publishing to a CDN

When you publish a stream to a CDN provider, make sure you use a streaming protocol that the CDN supports. Contact your CDN for a list of supported streaming protocols and audio codecs they support.

To publish content to a CDN provider, ensure you have:

- the URL (or path) to the mount point or an XML configuration file (provided by the CDN provider)

- the supported transport protocols, audio codecs, and any other settings like key frame rates and bit rates recommended by the CDN provider

- select the H.264 codec from the channel's Encoding page

You can control when streaming to a CDN is enabled by using the Admin panel or the touch screen. See Start and stop streaming to a CDN.

You can also test how your content is streamed by sending your content to Epiphan's CDN. For a list of Epiphan's preferred CDN providers, see: https://www.epiphan.com/partners/cdn-partners/.

About streaming using SRT

Secure Reliable Transport (SRT) is an open-source streaming protocol that offers quality, low-latency streaming to CDNs and other SRT enabled decoders across unreliable Internet connections using User Datagram Protocol (UDP) transport and additional error checking. Low-latency SRT is particularly good for real-time, two-way communications between a remote guest and a local on-site host.

You can configure Pearl as an SRT source encoder and stream video using SRT. You can also configure Pearl as an SRT decoder and ingest SRT streams as video inputs.
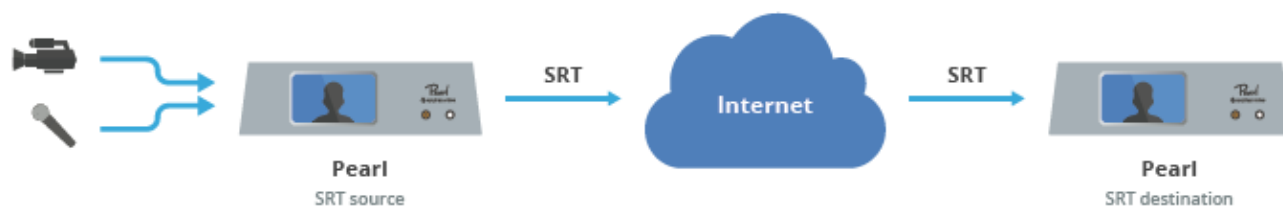
Up to two of the video inputs configured for Pearl can come from SRT sources and Pearl can stream up to four SRT streams.
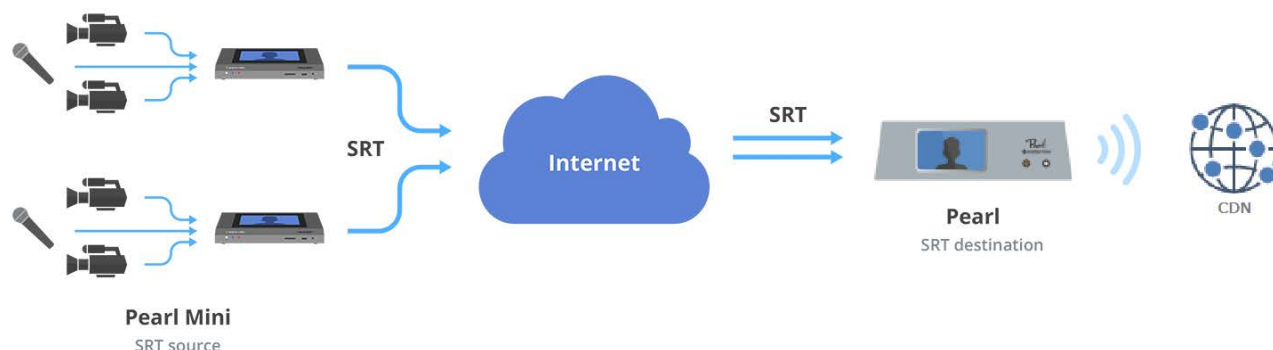
Before content is streamed between the SRT source and destination, a communication link must be established between them for SRT control and recovery packets. Any firewalls blocking the path must be traversed.

SRT streaming modes and firewalls

Streaming through firewalls can be a challenge. With SRT you get easy firewall traversal with little to no IT involvement.

SRT offers three modes to simplify the process: Rendezvous, Caller, and Listener.

- Rendezvous mode is the easiest to setup and usually doesn't need any intervention from your IT administrator for the SRT stream from the source to traverse the firewall to the destination. The SRT source and destination devices must use the same SRT port value, see Set up an SRT stream using rendezvous mode.

- Caller and Listener modes work together to establish the SRT connection between your source and destination devices when traversing the firewall is difficult. In this case, your IT network administrator must configure the network to allow traffic that comes in on the port configured for SRT streaming and forward the traffic to the destination device, see Set up an SRT stream using caller and listener modes.

> The device you set as the Caller (or Listener) is arbitrary, as long as one device is a Listener and the other is a Caller.

SRT latency controls and AES stream encryption

SRT includes latency controls to adjust for poor network quality while maintaining an acceptable amount of delay. Pearl provides statistics to determine the amount of packet loss. Using the Admin panel, you can increase or decrease the amount of latency applied to the stream to help mitigate any Quality of Service (QoS)

issues. The default latency values are 125 ms for an SRT stream and 80 ms for an SRT input, see Adjust latency and view the SRT stream status.

For greater security, you can set the SRT stream to 128 bits, 192 bits, or 256 bits AES encryption. Encryption settings must be set to the same values on both the SRT encoder sending the stream and the SRT decoder that's receiving the stream, see Set AES encryption and a passphrase for SRT.

Secure streaming

Secure streaming is a great option for confidential content, such as corporate meetings or internal employee training. There are several ways to secure your live stream with Pearl.

- Stream to a CDN or media server over the Internet using Secure Reliable Transport (SRT).
- Stream to a CDN or media server over the Internet using Real Time Messaging Protocol Secure (RTMPS).
- Stream HLS (push) over local HTTPS networks.
- Stream MPEG-DASH (push) over local HTTPS networks.

SRT streaming includes additional AES encryption settings for even more security. You can set the SRT stream for 128 bits, 192 bits, or 256 bits AES encryption. Encryption settings must be set to the same values on both the SRT encoder sending the stream and the SRT decoder that's receiving the stream, see Set AES encryption and a passphrase for SRT.

RTMPS wraps the RTMP stream in TLS/SSL packets before it's transported over a TCP connection between the network server and Pearl (i.e. the client). To set up secure streaming using RTMPS, see Set up an RTMP or RTMPS (push) stream

Suggested stream settings

When you're setting up your live stream, you would typically consult your CDN or publishing destination for their recommended settings to use.

Stream setup can be a matter of balancing quality and system resources. When choosing your stream settings, it's important to consider the type of content you're streaming and the streaming protocol you've chosen.

For streaming fast moving video, a higher bitrate and frame rate delivers a better image. If you're streaming a slide presentation, you can save bandwidth and system processing by lowering the bitrate and frame rate without any noticeable image degradation.

The following table provides suggested settings to maximize your video quality while minimizing system resource usage when streaming video content from your Pearl.

Table 53 *Suggested stream settings for video*

Option	Setting
Codec	H.264
Video encoding preset	Hardware accelerated
Video encoding profile	High
Key frame interval	2 sec[1]
Limit frame rate	30[1]
Bitrate	4000 kbps for HD 6000 kbps for Full HD 4000 kbps for HD; 6000 kbps for Full HD (Mac)
Audio format	AAC 22 KHz[1]

[1]For HLS streaming, the key frame interval should be set to 2s and the frame rate should be set to 60 fps (or 59.94) for live NTSC content.

The following table provides suggested settings to maximize your stream quality while minimizing system resource usage when streaming a slide presentation from a PC, Mac, or tablet.

Table 54 Suggested stream settings for slides

Option	Setting
Codec	H.264
Video encoding preset	Hardware accelerated
Video encoding profile	High
Key frame interval	2 sec
Limit frame rate	30
Bitrate	1000 kbps for HD; 2000 kbps for Full HD
Audio format	AAC 44 KHz

Streaming a channel direct to viewers

Pearl is ready to stream content directly to viewers on the local network using the default streaming settings as soon as you've powered on the system and configured a channel. Just choose the live broadcast method that's right for your viewers. They can tune into the stream and watch using their favorite web browser or media player.

Table 55 *Publishing options for streaming direct to viewers on the local network*

Publishing Options	Use this option to...
HTTP or HTTPS	Viewers on the same local network as Pearl can access the Live broadcast URL using a web browser on the local network and are instantly connected. Viewers can also choose to use their favorite media player to watch the stream on the local network. They just need the URL for any of the other supported streaming methods (like FLV or MPEG-TS) to watch using their media player. Use these direct streaming methods for only a small number of viewers because each viewer uses the full stream bandwidth and consumes resources on Pearl. For more information about using an HTTP stream, see Share a live broadcast stream (HTTP, HTTPS or RTSP).
RTSP	Viewers can copy and paste the URL of the RTSP stream into a media player and watch the stream on the local network. For more information about using RTSP streaming, see Share a live broadcast stream (HTTP, HTTPS or RTSP).
HTTP Live Streaming (HLS) pull	Stream live over the standard HTTP port 80, making it possible to cross firewalls and proxies that are normally accessible to other HTTP traffic and facilitates conte nt delivery to CDNs. If HTTPS is configured on Pearl, traffic from port 80 is redirected to port 443. See Enable HLS (pull) for details. There is approximately a 30 second delay when streaming using HLS.

> To stream video outside your LAN using the channel's HTTP/HTTPS or RTSP URLs, you must configure port forwarding on your router. Consult with your Network Administrator.

To set up Pearl for direct streaming to viewers, see:

- Disable and enable direct channel streaming
- Restrict viewer access to channel streams

- ○ Share a live broadcast stream (HTTP, HTTPS or RTSP)

- ○ Change HTTP and RTSP streaming port values

- ○ Enable HLS (pull)

- ○ Stream using UPnP

Share a live broadcast stream (HTTP, HTTPS or RTSP)

The easiest way to deliver your content to your viewers is to give them the live broadcast URL of the channel. You can get that using the Admin panel. A separate URL exists for each channel you stream.

The format of the URL depends on the method you used to access Pearl, which can be done though network discovery using Pearl's serial number or IP address. Pearl must be accessible on the viewer's LAN for them to access and view the stream using serial discovery.

If HTTPS is configured for Pearl, the live broadcast URL will start with *https* instead of *http*.

> If Pearl is behind a firewall and you want to share a stream with remote viewers, you need to set up port forwarding on your network. Consult with your network administrator.

Table 56 *URL options*

Access Method	URL Format
serial discovery	http://*<serial>*.local/preview.cgi?channel=<channel number> https://*<serial>*.local/preview.cgi?channel=<channel number> rtsp://*<serial>*.local:*<port>*/stream.sdp Where *serial* is the serial number of the system, the *port* number for the channel is found on the Info page, and the channel number is provided from the Admin panel. You must install **Bonjour Print Services** on your Windows or Mac computer to access the live Preview using the serial number.
IP address	http://*<IP Address>*/preview.cgi?channel=2 https://*<IP Address>*/preview.cgi?channel=2 rtsp://*<IP Address>*:*<port>*/stream.sdp Where *IP address* is the IP address of the system, the *port* number for the

Access Method	URL Format
	channel is found on the Info page, and the channel number is provided from the Admin panel.

To retrieve the stream URL for your viewers:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Channel menu, select a channel and click **Status**. The Status page appears.

3. Record the **Live broadcast**, **RTSP stream** URL or other web streaming address. This is the address you can send to viewers or use to create a link to your broadcast.

> **STOP** If you're seeing URLs with serial numbers instead of IP addresses and want to change this, log into the Admin panel by IP address (instead of by Serial number/Bonjour Print Services) to see URLs with the IP address, see **Connect to Admin panel**.

Enable HLS (pull)

Stream a live broadcast of a channel directly to viewers on the same local network as Pearl using HTTP over port 80. This gives viewers with iOS devices convenient access to the channel's live broadcast. If HTTPS is configured for Pearl, the traffic from port 80 is redirected to HTTPS port 443.
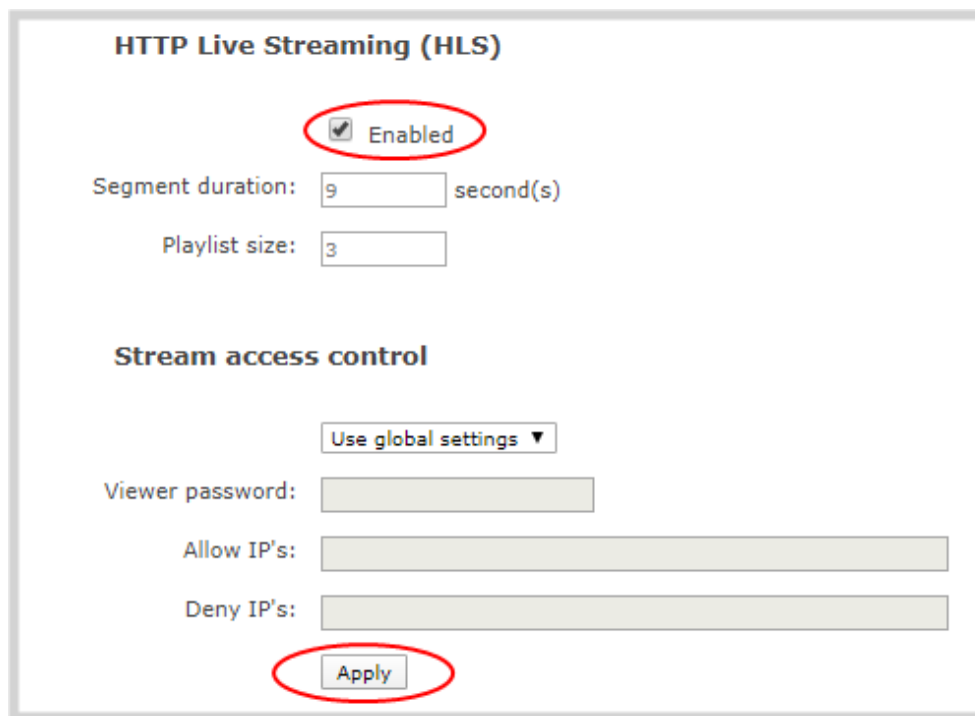
HTTP Live Stream (HLS) supports the H.264 codec and MP3 or AAC audio encoding. Audio and video are sent as a series of small files called media segment files. You can set the segment duration, as well as define the playlist size using the Admin panel. By default, the segment duration is 9 seconds and the playlist size is 3.

When live broadcasting a channel using HLS (pull), there is approximately a 30 second delay.

To enable HLS (pull):

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Channels menu, select the channel containing video you want to stream and click **Streaming**. The Streaming configuration page opens.

3. Under **HTTP Live Streaming (HLS)**, check **Enabled**.

4. (Optional) Set the **Segment duration** and **Playlist size**.

5. Click **Apply**

6. To share the HLS (pull) URL with viewers, click **Status** from the Channels menu, then copy the HLS URL and provide that to your viewers.

Restrict viewer access to channel streams
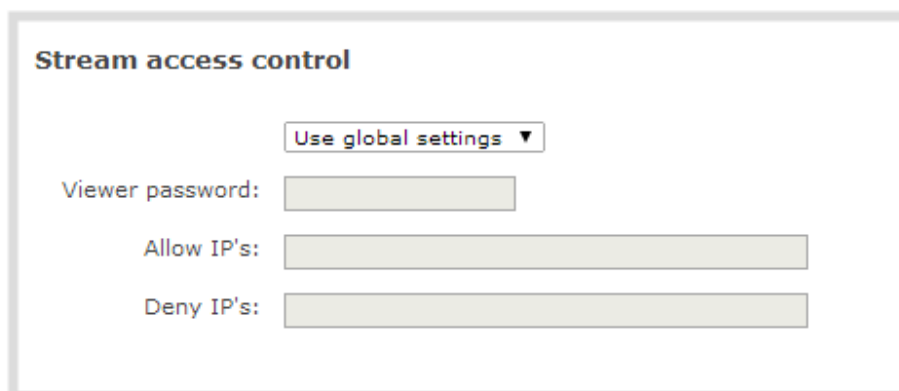
Pearl can restrict access to all viewer streams from the channels on Pearl using global viewer passwords and IP allow/deny lists. See Set or change user passwords and Restrict viewers by IP address.

> **STOP** If LDAP is configured for viewer authentication, the viewer must pass global autentication using LDAP credentials (or the viewer global password, if there is one) and must meet the local channel settings (come from an allowed IP address). See **Configure LDAP user authentication** for more information on LDAP configuration.

To restrict viewers for a channel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

3. From the Channels menu, select a channel and click **Streaming**. The streaming configuration page opens.

4. In the **Stream access control** section, select **Use these settings** from the drop down.

Stream access control

	Use global settings ▼
Viewer password:	
Allow IP's:	
Deny IP's:	

To return the channel to the global access control settings, select **Use global settings** from the drop down and click **Apply**. The configuration fields are disabled and any changes to the configuration fields are not saved.

> **STOP** Global LDAP settings are always enforced. Any local settings are in addition to LDAP sign on.

5. (Optional) Specify a password for viewers of this channel. The password is masked as you enter it.

> If you have global allow/deny lists or a global user password, you can override the global settings and remove all access control for a channel by selecting **Use these settings** and leaving all the fields blank.

6. (Optional) Enter the allow and deny IP addresses for viewers of this channel. See Restrict viewers by IP address for details about allow and deny lists.

7. Click **Apply**.

Restrict viewers by IP address

Pearl permits you to restrict which computers can access broadcasts by building a list of allowed and denied IP addresses. You can do this at a global level for the system and can also override these settings on a per-channel basis. Both global and per-channel configuration procedures are described.

The following table describes what happens when an IP address is added to the allowed and denied IP address lists.

Item	Description
Allow IP's	Users connecting from addresses in this list are permitted to view broadcasts from the system, provided their IP address is not in the Deny IP's list. To allow all except IP addresses in the deny list, if any, leave the field blank. You can use the Allow list by itself, or in conjunction with the Deny IP's list as an exception to a rule in the allow list.
Deny IP's	Users connecting from addresses in this list are not allowed to view broadcasts from the system, unless their IP address is in the Allow IP's list. If a specific IP address is in both lists, access to the stream is denied. You can use the Deny list by itself, or in conjunction with the Allow IP's list as an exception to a rule in the allow list.

If your viewer account has a password, your viewers must connect to the system from a computer (or gateway) with a permitted IP address and must also supply the user name (viewer) and password before they can view the broadcast.

To restrict access by IP address, you need to know the IP addresses or range of addresses for your viewers. By default, all IP addresses are allowed to connect to the broadcast.

If a user attempts to connect to the stream from a disallowed IP address, access is denied. If there's an attempt to connect using a web browser, the message "IP address rejected" is displayed.

Table 57 *IP Based Restriction Options*

If you're not familiar with creating allow/deny lists, see IP restriction examples.

> IP address restriction is valid for the viewer only and does not affect the Admin panel or the mobile configuration interface.

To restrict viewer access to watch streams for all channels by their IP address:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, select **Security**. The Security configuration page opens.

3. Enter the allowed IP addresses or address ranges in the **Allow IP's** field and enter denied IP addresses or address ranges in the **Deny IP's** field. Separate addresses with a comma. To specify a range, use a hyphen (-). Optional spaces improve readability.

4. Click **Apply**.

To restrict viewer access to watch streams on a specific channel by their IP address:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Channels menu, select a channel and click **Streaming**. The channel's streaming configuration page opens.

3. From the **Stream access control** drop-down, select **Use these Settings** to enable local password and Allow/Deny IP lists are enabled.

4. (Optional) Enter a password for the viewer in the **Viewer Password** field.

5. Enter the allowed IP addresses or address ranges in the **Allow IP's** field and enter denied IP addresses or address ranges in the **Deny IP's** field. Separate addresses with a comma. To specify a range, use a hyphen (-). Optional spaces improve readability.

6. Click **Apply**.

IP restriction examples

The following table lists some example allow lists.

Table 58 *Example allow lists*

Example	Description
Allow list with distinct IP addresses	The simplest allow/deny list is to use the list of known IP addresses to craft a list of allowed IP addresses. All other addresses are denied access to the broadcast.

Example	Description
	For example if your system is accessible on your local area network (LAN) and you want to make sure only the CEO's specific desktop, laptop and tablet computers (with IP Addresses 192.168.1.50, 192.168.1.51, and 192.165.1.75, respectively) can connect to the broadcast, construct the following allow list: Allow: 192.168.1.50, 192.168.1.51, 192.168.1.75
Allow list with a range of IP addresses	Sometimes you'll want a range of computer IP addresses to connect to your system. This may happen when you have one range of IP addresses assigned to desktop computers (i.e. in the range 192.168.1.1 to 192.168.1.100) and another range assigned to boardroom computers (i.e. the range 192.168.1.200 to 192.168.1.250). If you only want the boardroom computers to connect to broadcasts from the system you can specify the range of boardroom IP addresses rather than needing to type in each individual address. The allow list looks as follows: Allow: 192.168.1.200-192.168.1.250 Note that we could have specified two of the IP addresses in the previous example as a range.
Allow list with a range of IP addresses and one or more specific IP addresses	Putting the first two examples together, we want to permit access to IP addresses in the range of boardroom computers (192.168.1.200-192.168.1.250) and also want to add the desktop, laptop and tablet computers of the CEO (IP addresses 192.168.1.50, 192.168.1.51, and 192.168.1.75, respectively). Note the first two IP addresses are consecutive, so they can be added as a second range. Add these IP addresses to the list as follows: Allow: 192.168.1.200-192.168.1.250, 192.168.1.50-192.168.1.51, 192.168.1.75 Your list can have multiple ranges and multiple distinct IP addresses, provided they are separated by commas.
Allow list with a range of IP addresses, distinct	Building on the previous examples, consider a situation where you want the CEO's computers (192.168.1.50, 192.168.1.51, 192.168.75) and all

Example	Description
IP addresses, and an exception	boardroom computers (192.168.1.200-192.168.1.250) to access the broadcast, with the exception of the public boardroom computer (192.168.1.211). Use both allow and deny lists to create the rule as follows: Allow: 192.168.1.200-192.168.1.250, 192.168.1.50-192.168.1.51, 192.168.1.75 Deny: 192.168.1.211 Both lists can have multiple ranges and multiple distinct IP addresses, provided they are separated by commas.

The following table lists some example deny lists.

Table 59 *Example deny lists*

Example	Description
Deny list with distinct IP addresses	Another simple allow/deny list is to use the list of known IP addresses to list specific denied IP addresses. All other addresses are allowed access to the broadcast. For example imagine your system is accessible on your local area network (LAN) and you want to allow any computer on the LAN can access the stream except your publicly-accessible boardroom (with IP address 192.168.1.211). You can use the following deny list (leave the allow list empty) to permit all computers except the boardroom computer: Deny: 192.168.1.211 As with allow lists, your deny list can specify a range of IP addresses, and can specify multiple ranges or distinct IP addresses in a comma-separated list.
Deny list with a range of IP addresses	Consider a situation where you want every computer on the network to access the broadcast, with the exception of the CEO's desktop, laptop and tablet computers. Additionally, boardroom computers should not be permitted with the exception of the cafeteria computer (IP address 192.168.1.222). The deny list is an "exception" list for the allow list. So to craft the rule described above we need to allow all the computers in the local subnet, then

Example	Description
	deny specific sub-ranges including two groups of boardroom computers ensuring the cafeteria computer's IP address is not in the deny list: Allow: 192.168.1.1-192.168.1.250 Deny: 192.168.1.200-192.168.1.221, 192.168.1.223-192.168.1.250, 192.168.1.50-192.168.1.51, 192.168.1.75

Change HTTP and RTSP streaming port values

By default, each channel you create is assigned a unique HTTP and RTSP port number. You can use the Admin panel to configure a specific streaming port value for the channel. Ensure that each channel has unique streaming port values that are not currently assigned to any other process, see Network ports used by Pearl.

For RTSP streaming directly to users on your LAN, the only information that's needed to view the broadcast is the URL and the RTSP port number used to stream the broadcast.

HTTP port numbers are used for FLV and MPEG-TS streaming methods.

To set the HTTP and RTSP streaming ports for streaming to viewers on the local network:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Channels menu, select a channel and click **Streaming**. The Streaming page opens.
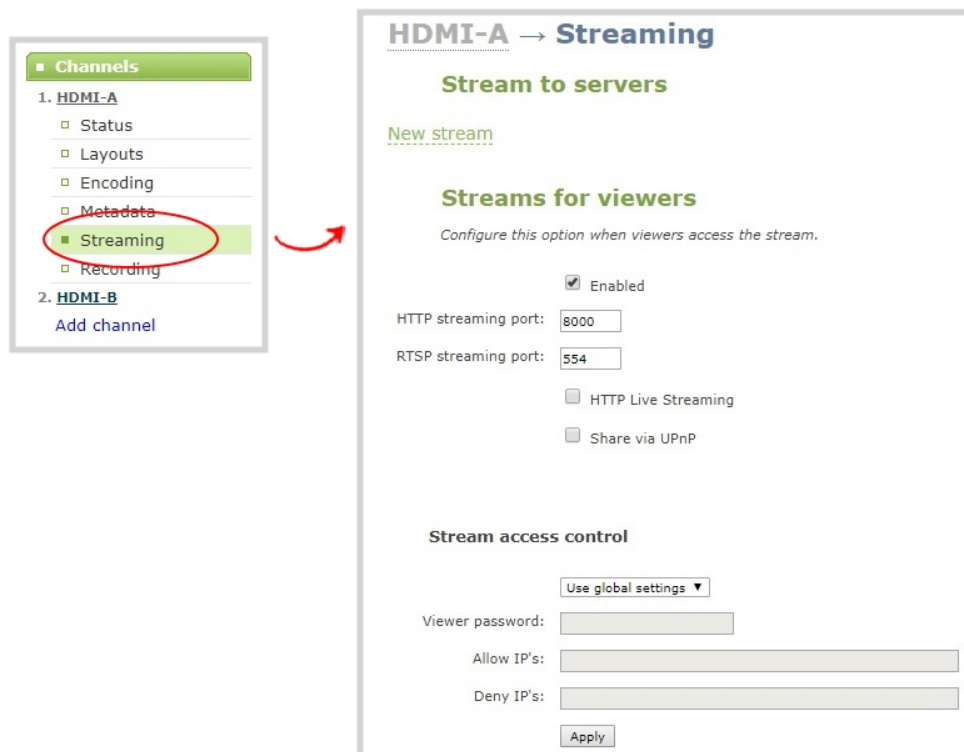
3. Set the **HTTP Streaming port** to specify the port used to stream the HTTP broadcast. This value along with the URL is used by viewers to access the FLV and MPEG-TS streams.

> The port number must be higher than 500 for HTTP. In the case of RTSP streaming this value is ignored.

4. Set the **RTSP Streaming port** to specify which port to use when you are streaming live video via RTSP. This value along with the URL is used by viewers to access the broadcast. The default for channel one is 554.

5. Click **Apply**.

Disable and enable direct channel streaming

When you create a channel, the channel's streaming URLs are enabled by default. The channel streaming URLs are listed on the Status page for the channel, which you can share with viewers. You can disable channel streaming using the channel's streaming URLs from the Streaming configuration page using the Admin panel.

Disabling channel streaming for viewers using their web browser or media player does not disable live streaming to a CDN.

> **STOP** Disabling streams for viewers does disable all viewer formats, including: HTTP/HTTPS, RTSP, HLS and UPnP.

To disable or enable the channel streaming URLs:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Channels menu, select a channel and click **Streaming**. The streaming page opens.
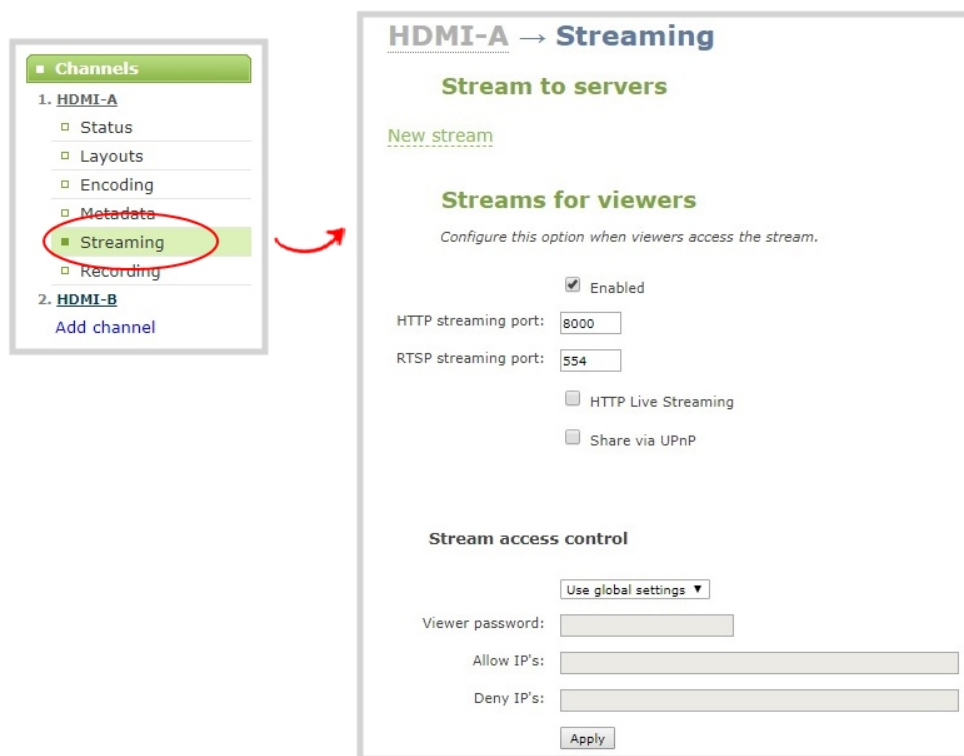
3. Uncheck **Enabled** to disable direct streaming of channels to viewers using the channel's streaming URLs. Leave **Enable** checked to allow direct streaming using the channel's URLs.

4. Click **Apply**.

Directly share channel stream URLs with viewers

People on the same local network as Pearl can easily view a channel's live broadcast stream. All you need to do is provide them the channel's stream URL and log in credentials if you've set one for viewers, see Set or change user passwords.

You can provide people separate URLs for streams coming from each channel, or one URL that includes all the streams for the channel. Choose the right type of URL for the type of device the person will use to watch the

stream. For more information on compatibility between codec and file formats, see Viewing a channel's live broadcast stream.

To share the channel's stream URL directly with viewers:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Channels menu, select the channel and click **Status**. The Status page opens.

MPEG-TS: Used in broadcast systems sych as DVB, ATSC and IPTV. It is supported by media players such as MPlayer, VLC and KMPlayer.

RTSP: Supported by most media players including QuickTime, MPlayer and VLC. Supports H.264 and MPEG4 standards and analog audio from an external source.

Stream info

Live broadcast: http://192.168.0.183/preview.cgi?channel=1

Video: H.264 1920x1080@30, 6.47 Mbps
Actual framerate: 30
Audio: AAC 44kHz stereo 320 kbps
Total: 6.79 Mbps
RTSP stream rtsp://192.168.0.183:554/stream.sdp
MPEG-TS stream http://192.168.0.183:8000/stream.ts
Flash stream http://192.168.0.183:8000/stream.flv

FLV: Supported on most web browsers and media players. Supports the H.264 standard and analog audio from an external source.

3. Copy the URL and provide that to viewers.

Viewers can now watch the stream using a digital media player or browser, see View the live broadcast URL using a web browser and View the streaming URL using a media player.

> HTTP only is used for MPEG-TS and FLV streaming. HTTPS is not supported.

Viewing a channel's live broadcast stream

When you set up a channel, the system automatically generates and displays a list of available live broadcast streams. You can share the channel's stream URLs with people on the same local network as Pearl so they can watch a live broadcast of the channel. All you need to do is provide them the channel's stream URL and log in credentials if you've set one for viewers, see Set or change user passwords.

> To stream video outside your LAN using the channel's live broadcast streams, you must configure port forwarding on your router. Consult with your Network Administrator.

The live broadcast stream URLs for a channel are available from the Channel menu in the Admin panel when you select **Status**. The audio and video codecs configured for the channel affect which live broadcast formats are listed.

Just copy the live broadcast URL and share that with viewers so they can watch the channel stream using a web browser, see View the live broadcast URL using a web browser.

Or choose one of the other channel stream URLs if your viewers prefer to watch using a media player, see View the streaming URL using a media player.

MPEG-TS: Used in broadcast systems sych as DVB, ATSC and IPTV. It is supported by media players such as MPlayer, VLC and KMPlayer.

RTSP: Supported by most media players including QuickTime, MPlayer and VLC. Supports H.264 and MPEG4 standards and analog audio from an external source.

Stream info

Live broadcast: http://192.168.0.183/preview.cgi?channel=1

Video: H.264 1920x1080@30, 6.47 Mbps
Actual framerate: 30
Audio: AAC 44kHz stereo 320 kbps
Total: 6.79 Mbps
RTSP stream rtsp://192.168.0.183:554/stream.sdp
MPEG-TS stream http://192.168.0.183:8000/stream.ts
Flash stream http://192.168.0.183:8000/stream.flv

FLV: Supported on most web browsers and media players. Supports the H.264 standard and analog audio from an external source.

> 🛑 If the channel is configured with 48 kHz audio, some web browsers may not work. In this case, we recommend using one of the channel's other URL formats and viewing the channel steam using a media player instead.

View the live broadcast URL using a web browser

You can share a channel's live broadcast URL with viewers so they can watch your live stream using their favorite web browser. Your viewers must be on the same network as Pearl to watch a live broadcast using the channel's live broadcast URL.

> 🛑 If the channel you're streaming is configured with 48 kHz audio, some web browsers may not work. In this case, we recommend viewing the channel steam using a media player instead.

The live broadcast URL appears in two places in the Admin panel:

- On the channel's status page.

- On the Info page from the Configuration menu.

To locate the IP address for the broadcast, see Directly share channel stream URLs with viewers.

If a viewer password is configured, provide participants with the password to log in, along with the URL of the stream. To set a viewer password, see Set or change user passwords.

> If HTTPS is enabled on Pearl, replace *http* with *https* in the URL of the stream.

To share the live broadcast URL with viewers :

1. Login to the Admin panel as **admin** or **operator**, see Connect to Admin panel.

2. Open the channel's status page and copy the live broadcast URL. From the Channels menu, select a channel and click **Status**. You can copy the Live broadcast URL and share that with your viewers.

3. Alternatively, open the **Info** page to get the live broadcast URL. From the Configuration menu, click **Info** and then click **View** for the channel you want to share the broadcast URL.

A page opens displaying the live broadcast and the broadcast URL. Copy the URL and share that with your viewers.

To watch a stream using a web browser and the live broadcast URL:

1. From your web browser, enter the IP address of the live broadcast stream.

> If the IP address of the broadcast is 172.20.1.33, then browse to:
>
> http:// 172.20.1.33/preview.cgi?channel=<channel number>

2. Enter **viewer** as the user name and the password when prompted and press **Enter**. The stream plays in a new tab in your web browser.

View the streaming URL using a media player

You can share a channel's streaming URL with viewers so they can watch your live stream using their favorite media player, like VLC. Your viewers must be on the same network as Pearl to watch a channel stream using a stream URL.

The different stream types available for channels include: RTSP, MPEG-TS, and Flash streams, see Viewing a channel's live broadcast stream. The URL contains either the IP address of Pearl or the serial number, see

The type of stream URL you provide to your viewers can affect their choice of media player needed to watch the stream.

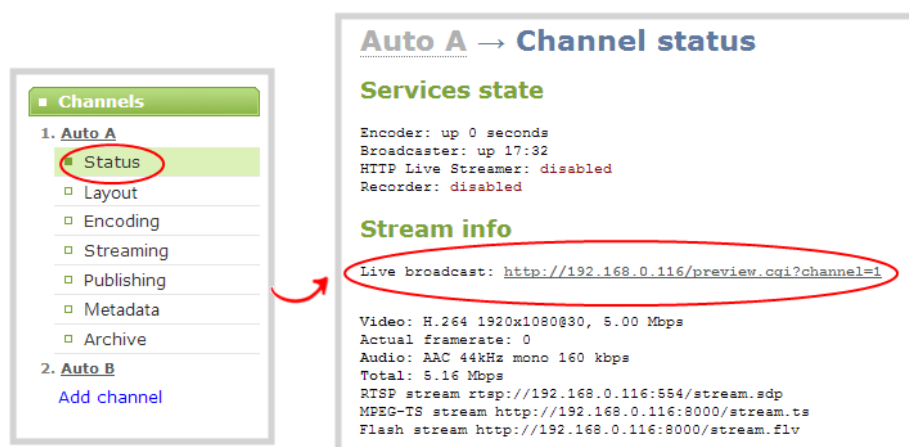This procedure assumes that the VLC media player is used.

If a viewer password is configured, provide participants with the password to log in, along with the URL of the stream. To set a viewer password, see Set or change user passwords.

To share the channel's stream URL with viewers:

1. Login to the Admin panel as **admin** or **operator**, see Connect to Admin panel.

2. Open the channel's status page and copy the channel's stream URL. From the Channels menu, select a channel and click **Status**. You can copy the Live broadcast URL and share that with your viewers.
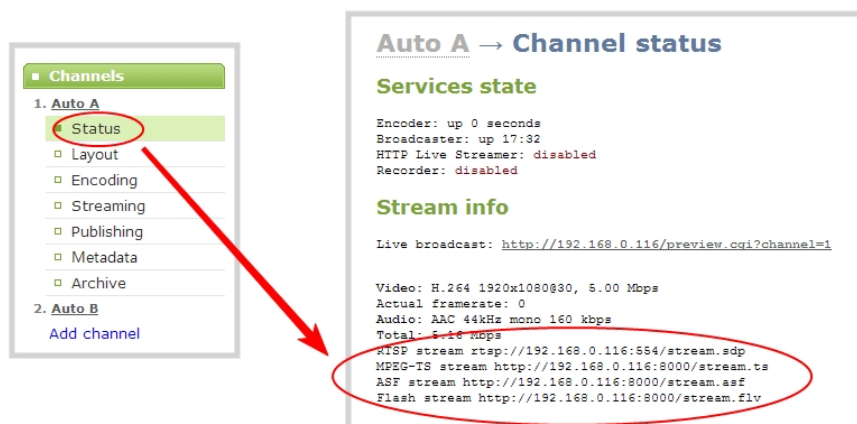
To view the channel's stream URL using a VLC:

1. Launch a media player.

2. Click the **Media** tab and select **Open Network Stream** from the drop-down menu.

3. Enter the stream URL. In this example, the serial number method is shown.

> rtsp://49E7B8E4.local:554/stream.sdp
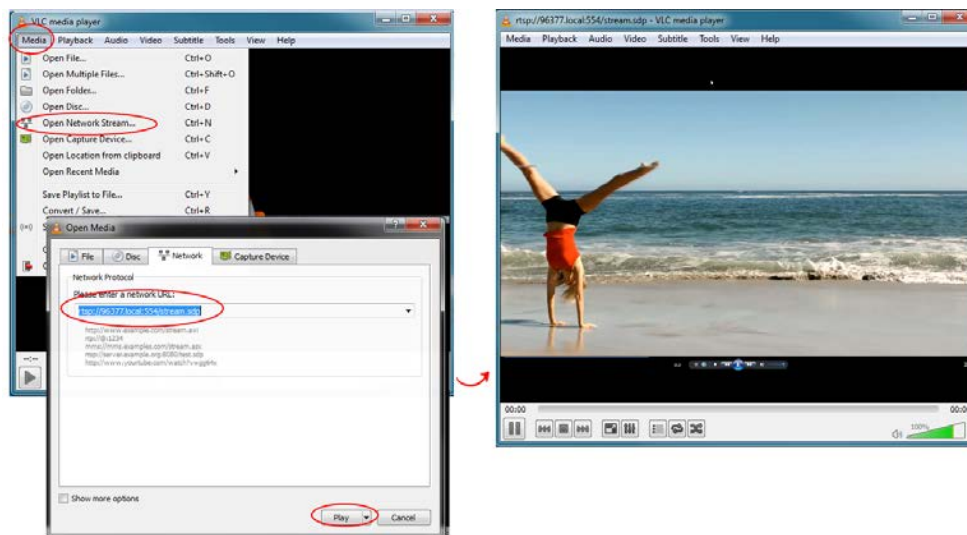
4. Press **Play** to watch the stream in the media player window.

Streaming to servers, CDNs, and other devices

Pearl can stream to CDNs, local media servers, and even to other Pearl devices that are acting as a streaming ingestion point. Pearl supports many streaming protocols, including: SRT (push), HLS (push), MPEG-DASH (push), RTMP/RTMPS, and RTSP. Use the Admin panel to set up individual channels configured on Pearl for streaming.

Topics include:

- Set up an RTMP or RTMPS (push) stream
- Set up an SRT stream using caller and listener modes
- Set up an SRT stream using rendezvous mode
- Adjust latency and view the SRT stream status
- Set AES encryption and a passphrase for SRT
- Set up an RTSP announce stream
- Stream to a CDN using an XML profile

For details to configure multicast streaming, see Multicast streaming. Streaming a channel to CDNs and multicast streaming is available only when the H.264 codec is configured as the channel encoding, see Configure video encoding.

Set up an RTMP or RTMPS (push) stream

Real Time Messaging Protocol (RTMP) is this the most common way to stream to a CDN, including both Facebook Live and YouTube.
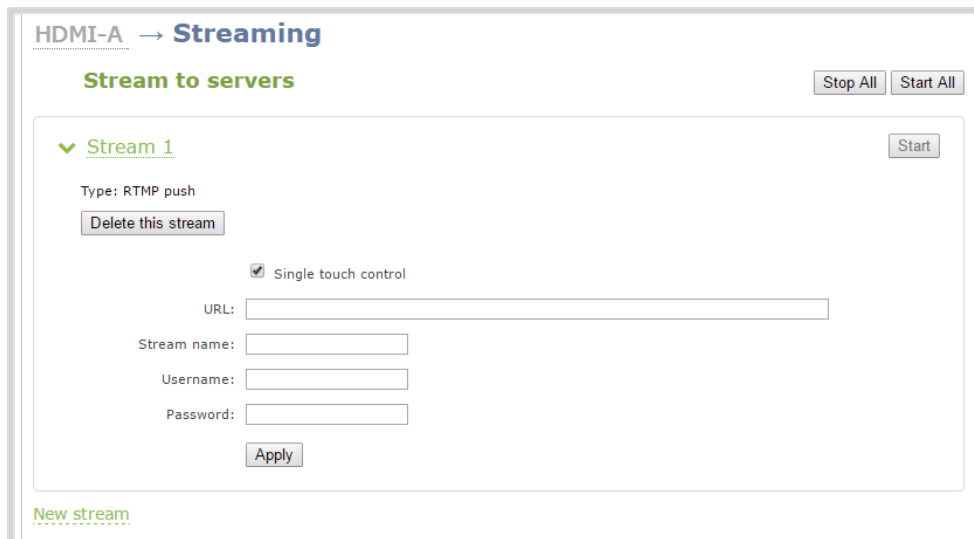
Use Real Time Messaging Protocol Secure (RTMPS) to encrypt content before it's streamed over a TLS/SSL connection for secure live streaming. When enabled, Pearl will always attempt to validate the digital certificate it receives from the CDN to establish a secure RTMPS connection. The connection will fail if Pearl can't find the CA certificate of your CDN in it's list of certificates.

Pearl has the CA certificates for many of the major CDNs already installed. For RTMPS streaming to work for your particular CDN, or if you're using a proprietary RTMPS server, ensure that your streaming server's CA certificate is uploaded to Pearl, see Manage CA and self-signed certificates.

To stream using RTMP or RTMPS:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Channels menu, select a channel and click **Streaming**. The Streaming configuration page opens.

3. Click **New stream** and choose **RTMP push**. The new stream is created using the default name *Stream 1*.

4. Click the stream name to see the stream settings.

5. (Optional) Uncheck **Single touch control** if you don't want this stream to be started and stopped using One Touch streaming and recording control. This is enabled by default.

6. Enter the **URL** of the ingestion point provided by the CDN or media server.

    - For RTMP push, enter **rtmp** followed by the rest of the URL, for example: *rtmp://<server-ip-address>:<port>/etc…*

    - For RTMPS, enter **rtmps** followed by the rest of the URL, for example: *rtmps://<server-ip-address>:<port>/etc…*

7. Enter the **Stream name** (which also is called a stream key by some CDNs)

8. (Optional) Enter a **User name** and **Password**.

> The CDN provider assigns a user name and password to authenticate the publisher. Contact the CDN provider for your log in credentials. Some CDNs, like YouTube and Facebook Live, do not require you to enter your log in credentials here.

9. (Optional) Rename the stream. Click the current name and enter a different name, then press **Enter**.

10. Click **Apply**.

11. To start streaming, click **Start** or click **Start all** to simultaneously start this stream and any other streams you have configured for this channel.

12. Click **Delete this stream** at any time to delete the stream.

See Start and stop streaming to a CDN for instructions to control streaming from the touch screen or see Control streaming and recording for instructions to use Epiphan Live.

Set up an SRT stream using rendezvous mode

Secure Reliable Transport (SRT) is an open-source streaming protocol that offers quality, low latency streaming to CDNs and other SRT enabled decoders across unreliable Internet connections via UDP.

The easiest way to establish a link between the SRT source and destination devices is to use rendezvous mode. In rendezvous mode, both the SRT source and destination device are ready to establish the SRT connection as soon as an SRT stream starts.

Typically, no intervention is needed from your IT administrator to traverse a firewall in rendezvous mode. However, you can switch to SRT caller and listener modes if you experience difficulties streaming through a firewall in rendezvous mode, see Set up an SRT stream using caller and listener modes.

To establish the SRT connection between the source and destination devices in rendezvous mode, both devices must be configured and ready to establish the connection between them. Each must know the IP address of the other device and both must be configured to use the same port for the SRT stream.

In the following example, a Pearl is setup as SRT Source A (192.168.1.10) with port 20000 and another Pearl is setup as SRT Destination B (203.0.113.10) with port 20000.

SRT Source

A
192.168.1.10
port 20000

Firewall A
192.168.1.1

Public IP
198.51.100.20

Internet

Firewall B
Public IP
168.112.1.1

203.0.113.1

B
203.0.113.10
port 20000
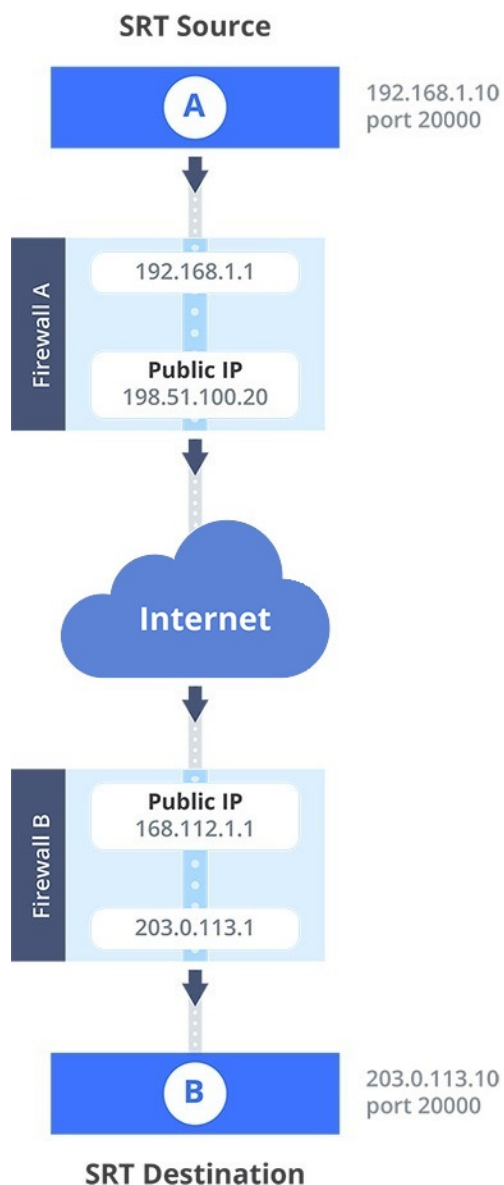
SRT Destination

Source A streams through Firewall A and Firewall B to Destination B, which ingests the SRT stream as a video input with embedded audio. All traffic received at Firewall B that's addressed to 168.112.1.1 on port 20000 passes through the firewall directly to Destination B (203.0.113.10) because of the port number.

What's needed for this setup
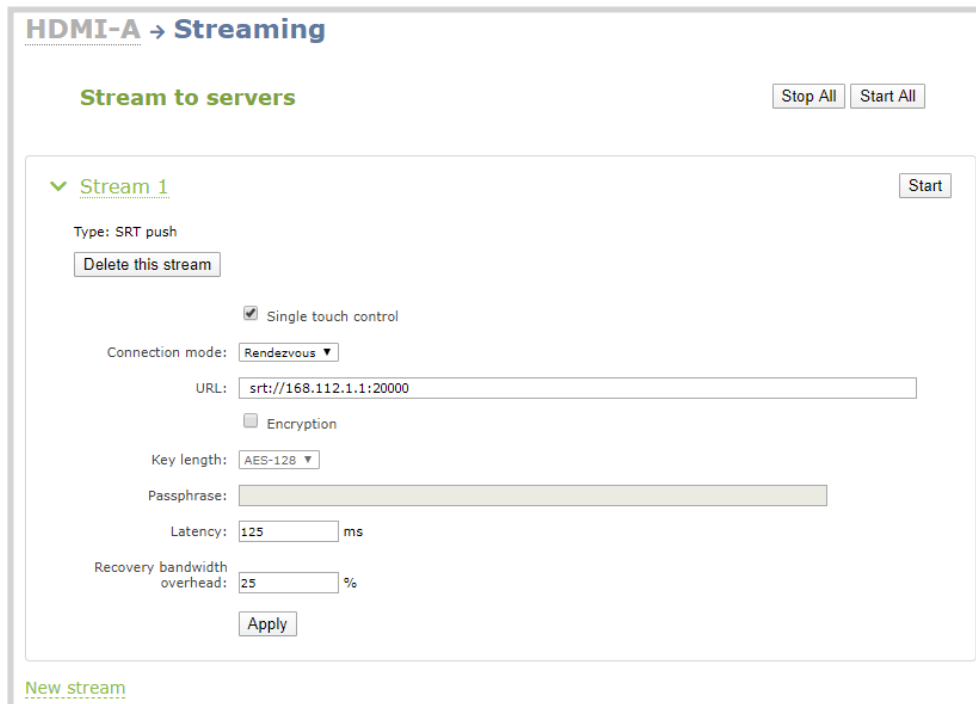
- The public IP address of Source A (e.g. 198.51.100.20) and the public IP address of Destination B (e.g. 168..0.113.10).

- The SRT streaming port that Source A is configured to use (e.g. port 20000).

- Configure SRT Destination B to use the same port value as Source A for the SRT stream (e.g. 20000). You do this when adding the SRT stream as a video input source on the destination Pearl device using the Admin panel, see Connect an SRT stream as an input.

When you're configuring an SRT stream on Pearl, you can also adjust the recovery bandwidth overhead using the Admin panel. This setting defines how much of the stream's total bandwidth is dedicated for the exchange of SRT control and recovery packets between the source and destination. Ensure that the total SRT stream bitrate (i.e. the bandwidth required for the stream plus the recovery bandwidth overhead) is less than the network bandwidth you have available.

To setup Pearl as a streaming source in rendezvous mode using the Admin panel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Channels menu, select a channel and click **Streaming**. The Streaming configuration page opens.

3. Click **New stream** and choose **SRT push**. The new stream with the default name *Stream 1* is created.

4. Click the stream name to expand the stream settings.

5. In the **Connection mode** field, select **Rendezvous**.

6. Enter the **URL** of the SRT destination (decoder) using the format *srt://<decoder-ip-address>:<port>*, where the *<decoder-ip-address>* and *<port>* values are provided by the CDN, media server, or an SRT decoder device such as a second Pearl at the destination.

7. (Optional) Check Encryption and choose the AES key length if the SRT destination requires AES encryption. These settings must match the encryption settings of the destination device, see Set AES encryption and a passphrase for SRT.

8. (Optional) If the SRT destination has a required security **Passphrase** along with the AES encryption, you can enter that here.

9. (Optional) In the **Latency** field adjust the amount of latency to apply to the stream. The default value is 125 ms.

> We recommend using the default latency and recovery bandwidth overhead values for an initial test stream. After you perform a test stream, you can determine the Quality of Service (QoS) and calculate the latency requirements. To set the SRT stream latency, see Adjust latency and view the SRT stream status.

10. (Optional) In the **Recovery bandwidth overhead** field, adjust the % value of the bandwidth that's dedicate for SRT control and recovery packets. The default value is 25%.

11. (Optional) Rename the stream. Click the current name and enter a different name, then press **Enter**.

12. Click **Apply**.

13. When your ready to start streaming, click **Start**

What's next?

If you need to set up Pearl as an SRT destination and ingest an SRT stream from a remote source, you must add the SRT stream as a input, see Connect an SRT stream as an input.

Set up an SRT stream using caller and listener modes

When setting up SRT streaming on Pearl, you can configure Pearl as an SRT source encoder and send an SRT stream over the Internet to other SRT destinations (decoders) such as a CDN or another Pearl.

Caller and listener modes work together to establish the SRT link between your SRT source and destination device when traversing the firewall is difficult and Rendezvous mode didn't work.
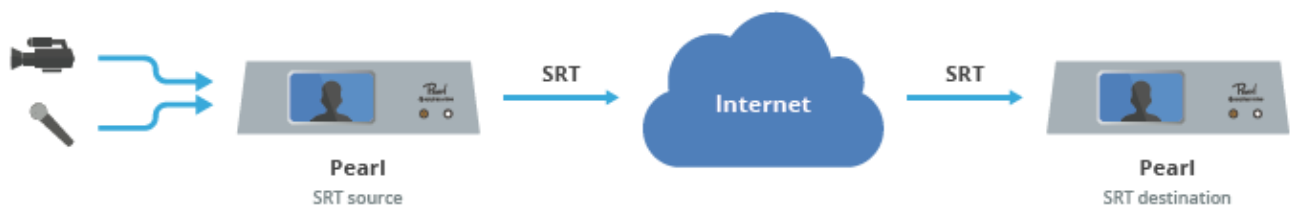
To establish an SRT link between the source and destination devices, ensure that one device is a Listener and the other is a caller. The device you set as the caller (or listener) is arbitrary. If the destination device is set as the listener and is ingesting multiple SRT sources, then all your SRT source devices must be set as callers.

In the following example, a Pearl is setup as SRT Source A (192.168.1.10) and another Pearl is setup as SRT Destination B (203.0.113.10). Source A is streaming through a firewall/NAT to Destination B, which ingests the SRT stream as a video input with embedded audio.
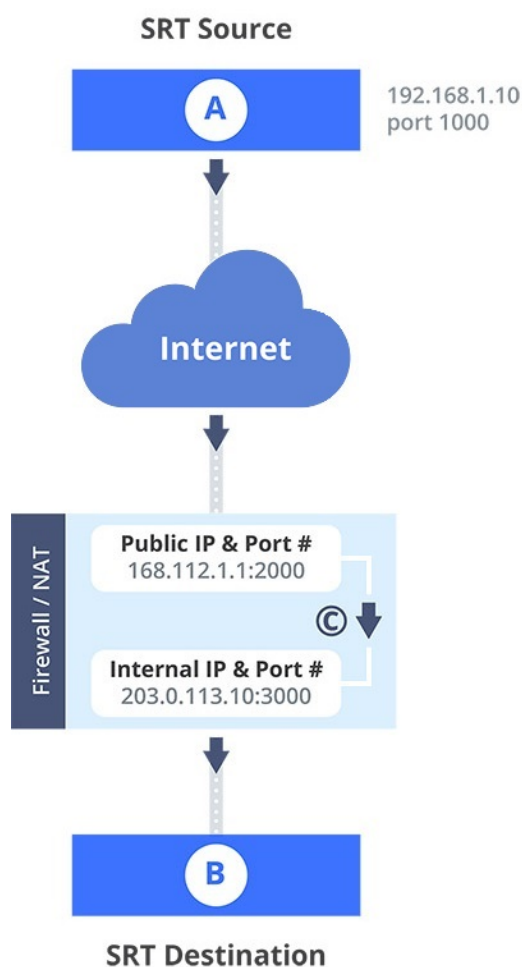
The public IP address of the Firewall/NAT is 168.112.1.1 and port 2000 is the designated SRT streaming port. All traffic received at 168.112.1.1 on port 2000 is granted permission to pass through the firewall and is forwarded (C) to Destination B's internal IP address (203.0.113.10) on port 3000.

What's needed for this setup
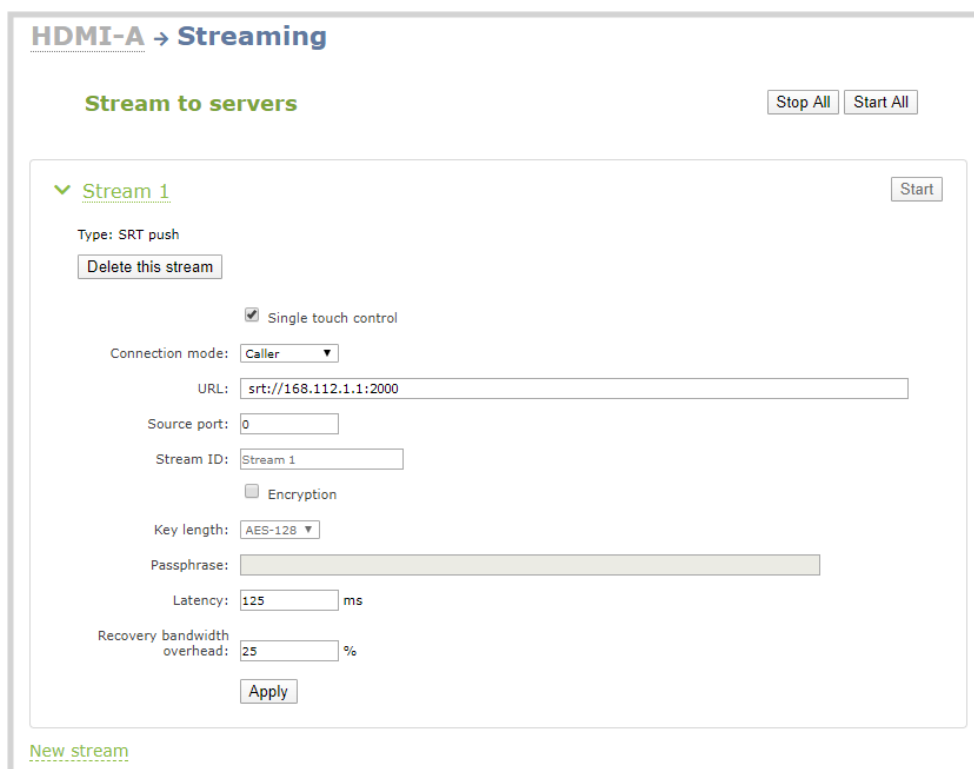
- The internal IP address of SRT Destination B (e.g. 203.0.113.10).
- The SRT port value that was configured on SRT Destination B using the Admin panel when the SRT stream was added as a video input source using the Admin panel (e.g. port 3000).

- The public IP address of the firewall. An easy way to get the public IP address is to use a web browser and do a Google search for "**What is my IP address**" (e.g. 168.112.1.1).

- The IT administrator in charge of the firewall must open a port for the SRT stream (e.g. port 2000). The port must allow 2-way traffic and route the traffic to the internal IP address and SRT port of Destination B. In this example, traffic received at the firewall's public IP address 168.112.1.1 on SRT port 2000 is routed to 203.0.113.10:3000.

When you're configuring an SRT stream on Pearl, you can also adjust the recovery bandwidth overhead using the Admin panel. This setting defines how much of the stream's total bandwidth is dedicated for the exchange of SRT control and recovery packets between the source and destination. Ensure that the total SRT stream bitrate (i.e. the bandwidth required for the stream plus the recovery bandwidth overhead) is less than the network bandwidth you have available.

To setup Pearl as a streaming source in caller/listener mode using the Admin panel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Channels menu, select a channel and click **Streaming**. The Streaming configuration page opens.

3. Click **New stream** and choose **SRT push**. The new stream with the default name *Stream 1* is created.

4. Click the stream name to see the stream settings.

5. In the **Connection mode** field, select if this Pearl is the caller or a listener.

    a. If **Caller** is selected, do the following:

        i. In the **URL** field, enter the IP address of the SRT destination (decoder) using the format *srt://<decoder-ip-address>:<port>*, where the *<decoder-ip-address>* and *<port>* could be provided by the CDN, media server, or be another SRT decoder device such as a second Pearl.

        ii. (Optional) In the **Source port** field, enter the port number that this Pearl should use for SRT traffic.

    b. If **Listener** is selected, enter the **Port** number that this Pearl should use for SRT traffic. See Network ports used by Pearl to determine available ports.

6. (Optional) In the **Stream ID** field, enter a unique name for this stream.

7. (Optional) Check Encryption and choose the AES key length if the SRT destination requires AES encryption. These settings must match the encryption settings of the destination device, see Set AES encryption and a passphrase for SRT.

8. (Optional) If the SRT destination has a required security **Passphrase** along with the AES encryption, you can enter that here.

9. (Optional) In the **Latency** field adjust the amount of latency to apply to the stream. The default value is 125 ms.

> ✅ We recommend using the default latency and recovery bandwidth overhead values for an initial test stream. After you perform a test stream, you can determine the Quality of Service (QoS) and calculate the latency requirements. To set the SRT stream latency, see Adjust latency and view the SRT stream status.

10. (Optional) In the **Recovery bandwidth overhead** field, adjust the % value of the bandwidth that's dedicate for SRT control and recovery packets. The default value is 25%.

11. (Optional) Rename the stream. Click the current name and enter a different name, then press **Enter**.

12. Click **Apply**.

13. When your ready to start streaming, click **Start**

What's next?

If you need to set up Pearl as an SRT destination and ingest an SRT stream from a remote source, you must add the SRT stream as a input, see Connect an SRT stream as an input.

Adjust latency and view the SRT stream status

Secure Reliable Transport (SRT) achieves high-quality, low-latency streaming across unreliable Internet connections via UDP packets. If packets are lost in transit to the SRT destination, a request to retransmit the lost packets is sent back to Pearl. Using the Admin panel, you can adjust the latency to improve the Quality of Service (QoS) of the stream and reduce the number of dropped packets.

During the SRT stream, you can view the stream statistics using the Admin panel and adjust the amount of latency based on the packet loss % and Round Trip Time (RTT). SRT stream statistics are provided on the streaming configuration page for a channel when Pearl is configured as an SRT source. If Pearl is configured as an SRT destination with an SRT input, then SRT statistics are available on the SRT input configuration page.

The following example shows SRT statistics for an SRT stream. The statistics section appears only while an SRT stream is active. It takes about 30 seconds for the statistics to appear after the SRT connection is established.

You can add from 80 ms to 8000 ms of latency to the SRT stream. Increasing latency gives more time to buffer packets and resend any that got lost in transit to the destination. If the latency value set for the stream is too low and there is packet loss over the network, retransmission of lost packets will not be possible and the stream quality will suffer.

> Latency can be configured at the source and at the destination. SRT uses the highest of the two latency values.

The formula to calculate latency is:

SRT Latency = RTT Multiplier × RTT

where the recommended range of the *RTT Multiplier* is a value from 3 to 20.

The following table provides guidelines for what values to use when calculating latency. An RTT multiplier value less than 3 is too small for SRT to be effective and a value above 20 indicates a network with 100% packet loss. Ensure the measured **buffer** is less than or equal to the latency value you use.

Table 60 *Suggested SRT latency values*

Packet loss %	RTT mul- tiplier	Recovery bandwidth overhead	Minimum SRT latency (for RTT ≤ 20 ms)
% is ≤ 1	3	33	60
% is ≤ 3	4	25	80
% is ≤ 7	5	20	100
% is ≤ 10	6	17	120

These values are from the SRT Deployment Guide. For up-to-date calculations, visit www.srtalliance.org.

For example, if the % of packet loss is 0.53 and the measured RTT is 16.506 ms, the latency calculation is: 49.518 = 3 × 16.506 ms or 50 ms of latency (rounded up).

To adjust the latency and recovery bandwidth overhead for an SRT stream using the Admin panel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. View the SRT statistics for the active stream. Do one of the following:

   a. To open the SRT statistics from the Channels menu, select the channel with the SRT stream to configure and click **Streaming**. The Streaming configuration page opens. Then select the arrow beside the SRT stream to reveal the SRT stream statistics.

   b. To open the SRT statistics from the Inputs menu, select the SRT input. Then on the SRT input configuration page, select the arrow beside Statistics.

> The statistics section only appears while an SRT stream is active.

3. In the **Latency** field, enter a numerical value from 80 ms to 8000 ms.

4. Click **Apply**.

We recommend testing your settings. Start the SRT stream and use the stream statistics to evaluate the effect the latency and recovery bandwidth overhead values have on the packet loss % of the stream.

Set AES encryption and a passphrase for SRT
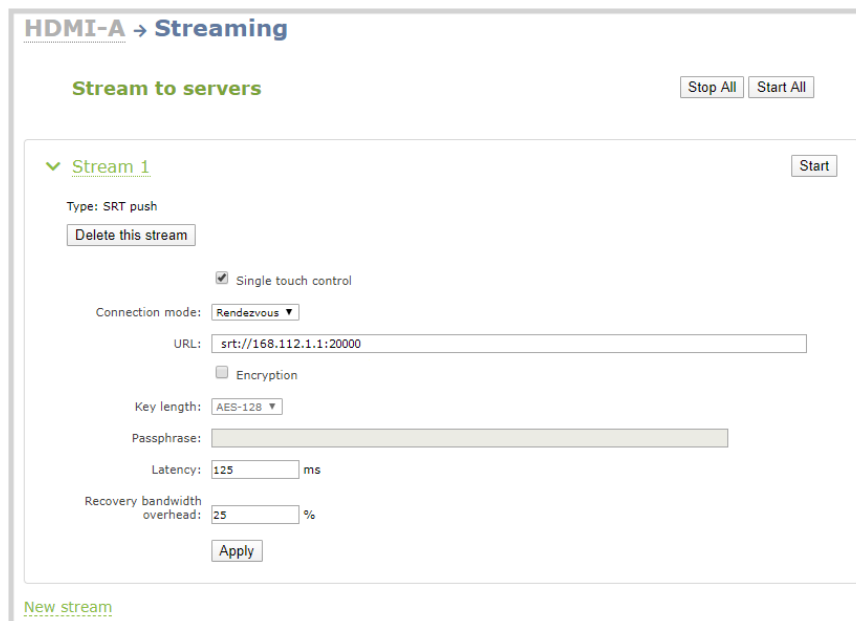
You can configure your Secure Reliable Transport (SRT) streams to use 128 bits, 192 bits, or 256 bits AES encryption using the Admin panel. You can also assign the SRT stream an alphanumeric passphrase if required. The encryption and passphrase settings on the SRT encoder sending the stream must match the settings on the SRT decoder receiving the stream.

The encryption key length is negotiated between the source and destination devices. The largest key length setting is what both devices will use for the stream. As long as the passphrases match, the key length will be negotiated.

To set up AES encryption and a passphrase for SRT using the Admin panel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. To set the AES encryption and passphrase for an SRT stream, do the following:

1. From the Channels menu, select the channel with the SRT stream to configure and click **Streaming**. The Streaming configuration page opens.

2. Click the arrowhead beside the SRT stream name to reveal the stream settings. In this example, the name of the SRT stream is Stream 1.

3. Check Encryption and choose the **Key length**.

4. In the **Passphrase** field, enter the passphrase using alphanumeric characters (if required).

5. Click **Apply**.

3. To set the AES encryption and passphrase for an SRT input, do the following:

a. From the Inputs menu, select the SRT input you want to configure. The SRT input configuration page opens.

b. Check Encryption and choose the **Key length**.

c. In the **Passphrase** field, enter the passphrase using alphanumeric characters (if required). Special characters are not supported.

d. Click **Apply**.

Set up an HLS (push) stream

HTTP Live Streaming (HLS) is an adaptive, HTTP-based streaming protocol that sends video and audio content over the network in small, media segments that get reassembled at the streaming destination. Media segments stream over HTTP port 80 or port 443 for HTTPS, which are typically open for network access. As such, the content can easily traverse firewalls with little to no IT involvement.

Pearl can send a single resolution and bitrate HLS stream as an HTTP POST (or HTTP PUT) to HLS ingestion servers and CDNs such as Akamai and YouTube. The default is HTTP POST. Your channels on Pearl must be configured for H.264 and AAC audio codec to stream using HLS. Pearl uses MD5 hashing algorithm to authenticate the stream.

HLS uses an MPEG2-TS transport stream container with a configurable media segment duration, as well as a configurable playlist size for reassembling the media segments at the ingestion server. Because HLS favors Quality of Service (QoS) over low-latency, lag times that can be high. If a specific media segment size isn't required by the ingestion server, then you can shorten the duration of the media segment to decrease latency. The default segment duration is six seconds.

Using the Admin panel, you can add advanced features like a master manifest, which is an address applied to each individual media playlist in the stream. You can also assign the HLS stream a user name and password. If security and authentication credentials are required to stream to the ingestion server, consult the ingestion server provider.

Important considerations

- Only a single resolution and bitrate stream is supported.

- Set the channel you're streaming to H.264 video encoding.

- Only MD5 hashing algorithm for digestion authentication is supported.

- Fragmented MP4 is not supported.

- If the HLS ingestion server requires a custom user-agent name, add that to the HLS stream in the Advanced settings using the Admin panel and ensure the agent-name is added to the HLS ingestion server's white list. Contact the IT administrator responsible for the ingestion server.

- If the HLS ingestion server requires a user name and password, you can get those credentials from the IT administrator responsible for the ingestion server.

To stream using HLS (push):

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Channels menu, select a channel and click **Streaming**. The Streaming configuration page opens.

3. Click **New stream** and choose **HLS push**. The new stream is created using the default name *Stream 1*. To see the settings, click the stream name.

4. In the **Media Playlist URL field**, enter the URL of the destination server that is ingesting the stream. For example: *http://p-ep721023.i.akamaientrypoin.net/722223/hlsQualification/my_video.m3u8*

5. (Optional) In the **Segment template** field, enter the naming format used for the names of media segments. For example: *chunk-$Number%05d$.ts*

6. (Optional) Enter a **Username** and **Password** if required for this stream. Get this from the ingestion server provider.

7. In the **Method** field, select **POST** or **PUT**. This selection must match the requirements of the ingestion server.

8. In the **Segment duration** field, enter the length of the media segment in seconds. The default duration is six seconds. Fractions and periods are not supported.

9. In the **Playlist size** field, enter the number of .ts segment files in each segment. The default playlist size is six.

10. (Optional) Under **Advanced settings**, you can set the following:

    a. **Master manifest**: Enter the URL (including the master playlist file name) of where Pearl will upload the master manifest file. The master playlist also provides the bitrate, resolution, and codec.

     b. **User-agent**: Enter a user-agent name using alphanumerical characters only if the ingestion server requires a specific value in the user-agent header to allow the incoming stream from this device.

11. Click **Apply**.

12. When you're ready to start streaming this channel, click **Start**.

For details on how to start and stop streaming using the touch screen, see Stream a channel using the touch screen. To learn how to start and stop streaming using Epiphan Live, see Control streaming and recording. For details about using the One Touch feature to control your recording and streaming across multiple channels and recorders simultaneously with the touch of a button, see About One Touch streaming and recording.

Set up an MPEG-DASH (push) stream

MPEG-DASH (Dynamic Adaptive Streaming over HTTP) is an open standard, adaptive HTTP-based streaming protocol that sends video and audio content over the network in small, media segments that get reassembled at the streaming destination. Media segments can stream over HTTP port 80 or port 443 for HTTPS, which are typically open for network access. As such, the content can easily traverse firewalls with little to no IT involvement.

As an open standard, MPEG-DASH is designed to be codec and resolution agnostic. Pearl can send a single resolution and bitrate MPEG-DASH stream as an HTTP POST (or HTTP PUT) to HLS ingestion servers and CDNs such as Akamai and YouTube. The default is HTTP POST. Your channels on Pearl must be configured for H.264 and AAC audio codec to stream using MPEG-DASH. Pearl supports using MD5 hashing algorithm to confirm the identity of Pearl to the ingestion server.

MPEG-DASH uses an MPEG2-TS transport stream container with a configurable media segment duration, as well as a configurable DASH list size for reassembling the media segments at the ingestion server. Because MPEG-DASH favors quality of Service (QoS) over low-latency, lag times that can be high. If a specific media segment size isn't required by the ingestion server, then you can shorten the duration of the media segment to decrease latency. The default segment duration is six seconds.
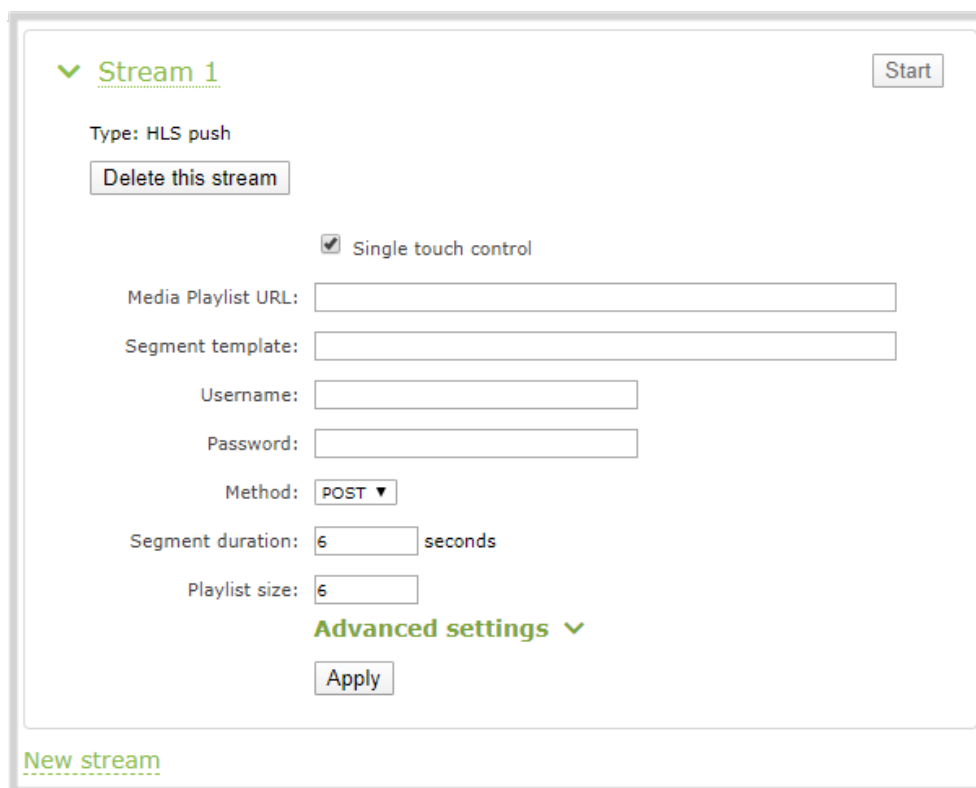
Using the Admin panel, you can configure advanced features like enabling DASH multiplex streaming. You can also assign the MPEG-DASH stream a user name and password.

The following table lists the optional advanced MPEG-DASH parameters. Check with the ingestion server provider to confirm if any of these parameters need to be configured.

Table 61 *Advanced MPEG-DASH parameters*

Item	Description
DASH Multiplex streams	Check this parameter to enable multiplex streams. When enabled, video and audio are sent

Item	Description
	in the same segment file instead of one segment for audio and a different one for the video.
Embedded initialization segment	Check this parameter to enable inserting an embedded initialization segment into this stream. When enabled, initialization data for the stream is embedded in the MPEG DASH MPD file instead of sending it separately.
User-Agent	If the ingestion server requires or only allows incoming streams with specific values in the user-agent header, use this parameter to configure Pearl with the value to insert in its user-agent header.
Initialization template	Use this field to specify the name of the initialization file that Pearl sends to the ingestion server. Check with the ingestion server provider for what value to use.
Media segment template	Use this field to specify the name of the media segment file that Pearl sends to the ingestion server. Check with the ingestion server provider for what value to use.
DASH MPD upload period	Set the duration as an integer in seconds. The acceptable range is from 1 to 999 seconds. The default value is 60 seconds. Fractions and periods are not allowed.
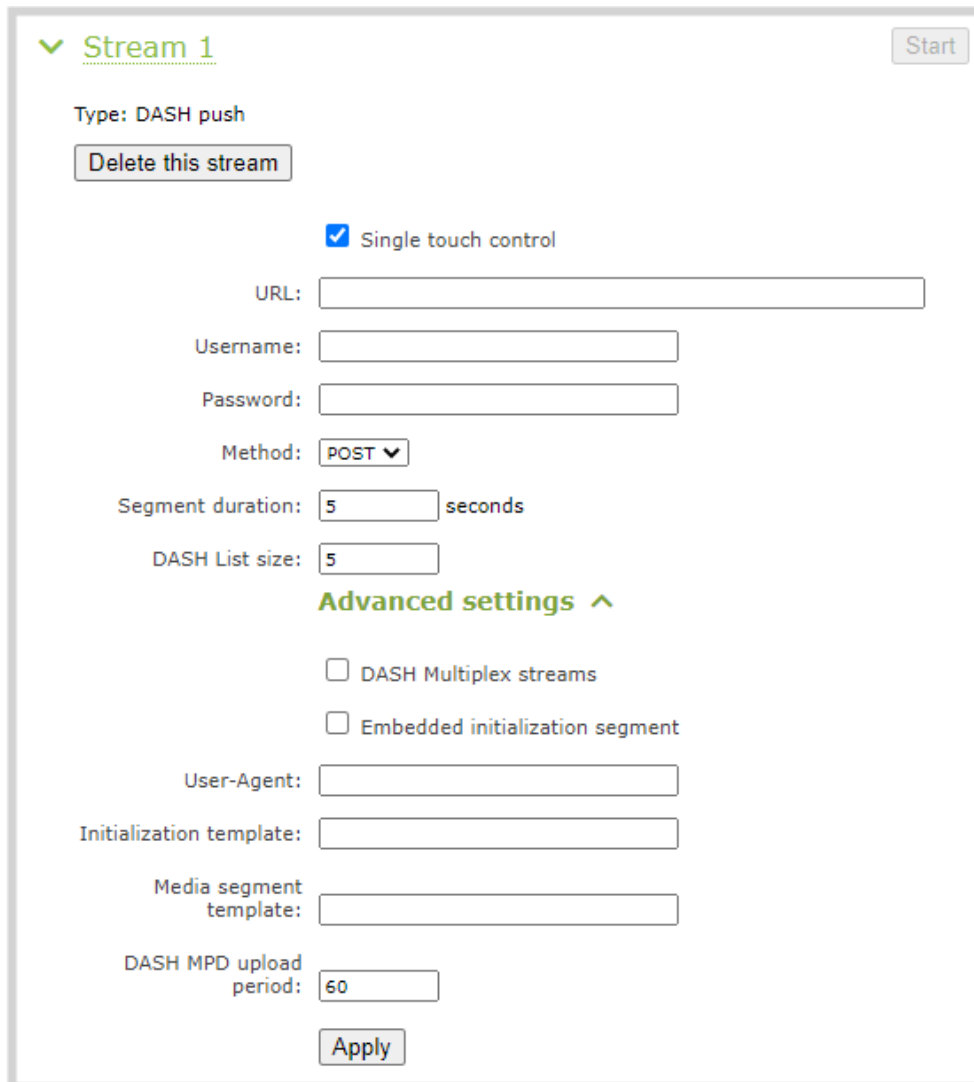
Important considerations

- Only a single resolution and bitrate stream is supported.
- Set the channel you're streaming to H.264 video encoding.
- Only MD5 hashing algorithm for digestion authentication is supported.
- Fragmented MP4 is not supported.
- If the MPEG-DASH ingestion server requires a user name and password, you can get those credentials from the IT administrator responsible for the ingestion server.

To stream using MPEG-DASH (push):

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Channels menu, select a channel and click **Streaming**. The Streaming configuration page opens.

3. Click **New stream** and choose **DASH push**. The new stream is created using the default name *Stream 1*. To see the settings, click the stream name.

4. In the **URL field**, enter the URL of the destination server that is ingesting the stream. For example: *http://p-ep721023.i.akamaientrypoin.net/722223/hlsQualification/my_video.m3u8*

5. (Optional) Enter a **Username** and **Password** if required for this stream. Get this from the ingestion server provider.

6. In the **Method** field, select **POST** or **PUT**. This selection must match the requirements of the ingestion server.

7. In the **Segment duration** field, enter the length of the media segment in seconds. The default duration is five seconds. Fractions and periods are not supported.

8. In the **DASH List size** field, enter the number of .ts segment files in each segment. The default playlist size is five.

9. (Optional) Under **Advanced settings**, you can set the following:

    a. Check **DASH Multiplex streams** to enable multiplex streaming.

    b. Check **Embedded initialization segment** to add an optional initialization segment to the stream.

    c. **User-agent**: Enter a user-agent name using alphanumerical characters only if the ingestion server requires that to allow the incoming stream from this device.

    d. **Initialization template**: Enter the address to use for each individual DASH list in the stream. The initialization template also provides the bitrate, resolution, and codec.

    e. In the **Media segment template** field, enter the naming format used for the names of media segments. For example: *chunk-$Number%05d$.ts*

    f. Enter the **DASH MPD upload period** as an integer in seconds. The default is 60 seconds.

10. Click **Apply**.

11. When you're ready to start streaming this channel, click **Start**.

For details on how to start and stop streaming using the touch screen, see Stream a channel using the touch screen. To learn how to start and stop streaming using Epiphan Live, see Control streaming and recording. For details about using the One Touch feature to control your recording and streaming across multiple channels and recorders simultaneously with the touch of a button, see About One Touch streaming and recording.

Set up an RTSP announce stream

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Channels menu, select a channel and click **Streaming**. The Streaming configuration page opens.

3. Click **New stream** and choose **RTSP announce**. The new stream is created using the default name Stream 1.

4. Click the stream name to see the stream settings.

5. (Optional) To rename the stream, click the current name and type a different name, then press **Enter**.

6. (Optional) Uncheck **Single touch control** if you don't want this stream to be started and stopped using One Touch streaming and recording control (checked by default).

7. Enter the following parameters:

   - The **URL** of the ingestion point provided by the CDN or media server.

   - Select the **Transport type** as either UDP or TCP. Consult your CDN provider to find out which transport protocols the CDN supports.

   - The CDN **User name** and **Password** (if required).

   > The CDN provider assigns a user name and password to authenticate the publisher. Contact the CDN provider for your log in credentials.

8. Click **Apply**.

9. To start streaming, click **Start** or click **Start all** to simultaneously start this stream and any other streams you have configured for this channel.

10. Click **Delete this stream** at any time to delete the stream.

See Start and stop streaming to a CDN for instructions to control streaming from the touch screen or see Control streaming and recording for instructions to use Epiphan Live.

Stream to a CDN using an XML profile

Some CDNs provide an XML file for easy configuration.

To stream to a CDN using an XML profile:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Channels menu, select a channel and click **Streaming**. The Streaming configuration page opens.
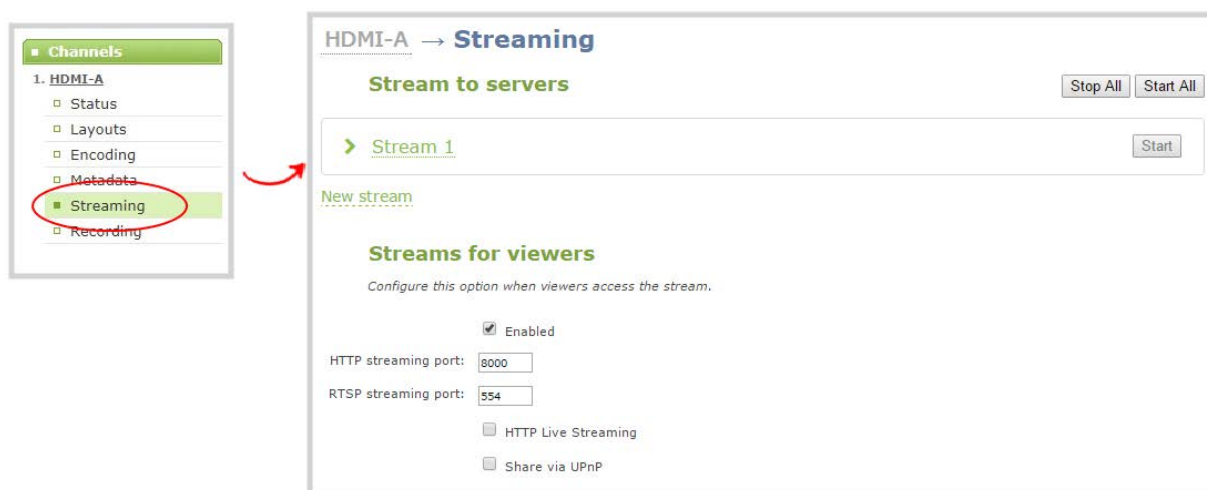
3. Click **New stream** and select **Use profile XML**.

4. Select the XML file that was provided by your CDN provider, then click **OK**. The new stream is created using the default name Stream 1 and the configuration from the XML file is applied.
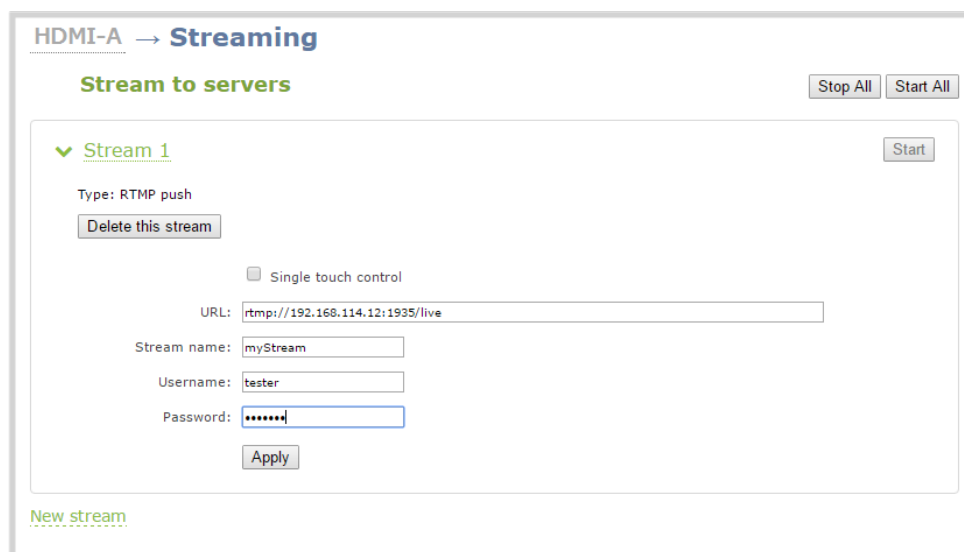
5. Click **Apply**.

6. To start streaming, click **Start** or click **Start all** to simultaneously start this stream and any other

streams you have configured for this channel.

7. Click **Delete this stream** at any time to delete the stream.
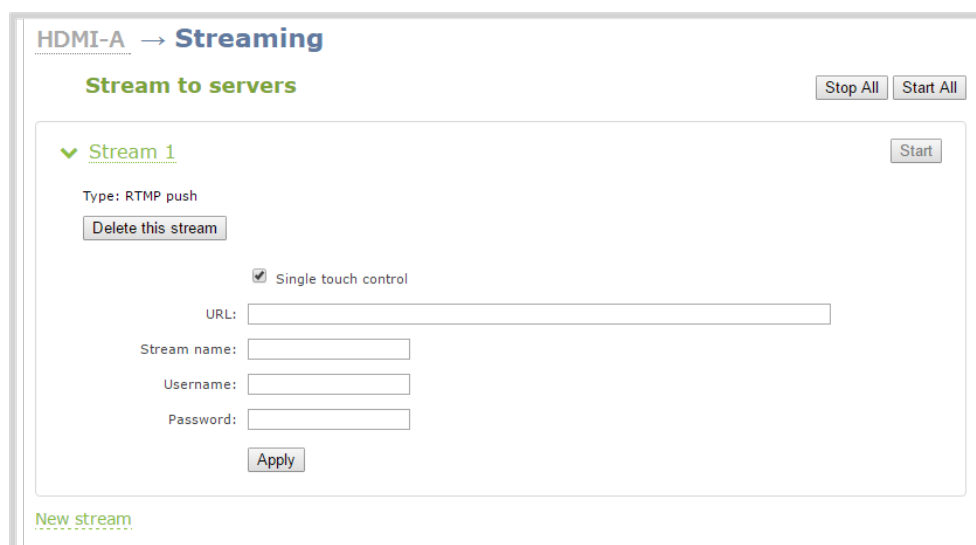
See Start and stop streaming to a CDN for instructions to control streaming from the touch screen or see Control streaming and recording for instructions to use Epiphan Live.

Start and stop streaming to a CDN

After your CDN streaming is configured for RTMP or RTSP, you can start and stop streaming using the Admin panel, the touch screen, or Epiphan Live.

To start and stop streaming using the Admin panel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Channels menu, select a channel and click **Streaming**. The Streaming configuration page opens.

> To set up a stream using the Admin panel, click **New stream** and follow the instructions for how to **Streaming to a CDN or multicast streaming**.

3. Click **Start** at the top right corner to start that stream, or click **Start all** at the top of the page to start streaming all streams that are configured for that channel.

4. Click **Stop** at the top right corner to stop that stream, or click **Stop all** at the top of the page to stop streaming for all streams that are configured for that channel.

You can tell if your channel is streaming from the touch screen on Pearl when you look at the channel view or the Grid view. The following shows an example Grid view.

- A blue dot in the top right corner means the channel is currently streaming.
- A yellow dot with an exclamation mark means a problem with streaming occurred that requires attention.
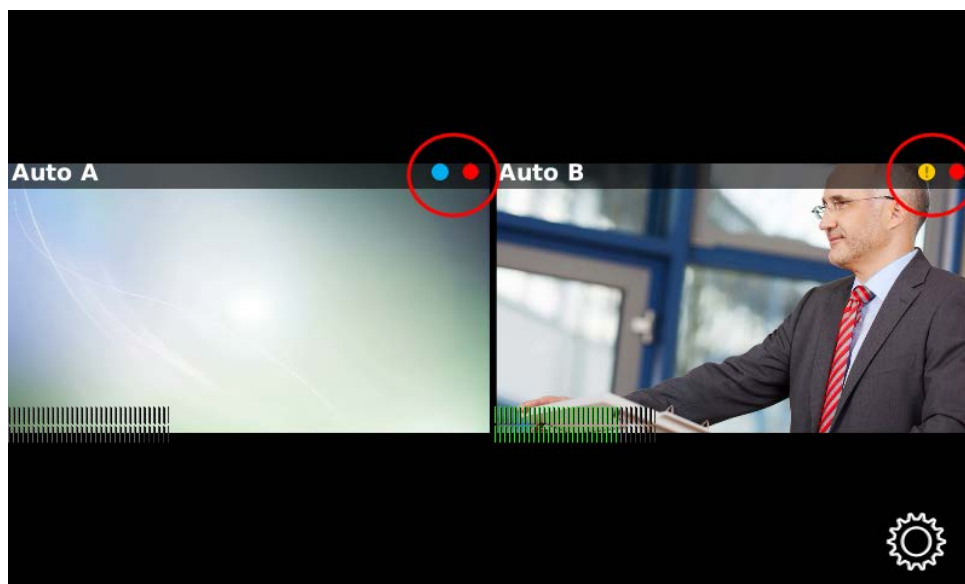
For details to start and stop streaming using the touch screen, see Stream a channel using the touch screen.

For details to start and stop streaming using Epiphan Live, see Control streaming and recording.

To learn how to use One Touch feature to control your recording and streaming across any number of specified channels and recorders simultaneously with the touch of a button, see About One Touch streaming and recording.
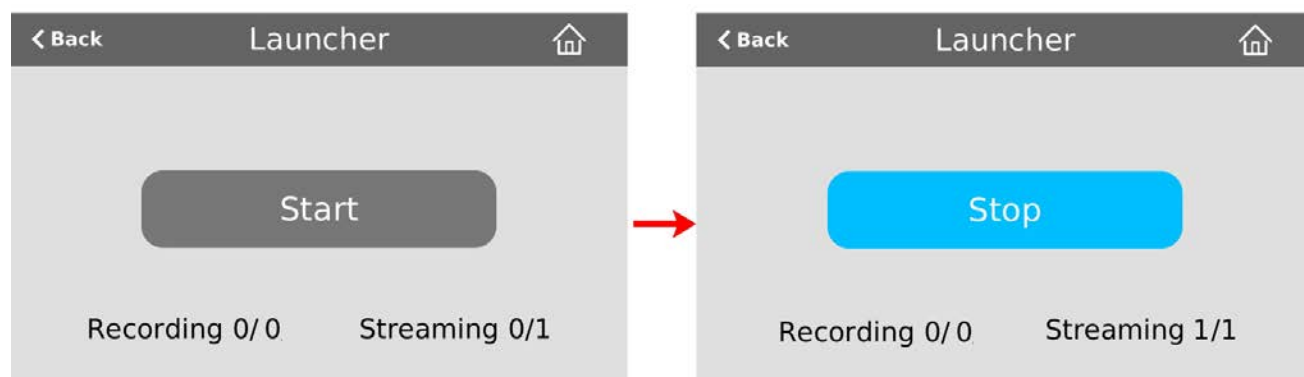
Multicast streaming

A multicast stream consists of one stream distributed to many viewers via a multicast-capable network. You can stream to several multicast networks and at the same time, stream to non-multicast CDNs.

Pearl supports multicast streaming content to an IP TV or a set-top box playlist when the stream format is MPEG-TS. You can add multiple multicast streams to a channel.

Topics include:

- MPEG-TS streams using RTP/UDP push
- MPEG-TS streams using UDP push
- Multicast streaming using RTP/UDP
- Set up traffic shaping
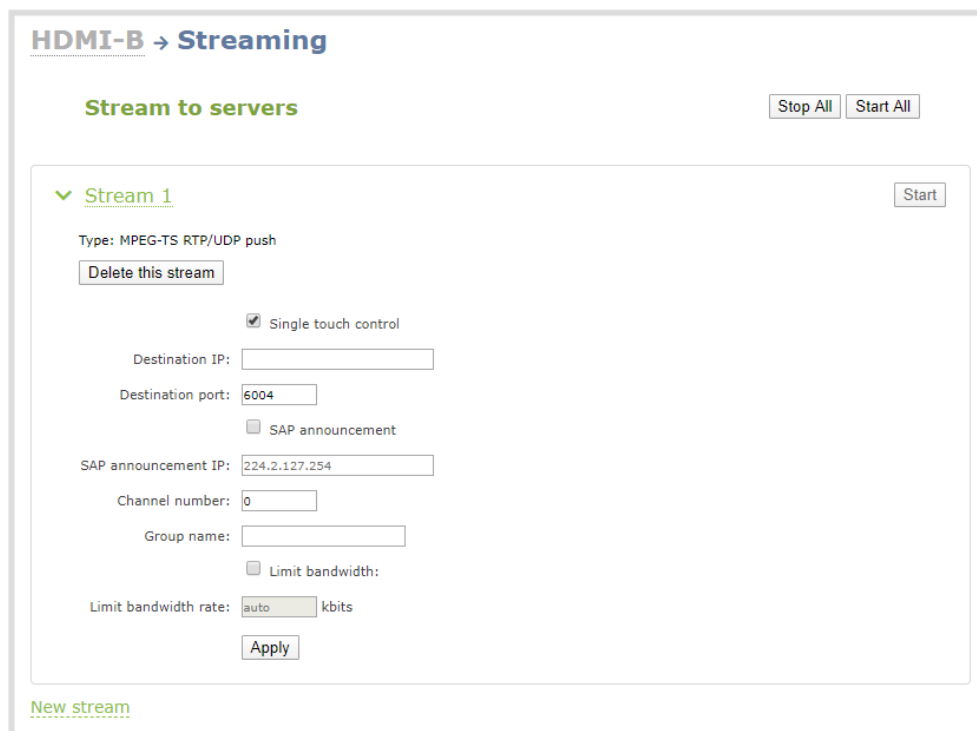
MPEG-TS streams using RTP/UDP push

Before configuring your channel for MPEG-TS streaming, ensure the following codecs are configured:

- Video – H.264
- Audio – MP3 or AAC, if audio is configured.

To configure your channel for MPEG-TS using RTP/UDP push:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Channels menu, select a channel and click **Streaming**. The Streaming configuration page opens.

3. Click **New stream** and select **MPEG-TS RTP/UDP push**.

4. Enter the destination multicast IP address where the broadcast can be viewed.

> A IPv4 multicast address range is an address between 224.0.0.0 to 239.255.255.255.
> Contact your System Administrator for the specific address to use.

5. Enter the destination port number through which the media will stream.

6. (Optional) To advertise your stream to a media player over a local network, do the following:

    a. Check **SAP announcement** to enable advertising your stream over a local network. When this is enabled and a multicast IP address is configured, your stream is displayed in the playlist of the local media player.

    b. Enter a multicast IP address in the **SAP announcement IP** field. If your media player is configured to receive multicast streams from an IP address that is different from the default address 224.2.127.254, you may need to contact your system administrator for a specific multicast IP address.

    c. Enter a channel number in the **Channel number** field to identify your stream in the media player. By default, the Channel number is the channel identifier.

> When a channel number value is not specified, viewers cannot select a channel from the set-top box or Smart TV .

    d. Enter a name for a group of streams in the text box next to **Group name**. Since media players simply present a list of available streams, you can organize your streams into multiple folders or in cases where folders are not displayed, use dot separator hierarchy to help your viewers filter out unwanted streams by category.

7. Click **Apply**.

8. Select **Start** when you're ready to start streaming.

9. Select the **Info** menu to see the stream information.

To view the stream from a media player, open the URL in a media player, for example:

> rtp://@ip:port or in the case of the sample configuration in the figure shown above:
>
> rtp://@226.10.24.32:7000

To view the stream when SAP announce has been set and the stream is advertised on a media player, set-top box or Smart TV, refer to Viewing with Session Announcement Protocol (SAP).

If you're streaming to 10/100 Mbps set-top boxes over Gigabit Ethernet and you notice frames are dropping, you can limit the bandwidth of the stream, see Set up traffic shaping.

MPEG-TS streams using UDP push

Before configuring your channel for MPEG-TS streaming, ensure the following codecs are configured in the encoding section:

- Video – H.264

- Audio – MP3 or AAC, if audio is configured.

To configure MPEG-TS with UDP push:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

3. From the Channels menu, select a channel and click **Streaming**. The Streaming configuration page opens.

4. Click **New stream** and select **MPEG-TS UDP push**.

5. Enter the destination multicast IP address where the broadcast can be viewed.

> A IPv4 multicast address range is an address between 224.0.0.0 to 239.255.255.255. Contact your System Administrator for the specific address to use.

6. Enter the destination port number through which the media will stream.

7. (Optional) To advertise your stream to a media player over a local network, do the following:

   a. Check **SAP announcement** to enable advertising your stream over a local network. When this is enabled and a multicast IP address is configured, your stream is displayed in the playlist of the local media player.

   b. Enter a multicast IP address in the **SAP announcement IP** field. If your media player is configured to receive multicast streams from an IP address that is different from the default address 224.2.127.254, you may need to contact your system administrator for a specific multicast IP address.

   c. Enter a channel number in the **Channel number** field to identify your stream in the media player. By default, the Channel number is the channel identifier.

> ✅ When a channel number value is not specified, viewers cannot select a channel from the set-top box or Smart TV .

d. Enter a name for a group of streams in the text box next to **Group name**. Since media players simply present a list of available streams, you can organize your streams into multiple folders or in cases where folders are not displayed, use dot separator hierarchy to help your viewers filter out unwanted streams by category.

8. Click **Apply**.

9. Select **Start** when you're ready to start streaming.

To view the stream, open the URL in a media player, for example:
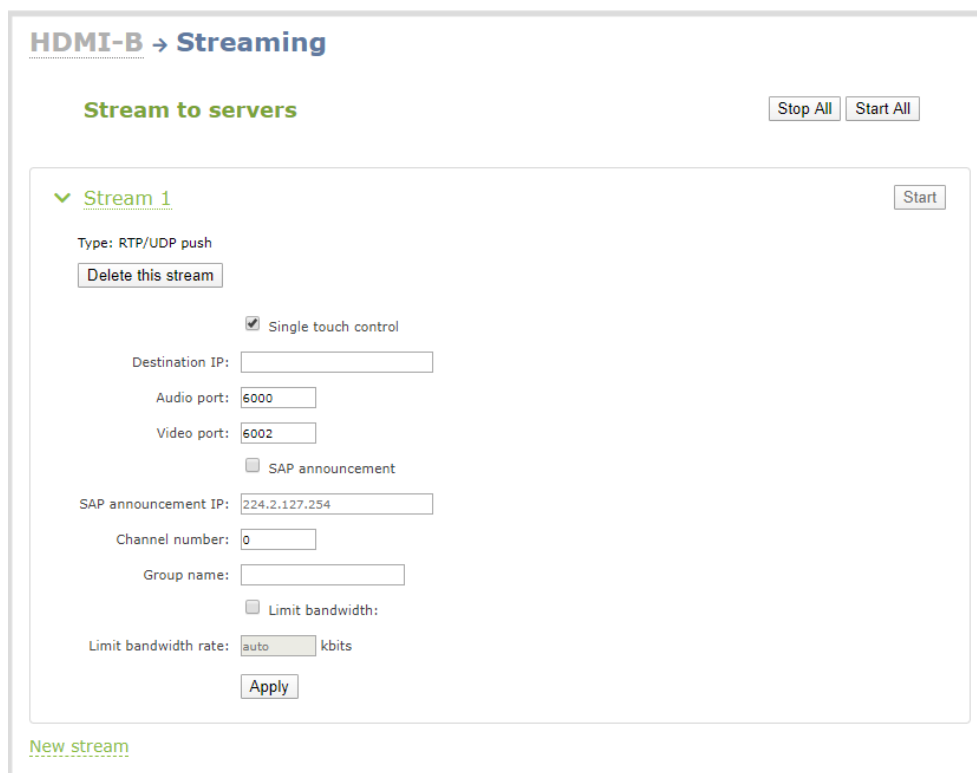
> udp://@ip:port
>
> **For example:** udp://@226.10.24.32:7000

To view the stream when SAP announce has been set and the stream is advertised from a media player, set-top box or Smart TV, refer to Viewing with Session Announcement Protocol (SAP).

If you're streaming to 10/100 Mbps set-top boxes over Gigabit Ethernet and you notice frames are dropping, you can limit the bandwidth of the stream, see Set up traffic shaping.

Multicast streaming using RTP/UDP

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

3. From the Channels menu, select a channel and click **Streaming**. The Streaming configuration page opens.

4. Click **New stream** and select **RTP/UDP push**.

5. Enter the following:

    ● Destination multicast IP address.

    ● Audio port number through which the audio will stream.

    ● Video port number through which the video will stream.

> Audio and video use nearby port numbers (<port number>and <port number+2>). The minimum
> distance between audio and video ports must be 2.

6. Click **Apply**. An SDP file is generated.

7. From the channel's **Status** page, click the SDP file to download it. Provide the SDP file name and
    location if prompted.

8. Share the file with your viewers and when you're ready to start streaming, select **Start**.

If you're streaming to 10/100 Mbps set-top boxes over Gigabit Ethernet and you notice frames are dropping,
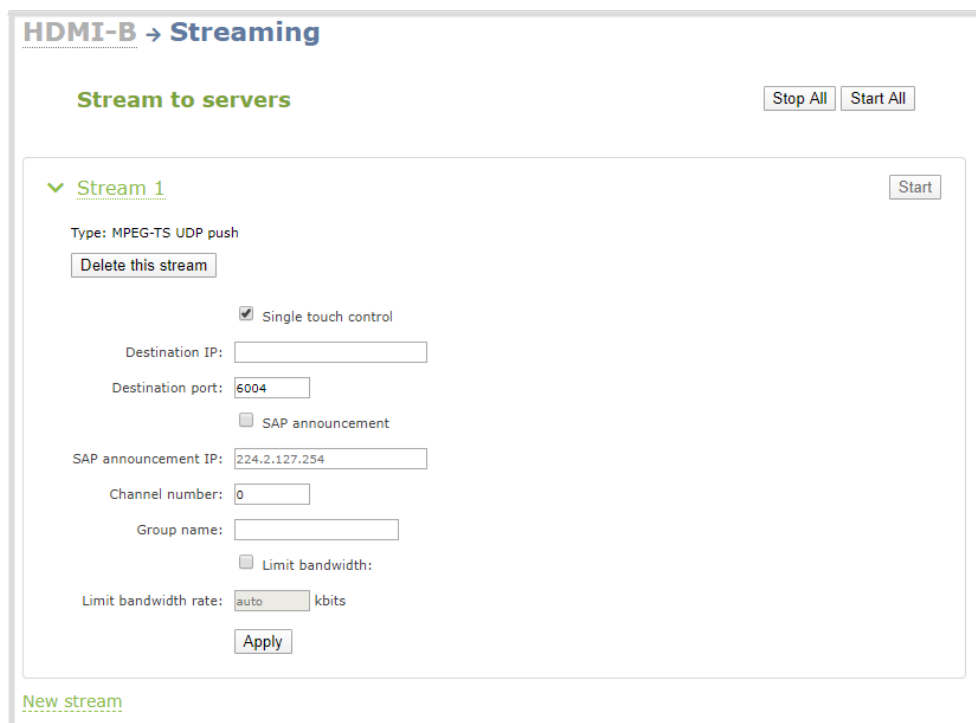you can limit the bandwidth of the stream, see Set up traffic shaping.

Set up traffic shaping

If you're multicasting to set-top boxes that have 10/100 Mbps interfaces on the same Gigabit Ethernet and you notice frames are dropping, you can limit the bandwidth of the stream using traffic shaping to adapt for the lower bandwidth set-top boxes. Only multicast streams support traffic shaping: MPEG-TS USP, MPEG-TS RTP/UDP, and RTP/UDP.

> If traffic shaping was previously setup using the API, we recommend switching to this method of setting traffic shaping using the Admin panel. See **Limitations and known issues** for instructions if traffic shaping is currently setup using Pearl's API.

When traffic shaping is enabled, the default bitrate limit is set to auto. In auto mode, the bitrate is limited to the sum of the channel's configured bitrate plus 4 Mbps and is adjusted to fit within the range of 4 Mbps minimum to 95 Mbps maximum.

You can also set a bitrate limit for the maximum amount of bandwidth that gets streamed using the Admin panel when traffic shaping is enabled. When you do, the streamed video won't exceed the maximum bitrate you set. The valid bandwidth limit bitrate range is 4 Mbps to 95 Mbps. We recommend that you set the bitrate to a value no less than the channel encoding bitrate plus 4 Mbps.

For example, if the bitrate for the channel is set to 10 Mbps in the encoding settings, the minimum value we recommend for the bandwidth limit bitrate is 14 Mbps.
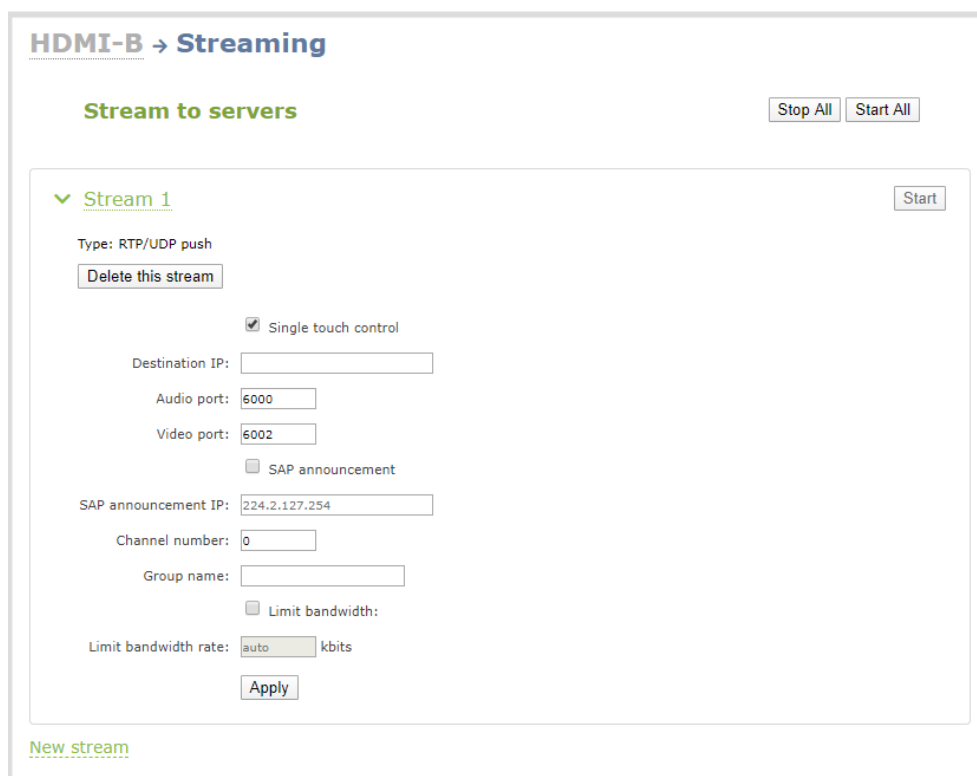
Important considerations

- Traffic shaping works for the local switch. Switches connected to the local switch don't respect the policy.

- If the channel encoding bitrate is set to a value that's less than 4 Mbps and traffic shaping is enabled, the minimum bandwidth limit does not drop below than 4 Mbps.

- If the channel encoding bitrate value is greater than 95 Mbps and traffic shaping is enabled, the maximum bandwidth limit does not exceed 95 Mbps.

- If the bandwidth limit is set to auto and the total of the channel bitrate plus 4 Mbps exceeds 95 Mbps, the maximum bandwidth limit does not exceed 95 Mbps.

- After enabling traffic shaping for a channel using the Admin panel, you can no longer use the Pearl API to clear or configure traffic shaping for that channel. If you currently use the API to configure traffic shaping, see Limitations and known issues.

After traffic shaping is enabled, we recommend that you first test a multicast stream using the auto traffic shaping settings. If your low bandwidth network device is displaying poor video quality, then go ahead and manually set the limit bandwidth bitrate according to the bandwidth of your particular network device.

To set traffic shaping for a multicast stream:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Channels menu, select a channel and click **Streaming**. The Streaming configuration page opens.

3. Click **New stream** and select a multicasting stream as the type: **MPEG-TS USP**, **MPEG-TS RTP/UDP**, or **RTP/UDP**. The new stream is created with the default name *Stream 1*.

4. Click the stream name to see the stream settings.

5. Check **Limit bandwidth**. The default bitrate is set to **auto**.

6. (Optional) Set the **Limit bandwidth rate** and enter a bitrate value from 4,000 kbps to 95,000 kbps.

7. Click **Apply**.

Viewing with Session Announcement Protocol (SAP)

When SAP Announce is configured for a stream that uses UDP streaming, the stream is advertised over the local network. Local viewers can view the stream using a software or hardware media player. Viewers are presented with a list of available channels, similar to a television menu. Viewers need only click on a stream and the video is streamed to their desktop, mobile or tablet. To configure SAP announce, go to Multicast streaming.

Your stream is advertised by the metadata title, if one was configured under Branding, otherwise it is identified by its channel identifier. For a description of how to set the metadata, refer to Add or remove channel metadata.

When browsing from a VLC media player, streams are advertised by their channel identifier and are organized by the group name. When browsing from an XBMC media player, streams are advertised by the stream's metadata title (if configured), otherwise streams are advertised by their channel identifier.

1. Ensure the stream has SAP announcement enabled, otherwise, it is not advertised in the media player's playlist.

2. Ensure the SAP announcement IP is a multicast IP address.

> Some media players, for example Exterity receivers, listen for SAP announcements on a specific multicast address 239.255.255.255. If your audience is using Exterity to view your stream, you must change the SAP announcement IP address to 239.255.255.255.

4. Launch a media player and play the streams.

   a. Using VLC, click **View** and select Playlist. The right-hand panel indicates the playlist is empty.

   b. From the side menu, click **Network streams (SAP)**. The playlist is populated with all streams in your network that are SAP announcement enabled. If you specified a Group Name when you configured the publish stream the stream will be listed in folder identified by the group name.

   c. Click on a live stream in the playlist to play the stream.

   This VLC example shows two streams D2P83658.vga and D2P83658.video, which are organized in a folder by their group name.
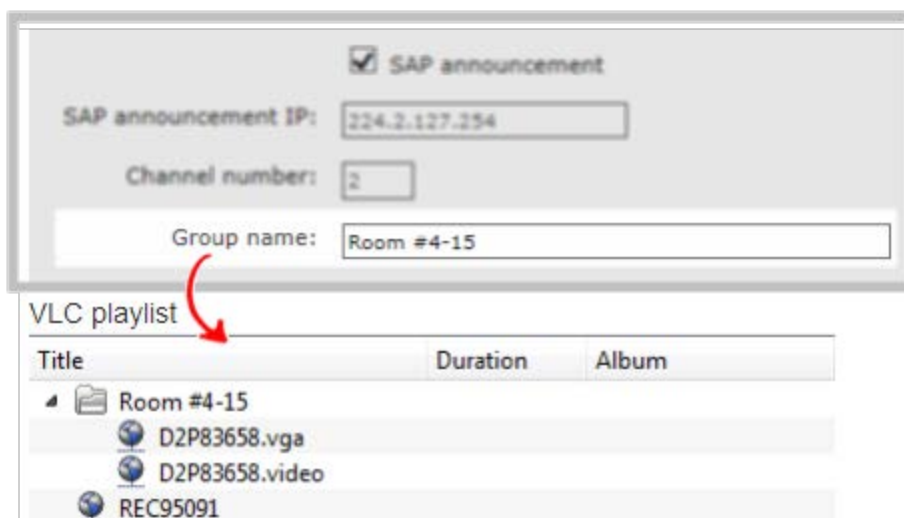
Streaming to a media player or smart TV

Your Pearl can use UPnP and SAP to stream to set-top boxes, digital signs, smart TVs and other digital media players.

The following table gives an overview of each option.

Publishing Options	Use this option to...
UPnP	Using the Universal Plug and Play (UPnP) networking protocol, your Pearl can be discovered and can stream to software and hardware media players, set-top boxes and Smart TVs with ease.
SAP	Viewing with Session Announcement Protocol (SAP)SAP (session announcement protocol) is a protocol for broadcasting multicast session information. Media players can see the announcement or can use the multicast SDP file (session description file) directly.

> To stream video outside of your LAN, use a CDN or configure port forwarding on your router. Refer to your Network Administrator. Network configuration is beyond the scope of this guide.

Stream using UPnP

Using the Universal Plug and Play (UPnP) networking protocol, your Pearl can be discovered and can stream to software and hardware media players, set-top boxes and Smart TVs with ease. If UPnP is enabled, Pearl automatically establishes communication with media players on the network.

UPnP uses MPEG-TS over HTTP with the H.264 codec and MP3 or AAC audio encoding (or no audio). You can only access live streams or recordings that meet these requirements.

For security reasons, UPnP access to live streams and recorded files is disabled by default.

> **STOP** Some players can not access the stream or saved recordings if a viewer password is set. See **User administration** to remove the viewer password if set.

Topics include:

- Enable UPnP
- Disable UPnP
- Viewing with UPnP

- Play directly to a media player

- Auto-restart playback to a UPnP device

- Change UPnP device name

To choose recordings or live streams from your media player, see Play directly to a media player.

Enable UPnP

For security reasons, UPnP is disabled for Pearl at the device level and for each channel by default. You can enable UPnP to allow digital media players on the network to browse for recorded media files or live streams on your Pearl.

There are two steps to enable UPnP on Pearl:

- Enable UPnP at the device level (including setting a share name)

- Enable UPnP for channels and recorders
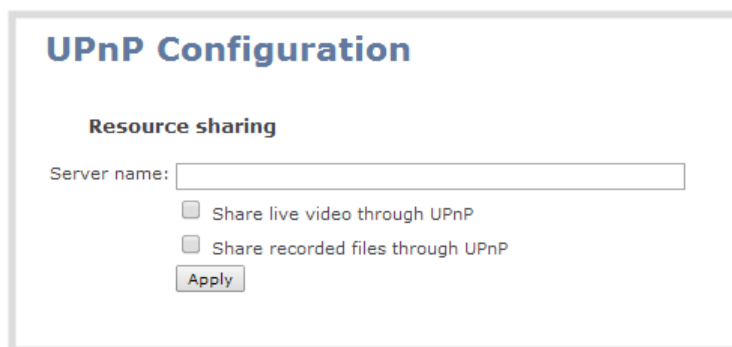
> Streams and MPEG-TS recorded files must use the supported codecs: H.264 with MP3 or AAC audio. Having a viewer password could prevent the ability to use UPnP.

Enable UPnP for the device

To enable UPnP sharing for the device:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

3. From the Configuration menu, click **UPnP**. The UPnP configuration page opens.

4. Enter a name in the **Server name** field. If no name is provided the server name will be the serial number of Pearl.

5. Select whether you want to share live video and recorded files and click **Apply**.

If no live stream is available that meets the criteria for UPnP, a message is displayed in the **Play on service start** section of the page.

Otherwise, the Play on service start section shows a drop-down list of what can be streamed.

Enable UPnP for channels and recorders

After you enable UPnP for the device to allow live stream and recorded file sharing, you need to enable sharing for each channel and recorder you want to share.

To enable UPnP sharing for channels and recorders:

1. For channels (live streaming):

   a. Click **Streaming** for the channel. The Streaming configuration page opens.

   b. Check **Share via UPnP** and click **Apply**.

If you have not already enabled UPnP for the device, the message "UPnP live video sharing is not enabled with this device, to fix it, click here" appears. Click **to fix it click here**. The UPnP service will start when you click **Apply**.

2. For channels (recorded files):

   a. Click **Recording** for a channel. The channel's recording page opens.

   b. Click **change** under Recorder Setup. The recording setup options opens.
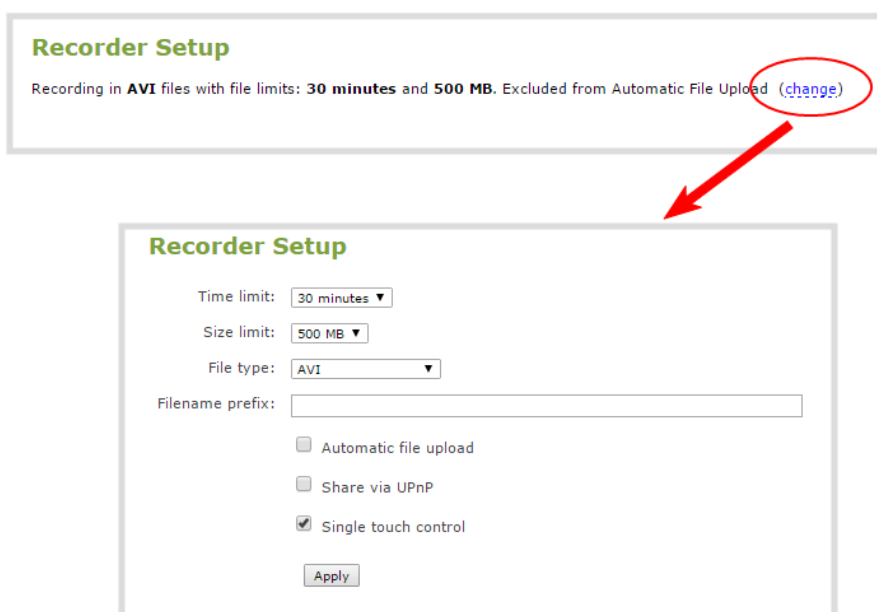
   c. Check **Share via UPnP** and click **Apply**.

   If you have not already enabled UPnP for the device, the message "UPnP live video sharing is not enabled with this device, to fix it, click here" appears. Click **to fix it click here**. The UPnP service will start when you click **Apply**.

3. For recorders:

   a. Click **Recording** for a channel. The channel's recording page opens.

   b. Click **change** under Recorder Setup. The recording setup options open.
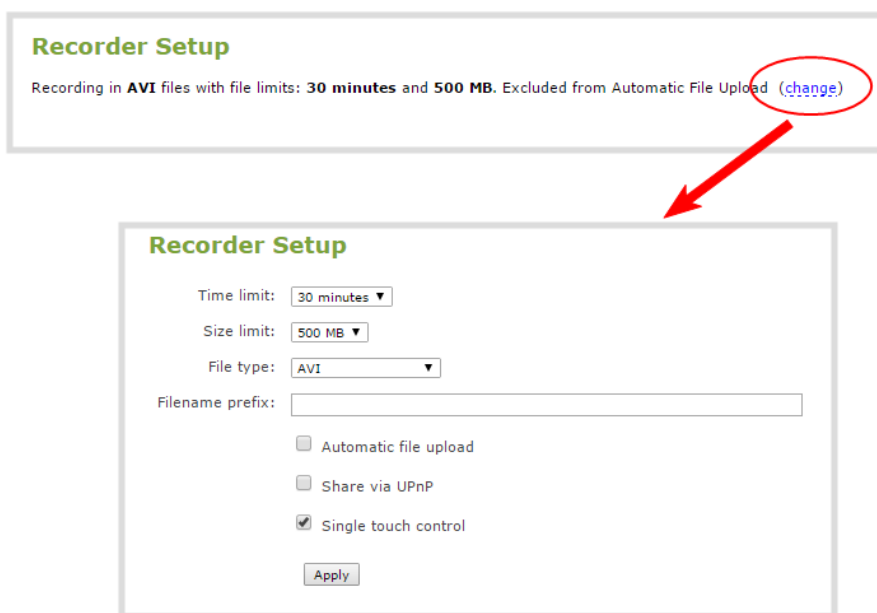
c. Check **Share via UPnP** and click **Apply**.

    If you have not already enabled UPnP for the device, the message "UPnP live video sharing is not enabled with this device, to fix it, click here" appears. Click **to fix it click here**. The UPnP service will start when you click **Apply**.

You can now browse for your server from your digital media player.

Disable UPnP

By default, UPnP sharing is disable for the device, and for each channels and recorder. If you enabled UPnP sharing it for a particular broadcast, you may want to disable UPnP sharing after the broadcast is complete. You can choose to disable access to live streams, recorded files, or to the whole system.

To disable UPnP for a channel or recorder:

1. For channels:

    a. Click **Streaming** for the channel. The Streaming configuration page opens.

    b. Uncheck **Share via UPnP** and click **Apply**.

2. For recorders:

    a. From the Recorders menu, select a recorder.

    b. Click **change** under Recorder Setup. The recording setup options opens.

    c. Uncheck **Share via UPnP** and click **Apply**.
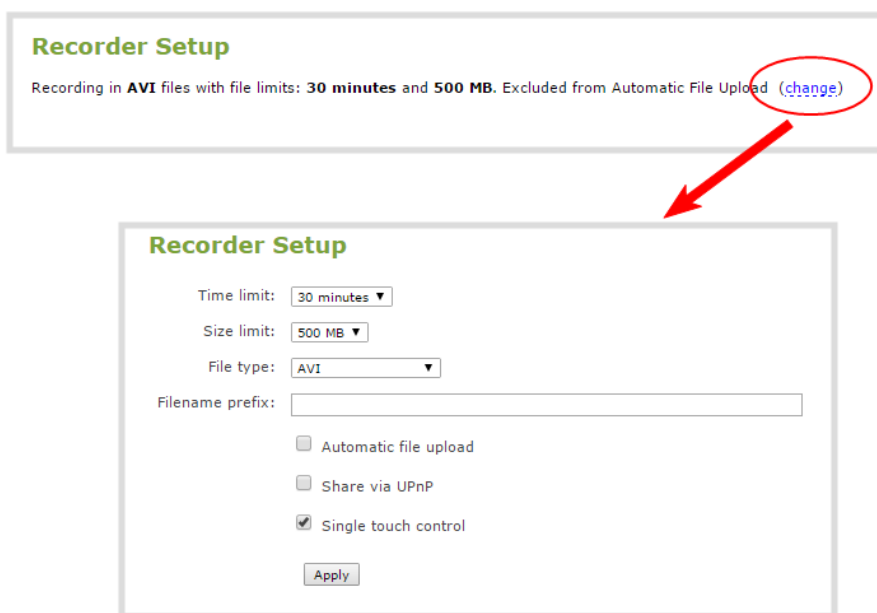
To disable UPnP globally for the device:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

3. From the Configuration menu, click **UPnP**. The UPnP configuration page opens.

4. Uncheck **Share live video through UPnP** to stop sharing live video.

5. Uncheck **Share recorded files through UPnP** to stop sharing recorded files.

6. Click **Apply**.

Viewing with UPnP

Using a software or hardware media player, you can browse for files or streams with Universal Plug and Play (UPnP). UPnP uses MPEG-TS over HTTP with the H.264 codec and MP3 or AAC audio encoding (or no audio). You can only access live streams or recordings that meet these requirements.

For security reasons, UPnP access to live streams and recorded files is disabled by default. To enable UPnP, see Enable UPnP

> Some players cannot access the stream or saved recordings if a viewer password is set. If needed, see **Remove user passwords** to clear the viewer password.

When browsing via UPnP your Pearl is displayed by the server name you set, or it's product serial number.

For example, when browsing from a Windows computer, you will see a list of media devices that includes Pearl:
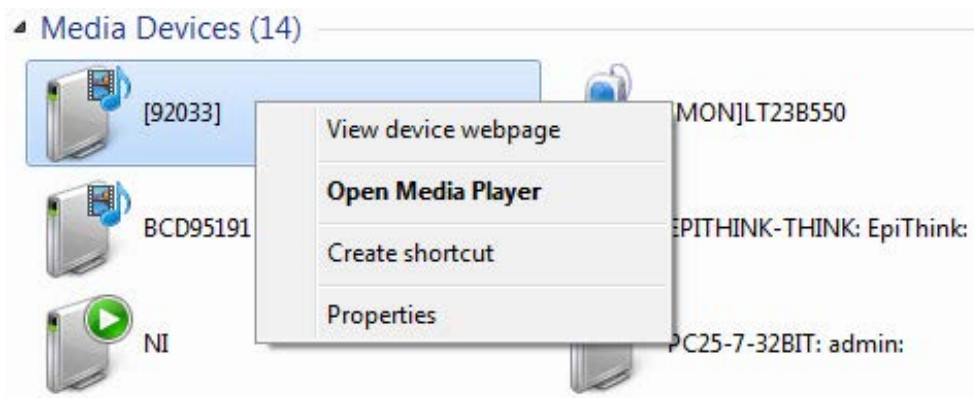
Live streams

When you open the device from Windows Media Player, you'll see a list of the available channels you can stream under the Videos tab. From other digital media players, the channel list can be under a **Live Streams** folder.

With Windows Media Player, double click to open any channel and press Play to start the stream. Using your digital media player, select a live stream and press play.

Recorded files

Recorded files are shown in the Recorded Files folder. Files are organized by the channel or recorder from which they were recorded. Windows Media Player shows the recorder files side by side with the channels and other digital media players show the recorded files in a file tree format, see below.
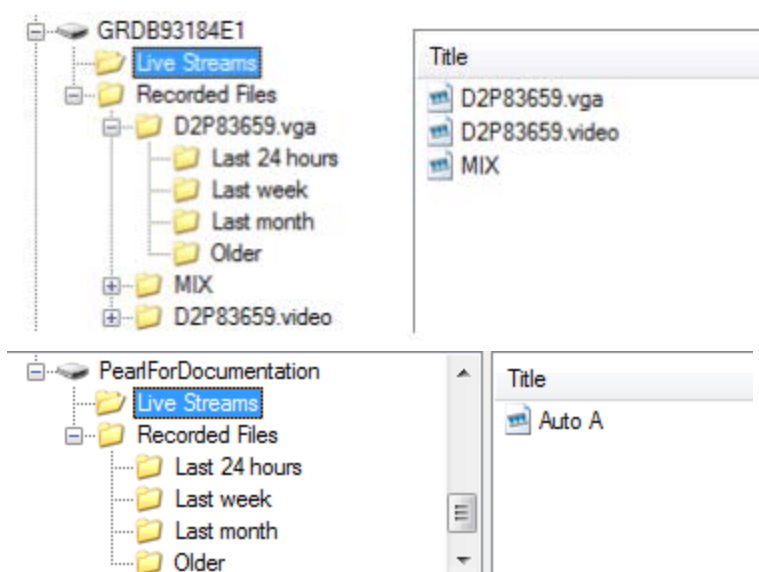
UPnP can also be used to directly play a recording to the digital media player, or to set a media player to automatically play a particular live stream after reboot of Pearl. See Stream using UPnP and Play directly to a media player.

Play directly to a media player

If your digital media player is UPnP enabled, Pearl can play direct the media player to play recorded files, without browsing through menus in the player.

Recorded files must be in MPEG-TS format and use the supported codecs: H.264 with MP3 or AAC audio.

If a viewer password is configured, that could prevent the ability to use UPnP, see Set or change user passwords.

To play directly to a media player:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. Ensure **Share recorded files through UPnP** is enabled on your Pearl and for the channel or recorder you want to share, see Enable UPnP.

3. Open the recorded files list for the channel or recorder, see View list of recorded files.

4. From the list of files, select the file you want to play and click on the **Play To** icon for the file. A list of visible digital media players is displayed.

5. Select a media player. The recording plays on the screen that is connected to the media player.

Auto-restart playback to a UPnP device

In unmanned situations such as industrial applications and digital signs, it is useful to automatically have a stream played to a digital media player, even if Pearl restarts.

To configure auto-restart of a stream to a media player:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

3. From the Configuration menu, click **UPnP**. The UPnP configuration page opens.

4. In the Play on service start section, select a stream from the **Live stream** drop-down list.

5. Select a digital media player from the **Player** drop-down list. Digital media players on your network that support UPnP playback appear automatically in the list.

6. Click **Apply**.

> Only a single stream and player combination can be configured for auto play. The channel's UPnP configuration must be enabled for it to appear.

Change UPnP device name

You can configure the UPnP server name that appears for your Pearl. By default, if you left the server name field blank when enabling UPnP, the server name is the system's serial number.

To change the UPnP server name:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

3. From the Configuration menu, click **UPnP**. The UPnP configuration page opens.

4. Highlight and delete the text in the **Server name** field, if any.

5. Type a new server name. Use characters A-Z, a-z, 0-9, _, :, @, ^, #, -. {}, [], ().

6. Click **Apply**.

PART 4: Record

Pearl encodes the video and audio it captures. You can stream your content and record it at the same time. You can even stream your switched program using a lower quality stream (i.e. 1280×720 at 2Mbps) and at the same time, make high quality recordings of each of the video inputs at full frame with a high bitrate for future re-use and post-processing.

Recorded files are stored on Pearl's hard drive. Plus there are a variety of automatic and manual mechanisms available to download the files.

Topics include:

- About recording
- Record a channel
- Record using One Touch control
- Configure recording settings, file size and type
- Restart recording
- Recorders
- Manage recorded files
- FTP and automatic file transfers
- Local FTP server

For instructions on how to use Pearl's touch screen to start/stop scheduled recordings and authenticate with a CMS to create unscheduled ad hoc events, see CMS event controls using the touch screen.

For information about recording with Content Management Systems (CMSs) like Kaltura and Panopto, see CMS recording and webcasting using the Admin panel.

About recording

You can record each of the channels on Pearl as AVI, MOV, MPEG-TS, MP4, or MP4-Fragmented. You can also setup multi-track recorders, see Recorders.

Easily stop and start recording using any of the user interfaces and access Pearl remotely, see User interfaces and remote access:

- Admin panel
- Touch screen
- Epiphan Live

Using the One Touch feature, you can control recording of all your channels and recorders with a single tap on the touch screen, see About One Touch streaming and recording. Pearl also comes with APIs so you can setup third party tools to control recording, see Controlling Pearl using HTTP/HTTPS commands and Controlling Pearl using RS-232 / serial port.

Recording using Pearl is robust. If an accidental system shutdown occurs while recording is in progress, your recordings are gracefully closed off so they are still playable.

Physically unplugging a video source from the input port or otherwise interrupting the signal does not stop recording. A No Signal image is inserted. When recording auto channels, a new recording is made when the input changes from one to another due to signal loss. When recording a multi-channel recorder or a multi-source layout channel, a new file is created if an additional source is added to the recorder.

Each channel or recorder has a maximum time or file size limit setting that you can configure using the Admin panel. The default recording limits are set to 30 minutes or 500 MB, whichever comes first. When the time or file size limit is reached, the current recording is saved and a new recording file starts automatically without losing any content. When the local drive is full, newer recordings overwrite oldest recordings.

For information about recording to Content Management Systems (CMSs) like Kaltura and Panopto, see CMS recording and webcasting using the Admin panel. For instructions on how to use Pearl's touch screen to start/stop scheduled recordings and authenticate with a CMS to create unscheduled ad hoc events, see CMS event controls using the touch screen.

Tested media players

Epiphan has tested recordings with the following players. See Troubleshooting Quick Reference for known player issues.

Table 62 *Tested Media Players*

Operating System	Tested Players
Mac OS	• QuickTime 10.3 • QuickTime 7.6.6+ • VLC 2.2.4 • Playback Pro 2.3.2 • Final Cut Pro 10.3.2 • Adobe Premiere Pro CC 2017
Windows	• QuickTime 7.6.6+ • VLC 2.2.6 • Windows Media player 12+ • Movies & TV (Windows 10) • Adobe Premiere Pro CC 2015
Linux	• MPlayer • VLC 2.2.2
HTML 5 Browsers (Windows)	• Google Chrome 37+ (works with MOV and MP4 files using H.264 codec)

> Not all media players and editors support all recording formats, such as the more modern MP4-fragmented format. To playback MOV files created by Pearl, we recommend using a newer media player.

Record a channel

Each channel has a configuration page in the Admin panel where you can start and stop recording, as well as configure recording settings for the channel.

You can also start and stop recording from the channel view using the touch screen on Pearl (see Record a channel using the touch screen) and using Epiphan Live (see Control streaming and recording).

The channel number turns red to indicate it is recording. If the system runs out of storage space, the oldest recorded file is deleted to make room for the new recording.

Channel 1 is recording
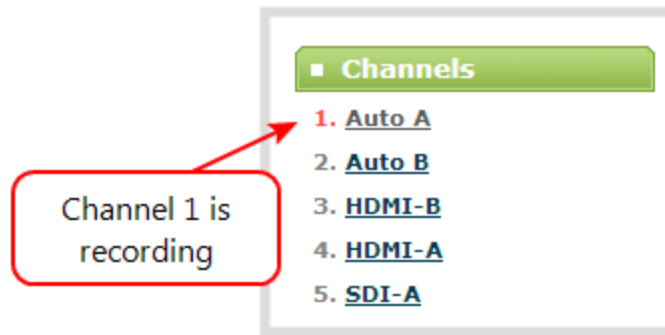
To start and stop channel recording using the Admin panel:

1. Login to the Admin panel as **admin** or **operator**, see Connect to Admin panel.

2. From the Channels menu, select the channel and click **Recording**. The channel recording menu opens.

3. Click **Start** to start recording the channel and click **Stop** to stop recording.

Recorder stopped

●
Start   Stop   Reset

Recorder Setup

Recording in **AVI** files with file limits: **30 minutes** and **500 MB** (change)

Recorded Files

No files recorded on internal storage.
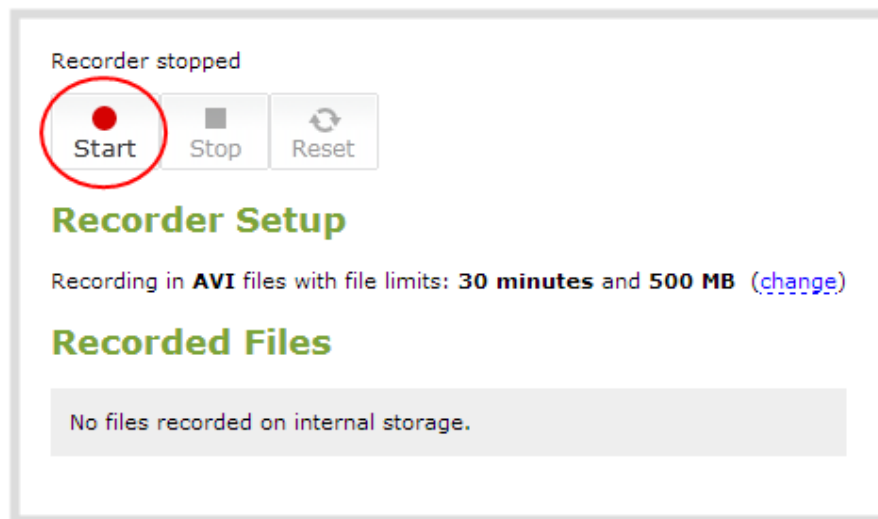
> [STOP] If the Start button is not active, there are no active sources for this channel or recorder.
> Check your inputs to ensure signals are working as expected.

You can navigate away from the recording page without affecting the recording.

Record using One Touch control

Pearl's One Touch recording and streaming control allows you to control your recording and streaming across any number of channels and recorders with a single tap on the touch screen. Channels and recorders are enabled for One Touch recording by default. For more information, see One Touch streaming and recording control.

To control recording using One Touch control:

1. Login to the Admin panel as **admin** or **operator**, see Connect to Admin panel.

2. Configure your channels and recorders for One Touch control, see Specify channels and recorders for One Touch recording.

3. Tap the **One Touch control** icon along the bottom of the touch screen to display the One Touch control screen.

> If the One Touch control icon is not visible on the touch screen, tap the screen once to activate the control icons. If the control icons are still not visible, they are disabled. See **Configure the touch screen**.

4. From the One Touch control screen, tap **Start** to begin recording and tap **Stop** to end recording.
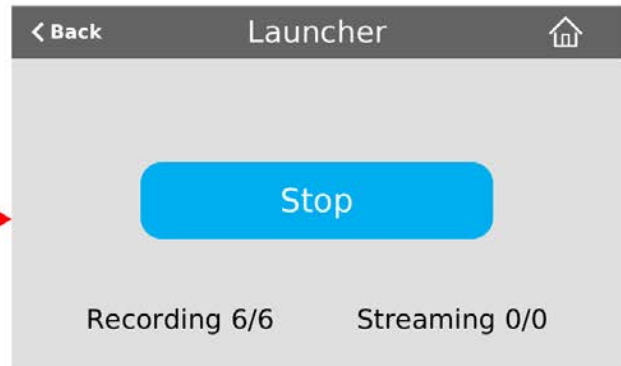
Configure recording settings, file size and type

Recordings are saved as AVI files by default. Each channel and recorder also has a file size limit set to 500 MB and the maximum file length set to 30 minutes by default.

When a recording reaches the file length of 30 minutes or 500 MB (whichever comes first), the system closes the current recording file and immediately opens a new one. No recorded data is lost.

> **Tip**: If you don't know what size to select, do some test recordings to get an idea of the file sizes you can expect. If you want to guarantee the recording lasts to a given time limit, select a file size that is far larger than you saw in your tests.

Important considerations

- You cannot change the recording settings, file size, and type for channels used with Kaltura events.

- The file recording type for a channel you are controlling and recording using AV Studio must be set to MP4 and the maximum file size supported is 500 MB.

The following table describes the recordings configuration settings.

Table 63 *Recordings Configuration Settings*

Label	Description / Options
Time limit	Specifies the length of time the system waits before the recording file is saved and a new one is started (assuming the size limit has not yet been reached). Values range from 5 minutes to unlimited.
Size limit	Specifies the maximum file size a recording can reach before it is saved and a new recording is started (assuming the time limit has not yet been reached). Values range from 50 MB to 64 GB.
File type	Specifies the recording file type. Select from AVI, MP4, MP4-Fragmented, MPEG-TS, or MOV. Choose MPEG-TS for UPnP playback. • **AVI**: Generally used for playback on Windows. • **MP4**: A progressive version of MP4. Select MP4 for the best compatibility with most video players and editors. Progressive MP4 files are initially recorded as MP4-Fragmented and are converted when the recording ends. > If power is lost while recording is in progress or during conversion, the files remain in fragmented MP4 format. You can run the file through **ffmpeg** or another transcoder to convert to the progressive format. • **MP4-Fragmented**: A newer MP4 format. Fixed 10 second intervals. Select MP4-Fragmented for the same file format as releases 3.15.x. Some applications, like Adobe Premiere Pro, don't yet support fragmented MP4. There's no way to tell the difference between MP4 files and MP4-Fragmented

Label	Description / Options
	files from the file name because both use the .mp4 extension. • **MPEG-TS**: Choose for UPnP playback. Does not support PCM audio encoding. • **MOV**: A progressive version of MOV. Generally used for playback on Mac OS. This type of MOV has the best compatibility with video players and editors.
Filename prefix	Specifies how the recordings are named. Recording files start with the given prefix followed by the date and time of the recording, which is set by the system. The channel or recorder name is used if no prefix is given. Allowed characters: A-Z, a-z, 0-9, _, , #, -, [], (). Avoid using spaces in recording file names. Use underscores or hyphens to separate words instead.
Automatic file upload	Select this if you want this channel or recorder to be part of any scheduled automatic uploads. See FTP and automatic file transfers for information on automatic uploads.
Share via UPnP	Select this if you want this channel or recorder to be available via UPnP. If global UPnP is not enabled when you select this option, a link appears to let you to fix it.
Single-touch control	Record using One Touch control

To change the recording configuration:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. Do one of the following:

    a. For a channel, click **Recording** from the Channels menu. The Recording page opens.

    b. For a recorder, select a recorder from the Recorders menu. The Recorder configuration page opens.

3. Click **change** under Recorder Setup. The recorder settings open.

4. Change the default recording file settings.

- **Time limit**: Select a value from 5 minutes to unlimited.

- **Size limit**: Select a value from 50 MB to 64 GB.

- **File type**: AVI, MPEG-TS, MOV, MP4, or MP4-Fragmented.

5. (Optional) Enter a prefix for the recordings. All new recorded files for this channel or recorder will be prefixed using the text you enter.

6. (Optional) Click the check box to exclude this channel or recorder from automatic file uploads, see FTP and automatic file transfers.

7. Click **Apply**.

Restart recording

Recordings are automatically saved to a file and a new recording is started when:

- The recording reaches the configured time or size limit.

- The channel or recorder name is changed.

- Changes are made to the stream.

You can manually force a recording that's in progress to save to a file and continue recording in a new file from that point forward without any loss of content.

This is useful if you need to download a recording since you cannot download recordings that are in progress.

To restart recording to a new file:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. Do one of the following:

   a. For a channel, click **Recording** from the Channels menu. The Recording page opens.

   b. For a recorder, click the recorder from the Recorders menu. The Recording page opens.
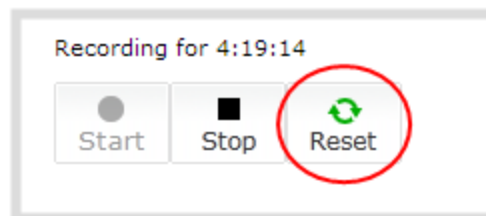
3. Click **Reset** to stop the current recording and start a new recording.

4. Refresh the page to see the updated list of recordings.

Recorders

Using recorders with Pearl, you can record multiple channels together in a single multi-track file.

Recording multiple channels at the same time ensures that all your recordings start and stop at the same time. After recording stops, you can automatically use one of the system's file synchronization methods to copy the recordings off the server, or you can use our built-in tool to split the file into individual tracks for post-processing.

For important considerations about file size limits when creating multiple recorders, see Configure recording settings, file size and type.

We do not recommend using Recorders for manual (ad hoc) recordings to the Kaltura Content Management System (CMS), see About Kaltura recording and webcasting.

Topics include:

- Add a recorder
- Select channels to record
- Rename a recorder
- Duplicate a recorder
- Delete a recorder

To change recording settings, such as the file size limit, type, or to add a custom prefix to the file name, see Configure recording settings, file size and type.

> You only need to create recorders for multi-track recordings. For single channel recordings, see **Record a channel**.

Add a recorder

Each channel has its own built-in recorder which you access from the channel's Recording page. However, if you want to record several channels simultaneously to a multi-track file, you need to add a recorder to Pearl using the Admin panel.

Each new recorder is automatically assigned a number, for example: Recorder 1, Recorder 2, etc. and is set to record all configured channels by default.

For important considerations about file size limits when creating multiple recorders, see Configure recording settings, file size and type.

To add a recorder:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Recorders menu, click **Add recorder**.

Select channels to record

When you create a new recorder, it records all the channels configured on Pearl in the single multi-track file by default. If you create new channels, they are automatically added to the recorder. You can choose which channels the recorder includes in the multi-track file using the Admin panel.

To change the channels recorded by a recorder:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Recorders menu, select a recorder. The recorder configuration page opens.

3. Click **change** next to the list of channels to record.
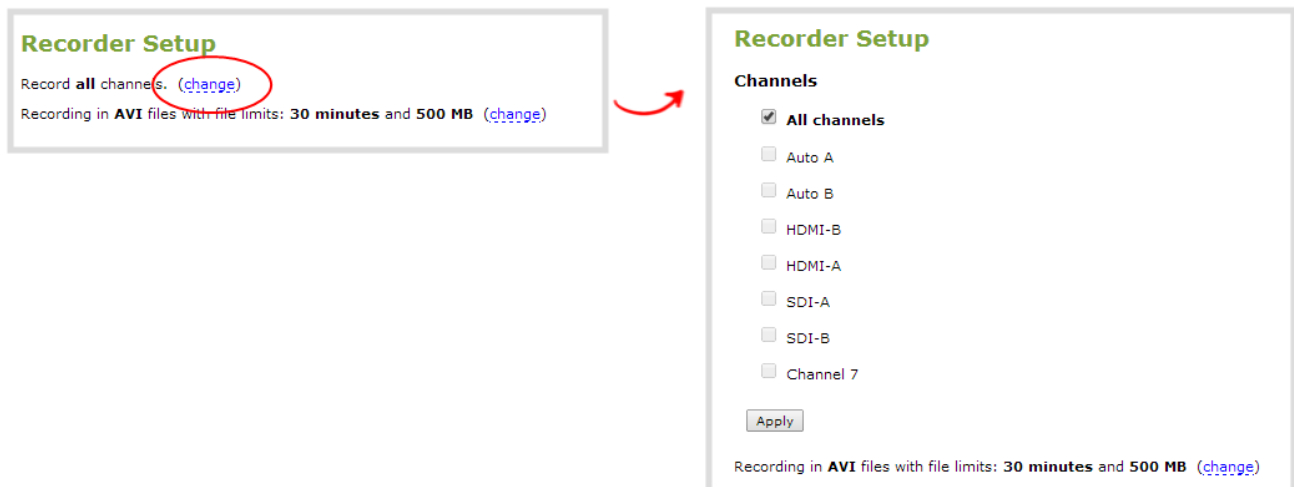
4. Check the boxes next to the channels you want to include, and click **Apply**.

> Channels with no active video source are displayed in italics. You can include these channels in your channel selections for the recorder.

Start and stop a recorder

You can start and stop recorders from the recorder's configuration page using the Admin panel.

You can also start and stop recorders using the One Touch control feature (see Record using One Touch control) and using Epiphan Live (see Record a channel using the touch screen).

The recorder number turns red to indicate it is recording. If the system runs out of storage space, the oldest recorded file is deleted to make room for the new recording.
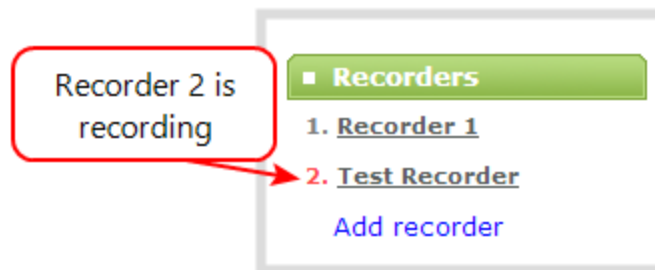
You can have multiple recorders and multiple channels recording all at the same time. The number of channels being recorded is shown below the Start and Stop buttons on the recorder's configuration page. To select which channels to include in the recorder, see Select channels to record.

To start and stop a recorder using the Admin panel:

1. Login to the Admin panel as **admin** or **operator**, see Connect to Admin panel.

2. From the Recorders menu, select a recorder. The recorder configuration page opens.

3. Click **Start** to begin recording and click **Stop** to end recording.
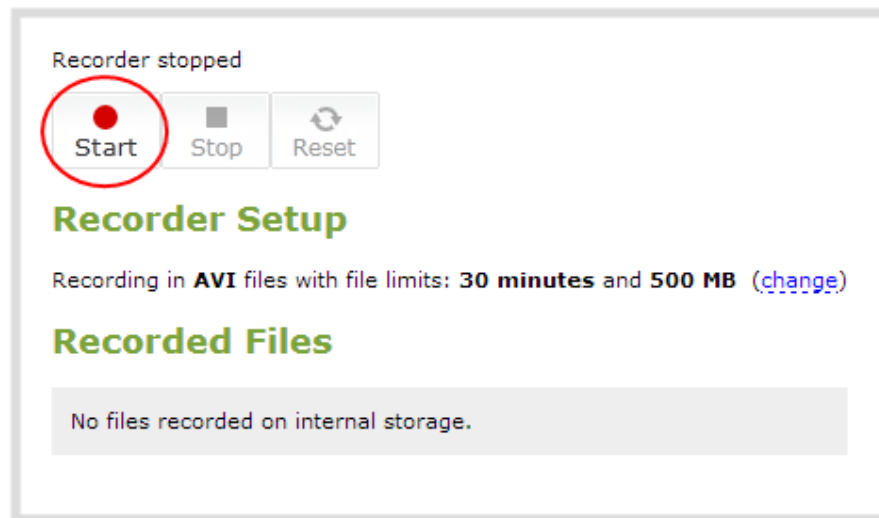
You can navigate away from the page without affecting the recording.

Rename a recorder

To rename a recorder:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Recorders menu, select a recorder. The recorder configuration page opens.

3. Click the recorder name and type the new name for the recorder.
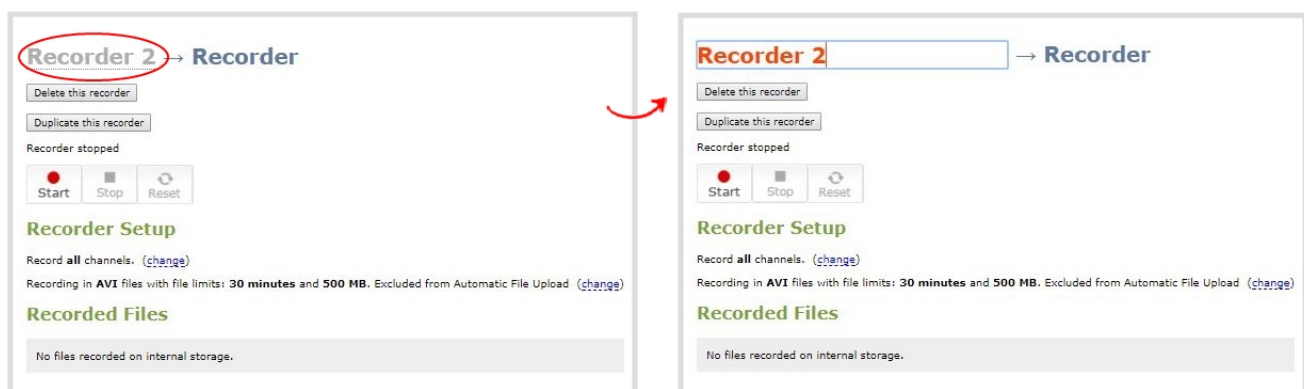
4. Press **Enter** to save the new name.

> ☑ You must press Enter to save the recorder name change.

Duplicate a recorder

You can duplicate any recorder you've created. All settings in the recorder you duplicate are recreated.

To duplicate a recorder:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Recorders menu, select a recorder. The recorder configuration page opens.

3. Click **Duplicate this recorder** . The duplicate recorder is created and assigned the next recorder number in your list of recorders.

Delete a recorder

When you no longer need a recorder, you can delete it.

> 🛑 Deleting a recorder deletes all the recorded files for the recorder. Be sure you have a copy of any important recorded files before proceeding.

To delete a recorder:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Recorders menu, select a recorder. The recorder configuration page opens.

3. Click **Delete this recorder** and click **OK** when prompted.

Manage recorded files

Your recordings are stored on the system's internal hard drive. Although there's a lot of space on the hard drive, it's good practice to remove old recordings to free up space before the drive if full. If there's no more free space for new recordings, new recordings will overwrite the oldest recordings on the hard drive.

There are a variety of ways to automatically transfer files from the system to local network storage. You can also manually select individual recordings to transfer or delete using the Admin panel.

Topics include:

- View list of recorded files
- Download recorded files manually
- Join recorded files together
- Extract tracks from a recording
- Rename recorded files
- Delete recorded files

For information about automatic file transfers or setting up Pearl as a local FTP server so you can manually or automatically connect to the system and download recordings, see FTP and automatic file transfers.

View list of recorded files

Recordings for Pearl are stored for each channel and each recorder separately. You can view all the recordings for a channel or recorder using the Admin panel. You can also view the list of recordings using Epiphan Live in the section called Your recordings.

To view the recordings for a channels or recorders using the Admin panel:

1. Login to the Admin panel as **admin** or **operator**, see Connect to Admin panel.
2. Do one of the following:

    a. To view files recorded for a channel, select a channel from the Channels menu and click **Recording**. The Recording page opens.

    b. To view files recoded for a recorder, select a recorder from the Recorders menu. The Recorder page opens.

3. All recordings are listed and sorted by date.

Files that are part of the same recording session are listed one after another. Three dots appear between files of different recording sessions. The file currently being recorded (if applicable) is shown at the top of the list. It cannot be modified or downloaded until it has finished recording.

4. If there are no recordings, a message indicates there are no recorded files for this channel or recorder.

Download recorded files manually

You can manually download recordings using the Admin panel. Files you download are saved to your connected admin computer.

> ☑ This feature is not available using the local console on Pearl.

To download recordings to your admin computer:

1. Login to the Admin panel as **admin** or **operator**, see Connect to Admin panel.

2. Find the recordings by channel or by recorder. See View list of recorded files.

3. To download an individual file:

    a. Click the name of a recording file to download it.

4. To download multiple files:

    a. Select the check box next to the recordings you wish to download from this channel or recorder.

    b. Click **Download Selected** to download a zip file containing the selected recordings.

What's next?

To free up space for new recordings, consider deleting recordings off of Pearl, see Delete recorded files.

Join recorded files together

After recording files on Pearl, you can join two or more files together. This is useful when a recording exceeds the maximum recording time limit and the recording is split in to multiple files. You can use the third-party tool called ffmpeg to join the files.

Download ffmpeg from the Internet (if necessary) to join recorded files:

1. Download the files that you need from Pearl and make sure you have the right paths and file names. For example:

> *C:\Users\JoesComputer\downloads\Program_A_May11_16-24-56.avi*

2. Use the command **ffmpeg -i** to specify the input file. For example:

> *ffmpeg -i C:\Users\JoesComputer\downloads\Program_A_May11_16-24-56.avi*

3. Repeat the process and specify the file you want to join to the first file. You can keep adding as many files as you want to join together. For example, specifying a second file looks like this:

> *ffmpeg -i C:\Users\JoesComputer\downloads\Program_A_May11_16-24-56.avi -i*
> *C:\Users\JoesComputer\downloads\Program_A_May11_12-26-14.avi*

4. Use the **-c copy** command to specify the output file. After the command, type in the location, file name and file extension that you want for the concatenated file. The full line looks like this:

> **ffmpeg -i** C:\Users\JoesComputer\downloads\Program_A_May11_16-24-56.avi **-i**
> C:\Users\JoesComputer\downloads\Program_A_May11_12-26-14.avi **-c copy**
> C:\Users\JoesComputer\Desktop\Concatenated_File.avi

5. After completing the process, you will be able to access your new file in the location you specified. The file moves straight from the first video into the second without a pause.

> **STOP** You can this process to join multiple files; however, the more files you join, the greater the chance that some audio desychronization can occur between the clips.

Extract tracks from a recording

Recorders combine multiple channels and audio sources together in a single multi-track file. You can create a copy of a recording using only select tracks. This feature is supported for .AVI, .MP4 and .MOV recordings only. MPEG-TS does not support track extraction.

Specific track versions of recorded files are not included in any automatic file transfers and need to be downloaded manually. Click the extracted track filename to manually download, see Download recorded files manually.

Ensure you have enough storage space for the extracted files before you start this procedure. To check how much internal storage space is available on Pearl, see Storage space maintenance.

To create a duplicate recording file with only select tracks:

1. Login to the Admin panel as **admin** or **operator**, see Connect to Admin panel.

2. From the Recorders menu, select a recorder. The recorder page appears.

3. Click the multi-track icon beside the recording. A list of tracks appears.

4. Select the tracks you want to extract.

> **Tip**: To deselect all tracks, click the check box for the top track, then hold SHIFT and click the check box for the bottom track.

5. Click **Extract tracks**. A copy of the recording is created with only the selected tracks.

> **STOP** Only one copy is saved per original recording. If you create a second copy, it will overwrite the previous one. Download the extracted copy of the recording with your chosen tracks to preserve it.

Rename recorded files

Recording files are named based on the file name prefix specified during configuration. You can change the recording file name using the Admin panel.

You can also change the default name that Pearl assigns recordings, see Configure recording settings, file size and type for information about setting file name prefixes.

To rename recordings:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. Find the recordings by channel or by recorder. See View list of recorded files.

3. Select the edit icon next to the file name you wish to change.


```
HDMI-A_May23_10-11-36.mp4    ✎    ▶    ⬇
```

4. Type the new file name and press **Enter** using your keyboard.

> 📋✓ The Admin panel keeps track of the filename extension (i.e. .avi) so you do not need to include it when renaming the file.

Delete recorded files

You can delete recordings using the Admin panel. You can delete one file at a time, select multiple files for a given recorder or channel and delete those, or you can delete all recordings for a channel or recorder.

> **STOP** Deleted recordings cannot be recovered.

To delete recordings:

1. Login to the Admin panel as **admin** or **operator**, see Connect to Admin panel.

2. Find the recordings by channel or by recorder. See View list of recorded files.

3. Do one of the following:

    a. To delete a single recording, click the X icon to the right of a recording and click **OK** when prompted.

    b. To delete multiple recordings, check the check box beside the recordings you want to delete and click **OK** when prompted.

    c. To delete all recordings for the selected channel or recorder, click **Delete Selected** and click **OK** when prompted.

> The list may not update immediately. You can refresh the list by reloading the Recording page (for channels) or the recorder settings page (for recorders).

FTP and automatic file transfers

Pearl can be configured to automatically upload recordings from local storage to a network storage location or an attached USB drive. We call this Automatic File Upload or AFU for short. You can also configure Pearl to act as an FTP server, allowing you to manually or automatically connect to Pearl and download recordings.

Topics include:

- About Automatic File Upload (AFU)
- Configure AFU to FTP server parameters
- Choose Channels and recorders to include in AFU
- Add recordings to an AFU queue
- Enable AFU and set parameters
- Configure AFU to FTP server parameters
- Configure AFU to RSync server parameters
- Configure AFU to CIFS server parameters
- Configure AFU to SCP client parameters
- Configure AFU to SFTP server parameters
- Configure AFU to AWS S3 parameters
- Configure AFU to WebDav server parameters
- AFU or copy to USB
- Local FTP server

To view and manage the USB file transfer queue, manage the AFU queue, and view the AFU upload logs:

- Manage USB file transfer queue
- View the AFU log
- View AFU and file transfer progress (via Pearl's touch screen)
- Manage the AFU queue

About Automatic File Upload (AFU)

Pearl can automatically upload recorded files from channels and recorders to an accessible off-system storage location. You can set the file transfer to happen after a set amount of time or after the file completes recording.

There are additional settings to help you manage your AFU recordings and avoid file name collisions at the AFU server side. You can:

- Automatically create a folder for your recorded files using the channel or recorder name.

- Save recordings to a folder that's labeled using the Pearl serial number.

Automatic File Upload (AFU) is not enabled by default. You must enable this feature for each channel or recorder that you want included in automatic file transfers. A log file of all file transfers is created that you can view anytime from the Admin panel.

The following types of off-system storage are supported for AFU:

- FTP

- RSync

- CIFS

- CP

- SFTP

- Amazon Web Server (AWS)

- WebDav

- USB Drive

> **STOP**   Do not reboot Pearl with a USB stick inserted. Doing so will result in a failure to boot.
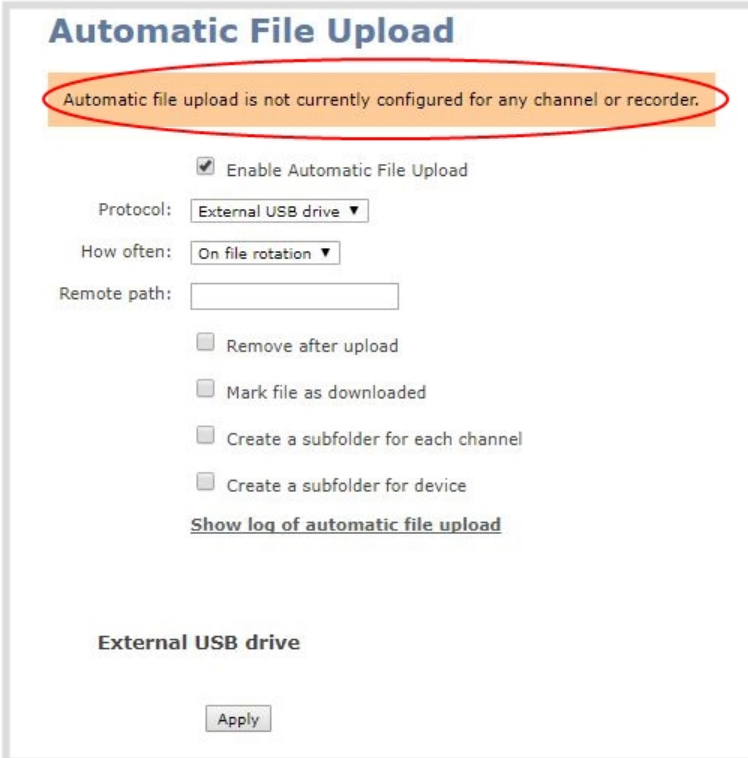
Important considerations

- Only **one** type of AFU can be used for all file transfers from the same channel or recorder.

- Automatic File Upload (AFU) is not available while Content Management System (CMS) is enabled Pearl.

- Files are automatically uploaded only once. New recordings created during later sessions do not overwrite files that were previously uploaded. A new file is uploaded.

- If the connection is lost during the transfer, the transfer automatically restarts when the connection is reestablished.

- If recorded files are selected for upload while the AFU is at maximum upload capacity or when the AFU is unavailable, they are added to an upload queue. Files and their relevant information are displayed in a list and are uploaded when the upload capacity becomes available.

Choose Channels and recorders to include in AFU

When configuring automatic file upload (AFU), you need to tell the system which channels and recorders you want included in the upload schedule.

If no channels or recorders are configured as a part of AFU, the following message appears in the Automatic File Upload configuration page.
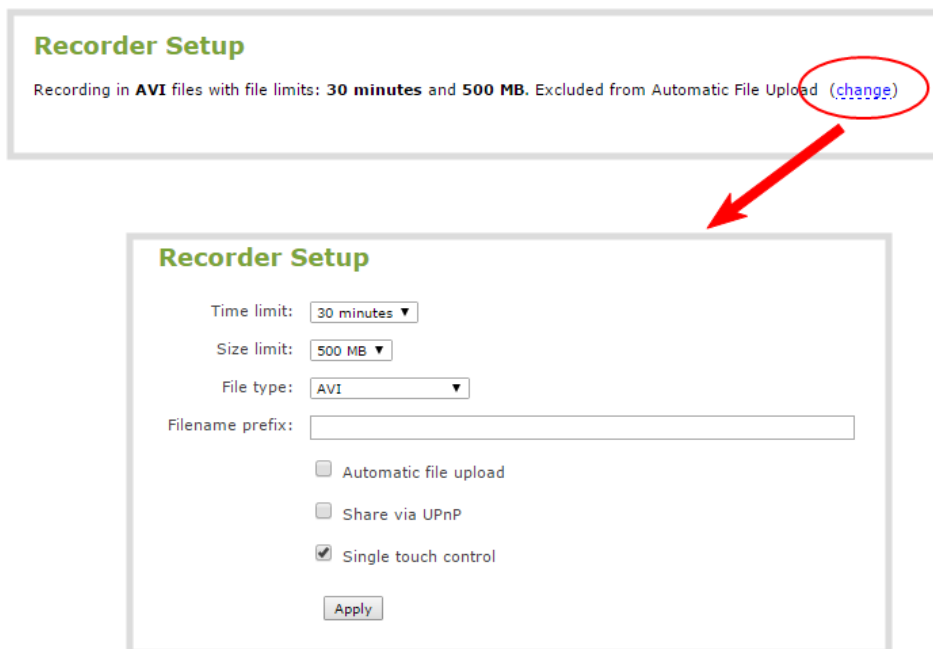
To add a channel or recorder to your AFU schedule:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. Do one of the following:

   a. To add a channel, select the channel from the Channels menu and click **Recording**. The Recording page opens.

   b. To add a recorder, select the recorder from the Recorders menu. The recorder configuration page opens.

3. Click **change** under Recorder Setup. The recorder setup opens.

Recorder Setup

Recording in **AVI** files with file limits: **30 minutes** and **500 MB**. Excluded from Automatic File Upload (change)

Recorder Setup

Time limit:	30 minutes ▼
Size limit:	500 MB ▼
File type:	AVI ▼
Filename prefix:	

☐ Automatic file upload

☐ Share via UPnP

☑ Single touch control

Apply

4.   Check **Automatic file upload** and click **Apply**.

What's Next

After you've enabled AFU for your channels and recorders, enable AFU and configure the AFU settings for the location type (i.e. FTP, USB, AWS, etc).

Enable AFU and set parameters

After configuring the channels and recorders you want included in your Automatic File Upload (AFU) schedule, you must enable AFU and configure the frequency of file transfers.

The first transfer takes place when the configured frequency is reached. All recorded files that complete during that time period are included in the transfer. Currently recording files are not included in an AFU transfer until the recording has ended.

> 🛑 Files saved before you complete automatic file upload configuration are not included as part of the automatic upload. You can manually transfer those files, see **Download recorded files manually**.

The following table describes the available AFU options.

Table 64 *AFU Interval Options*

Name	Description
On file rotation	The system uploads each file after it stops recording it. You can control file size and length to determine when files are done recording. You can also use the reset button to close the current file and open a new one. See Configure recording settings, file size and type.
Every hour	The system uploads completed recordings every hour.
Every 6 hours	The system uploads completed recordings every six hours.
Every 12 hours	The system uploads completed recordings every 12 hours.
Every 24 hours	The system uploads completed recordings every 24 hours.

To set up the frequency of automatic file uploads:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, click **Automatic File Upload**. The Automatic File Upload configuration page opens.

> If your screen does not indicate that AFU is enabled for at least one channel or recorder, return to
> **Choose Channels and recorders to include in AFU**

3. Check **Enable Automatic File Upload**.

4. Select how often automatic updates take place.

5. (Optional) Enter the remote path. If no path is specified, the files are copied to the root folder of the
    destination file system.

> If AFU to your server fails, check the server configuration and permissions.

6. (Optional) Set optional parameters:

    - Check **Remove after upload** to have the files deleted from local storage on Pearl when the
      upload completes.

- Check **Mark file as downloaded** to have the color of the file link in the recording list change to show the files are downloaded. This only applies if the files are not deleted after upload is complete.

- Check **Create a subfolder for each channel** to save the downloaded files in to a folder. Use either the channel or recorder name.

- Check **Create a subfolder for device** to save the downloaded files into a folder using the serial number of Pearl.

7. Select the protocol transfer type, and then configure the protocol settings:

   - Configure AFU to FTP server parameters

   - Configure AFU to RSync server parameters

   - Configure AFU to CIFS server parameters

   - Configure AFU to SCP client parameters

   - Configure AFU to SFTP server parameters

   - Configure AFU to AWS S3 parameters

   - Configure AFU to WebDav server parameters

   - AFU or copy to USB

Configure AFU to FTP server parameters

You can automatically upload recordings to an FTP server when you select FTP as the AFU protocol transfer type using the Admin panel.

The following table describes the parameters to configure for AFU to an FTP server.

Table 65 *FTP Automatic Upload Configuration Parameters*

Name	Description
Server address	The IP address (or fully qualified domain name) of the FTP server.
Server port	The port used by the target FTP server. Standard port is 21.
Login	User name for the FTP server.
Password	Password for the FTP user.
Use temp file	Causes files to be named with .part extension on the server during active upload. When the upload completes, the file is renamed to the appropriate extension (.mov, .mp4 or .avi).

Prerequisites

- Channels and recorders are already added for AFU, see Choose Channels and recorders to include in AFU

- AFU is enabled and the parameters configured, see Enable AFU and set parameters.

To set the FTP server parameters for AFU:

1. From the Automatic File Upload configuration page, select **FTP Client** as the protocol transfer type.

FTP Upload

Server address: [   ]

Server port: [   ]

Login: [   ]

Password: [   ]

☐ Use temp file

[Apply]

2. Specify the target **Server address**. If your system is configured with DHCP or has a valid DNS configuration (see Configure DHCP), you can use the server's fully qualified domain name instead of the IP address.

3. Specify the **Server Port** used for the target FTP server. The standard port is 21.

4. Enter the FTP account username in the **Login** field.

5. Enter the FTP account password in the **Password** field. The characters are masked with dots.

6. Select **Use temp file** to name files with a temporary filename extension (.part) on the server until upload is complete.

7. Click **Apply**.

Configure AFU to RSync server parameters

You can automatically upload recordings to an RSync server when you select RSync as the AFU protocol transfer type using the Admin panel.

The following table describes the parameters to configure for AFU to an RSync server.

Table 66 *RSync Automatic File Upload Configuration Parameters*

Name	Description
Server address	The IP address (or fully qualified domain name) of the RSync server.
Server module	The name of the shared folder on the RSync server.
Login	Username for the RSync server.
Password	Password for the RSync user.
Checksum	Select to enable checksum checking during file transfer. This increases the time taken to transfer, but also increases reliability of the transfer.

Prerequisites

- Channels and recorders are already added for AFU, see Choose Channels and recorders to include in AFU

- AFU is enabled and the parameters configured, see Enable AFU and set parameters.

To configure upload using RSync:

1. From the Automatic File Upload configuration page, select **RSync Client** as the protocol transfer type.

2. Specify the target **Server address**. If your system is configured with DHCP or has a valid DNS configuration (see Configure DHCP), you can use the server's fully qualified domain name instead of the IP address.

3. Specify the **Server module**. This is the name of the shared folder on the server. If needed, request this value from your network administrator.

4. Specify a username for the RSync Server in the **Login** field. The user must have write permissions for the module.

5. Specify the password for the user in the **Password** field; the value is masked by dots.

6. If desired, select the **Checksum** check box to add a checksum validation to the transfer between the system and the recipient server.

7. Click **Apply**.

Configure AFU to CIFS server parameters

You can automatically upload recordings to a CIFS server (also known as SMB or samba) when you select CIFS as the AFU protocol transfer type using the Admin panel. Samba version 1 is supported.

The following table describes the parameters to configure AFU to a CIFS server.

Table 67 *CIFS Automatic File Upload Configuration Parameters*
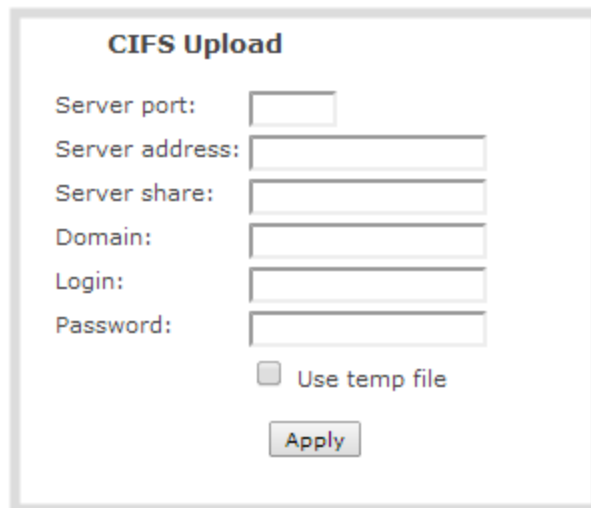
Name	Description
Server Port	The CIFS server port. Leave blank to use the default port, or enter the port used for your CIFS server.
Server address	The IP address (or fully qualified domain name) of the CIFS server.
Server share	The name of the shared folder on the CIFS server.
Domain	The CIFS server's Windows domain or Work Group name . Needed if the server is part of Active Directory or a Domain Controller.
Login	Username for the CIFS server.
Password	Password for the CIFS user.
Use temp file	Causes files to be named with .part extension on the server during active upload. When the upload completes, the file is renamed to the appropriate extension (.mov, .mp4, .ts or .avi).

Prerequisites

- Channels and recorders are already added for AFU, see Choose Channels and recorders to include in AFU

- AFU is enabled and the parameters configured, see Enable AFU and set parameters.

To configure upload using CIFS:

1. From the Automatic File Upload configuration page, select **CIFS Client** as the protocol transfer type.

CIFS Upload

Server port:

Server address:

Server share:

Domain:

Login:

Password:

☐ Use temp file

Apply

2. Specify the target **Server address**. If your system is configured with DHCP or has a valid DNS configuration (see Configure DHCP), you can use the server's fully qualified domain name instead of the IP address.

3. Enter the target **Server port**, if you have configured the server to use something non-standard. Leave this value blank to use the default port.

4. Specify the **Server share**. This is the CIFS share name or the name of the shared folder on the server. If needed, request this value from the network administrator.

5. If the system is in a different domain than the server or if it is part of Active Directory, enter the **Domain name** of the CIFS server.

6. Specify a username for the CIFS Server in the **Login** field. The user must have write permissions for the share folder.

7. Specify the password for the user in the **Password** field; the value is masked by dots.

8. Select **Use temp file** to name files with a temporary filename extension (.part) on the server until upload is complete.

9. Click **Apply**

Configure AFU to SCP client parameters

You can automatically upload recordings to an SCP (secure copy) client when you select SCP as the AFU protocol transfer type using the Admin panel.

The following table describes the parameters to configure AFU to an SCP client.

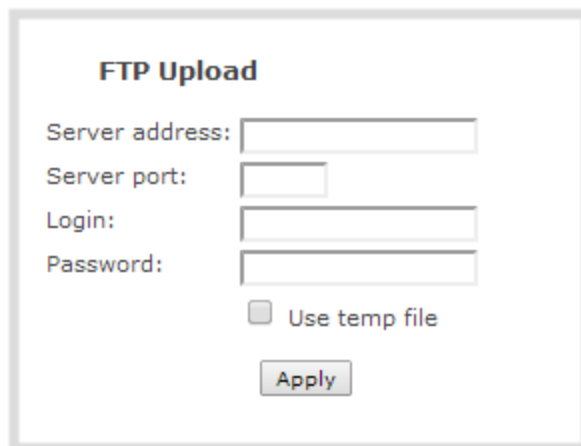**Table 68** *SCP Automatic Upload Configuration Parameters*

Name	Description
Server address	The IP address (or fully qualified domain name) of the destination server.
Server port	The SCP port used by the target server. Standard port is 22.
Login	Username for the SCP server.
Password	Password for the SCP user.

Prerequisites

- Channels and recorders are already added for AFU, see Choose Channels and recorders to include in AFU

- AFU is enabled and the parameters configured, see Enable AFU and set parameters.

To configure upload to an SCP client:

1. From the Automatic File Upload configuration page, select **SCP Client** as the protocol transfer type.

2. Specify the target **Server address**. If your system is configured with DHCP or has a valid DNS configuration (see Configure DHCP), you can use the server's fully qualified domain name instead of the IP address.

3. Specify the **Server Port** used for the destination SCP server. The standard port is 22.

4. Enter the SCP account username in the **Login** field.

5. Enter the SCP account password in the **Password** field; the characters are masked with dots. (Alternatively you can choose to use a private key instead of a password for authentication.)

> For secure copy you can upload an SSH identity for your Pearl. This key must be trusted by the destination server. Details for generating the key and setting up this trust are beyond the scope of this document.

6. (Optional) Set up SSH identity for SCP and SFTP clients. If no identity is uploaded, or to upload a new identity (overwrites the old identity):

a. Click **Choose File** and navigate to select the private key file from your hard drive, then click **Open**.

b. Click **Upload** to upload the file.

> The system accepts RSA keys for SSH-1; DSA, ECDSA, EC25519 and RSA for SSH-2. Keys must be in **OpenSSH** format.

c. (Optional) Use the **Test your key** field to test your uploaded key against the secure server.

7. Click **Apply**

Configure AFU to SFTP server parameters

You can automatically upload recordings to a secure FTP (SFTP) server when you select SFTP as the AFU protocol transfer type using the Admin panel.

The following table describes the parameters to configure AFU to an SFTP server.
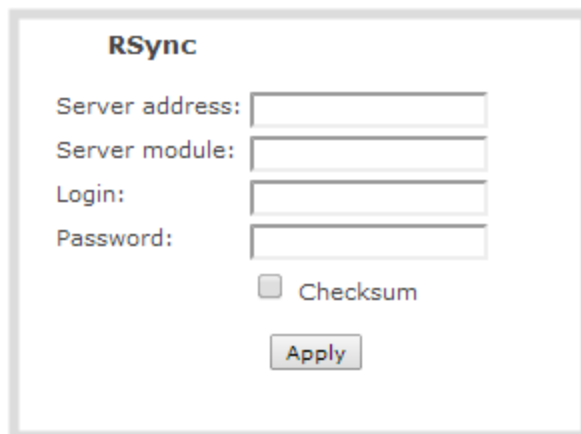
Table 69 *SFTP Automatic Upload Configuration Parameters*
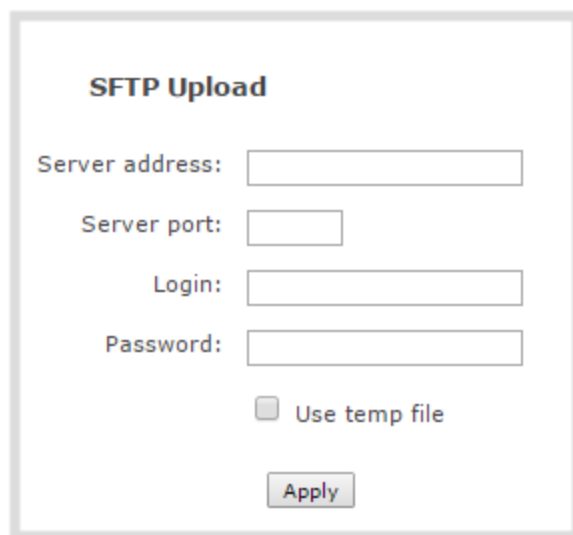
Name	Description
Server address	The IP address or fully qualified domain name of the SFTP server.
Server port	The port used by the target SFTP server. Standard port is 22.
Login	Username for the SFTP server.
Password	Password for the SFTP user.
Use temp file	Causes files to be named with .part extension on the server during active upload. When the upload completes, the file is renamed to the appropriate extension (.mov, .mp4 or .avi).

Prerequisites

- Channels and recorders are already added for AFU, see Choose Channels and recorders to include in AFU

- AFU is enabled and the parameters configured, see Enable AFU and set parameters.

To configure upload to an SFTP server:

1. From the Automatic File Upload configuration page, select **SFTP Client** as the protocol transfer type.
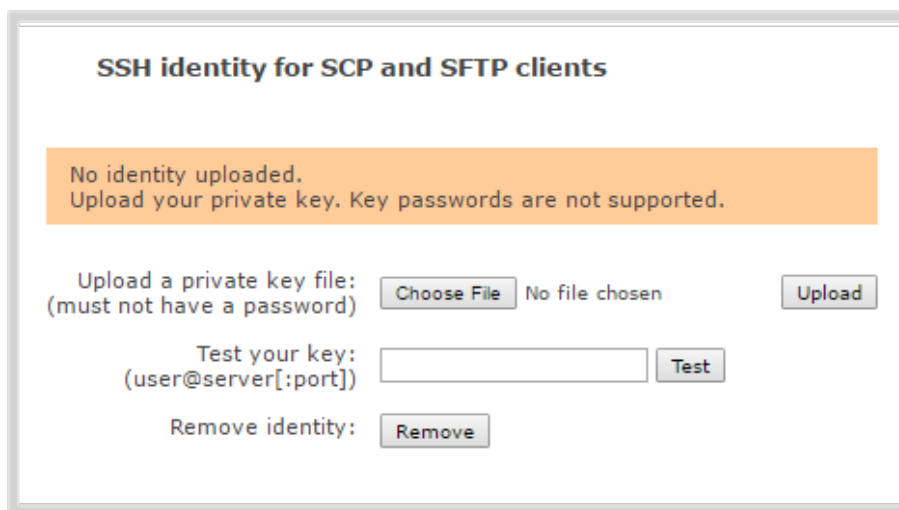
2. Specify the target **Server address**. If your system is configured with DHCP or has a valid DNS configuration (see Configure DHCP), you can use the server's fully qualified domain name instead of the IP address.

3. Specify the **Server Port** used for the target SFTP server. The standard port is 22.

4. Enter the SFTP account username in the **Login** field.

5. Enter the SFTP account password in the **Password** field. The characters are masked with dots. Alternatively, you can choose to use a private key instead of a password for authentication.

6. Select **Use temp file** to name files with a temporary filename extension (.part) on the server until upload is complete.

> For secure file transfer, you can upload an SSH identity for your Pearl. This key must be trusted by the destination server. Details for generating the key and setting up this trust are beyond the scope of this document.

7. (Optional) Set up SSH identity for SCP and SFTP clients. If no identity is uploaded, or to upload a new identity (overwrites the old identity):

a. Click **Choose File** and navigate to select the private key file from your hard drive, then click **Open**.

b. Click **Upload** to upload the file.

> The system accepts RSA keys for SSH-1; DSA, ECDSA, EC25519 and RSA for SSH-2. Keys must be in **OpenSSH** format.

c. (Optional) Use the **Test your key** field to test your uploaded key against the secure server.

8. Click **Apply**

Configure AFU to AWS S3 parameters

You can automatically upload recordings to an Amazon Web Server (AWS) when you select AWS S3 as the AFU protocol transfer type using the Admin panel.

The following table describes the parameters to configure AFU to a bucket on Amazon Simple Storage Solution (S3).

Table 70 *AWS Automatic Upload Configuration Parameters*
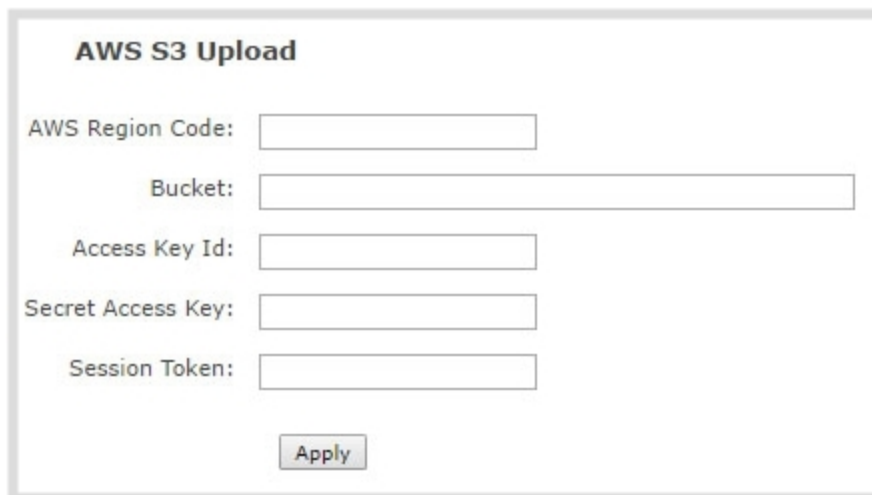
Name	Description
AWS Region Code	The geographical region of the AWS server that contains the bucket you want to upload to, e.g. us-east-2.
Bucket	The id of the data storage container you created in Amazon S3 for the recorded live streaming files.
Access Key Id	The Access Key Id is part of your access key for your AWS account, i.e. GAKSOSIFDONN2EXAMPLE.
Secret Access Key	The secret access key is part of your access key for your AWS account, i.e.bHaprXUenFEMI/K6MANVG/cPxDfiBYEXAMPLEKEY.
Session Token	The temporary security token provided by the AWS Security Token Service (STS) that allows access to your AWS account for authorized users.

Prerequisites

- You must have read and write privileges for your AWS account to setup AFU to upload to an AWS S3 location
- Channels and recorders are already added for AFU, see Choose Channels and recorders to include in AFU
- AFU is enabled and the parameters configured, see Enable AFU and set parameters.

To configure upload to AWS S3:

1. From the Automatic File Upload configuration page, select **AWS S3 Client** as the protocol transfer type.

AWS S3 Upload

AWS Region Code:

Bucket:

Access Key Id:

Secret Access Key:

Session Token:

Apply

2. Specify the **AWS Region Code** and the data storage **Bucket** where you want to upload the file.

3. Enter your AWS **Access Key Id** and **Secret Access Key** to authenticate access to the AWS S3 data storage bucket.

4. In the **Session Token** field, enter the temporary token you got from the AWS Security Token Service (STS).

5. Click **Apply**.

Configure AFU to WebDav server parameters

You can automatically upload recordings to a WebDav server when you select WebDav as the AFU protocol transfer type using the Admin panel.

The following table describes the parameters to configure AFU to a WebDav server.

Table 71 *WebDav Automatic Upload Configuration Options*

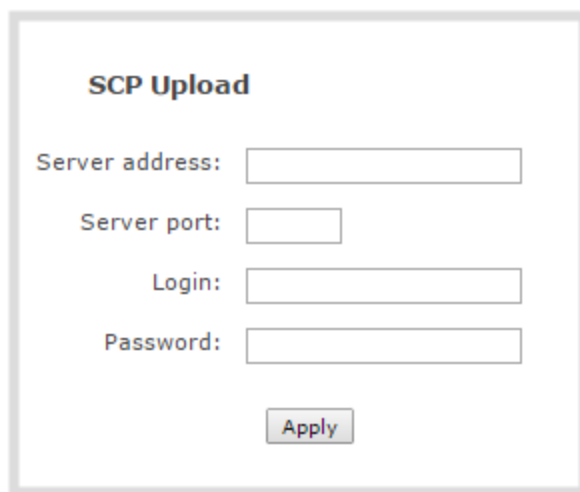| Name	Description / Options
Server address	The IP address (or fully qualified domain name) of the FTP server.
Server port	The port used by the target WebDav server. Standard port is 21.
Login	Username for the WebDav server.
Password	Password for the WebDav user.
Enable HTTPS	Select if you need to use a secured HTTPS link to the WebDav server.
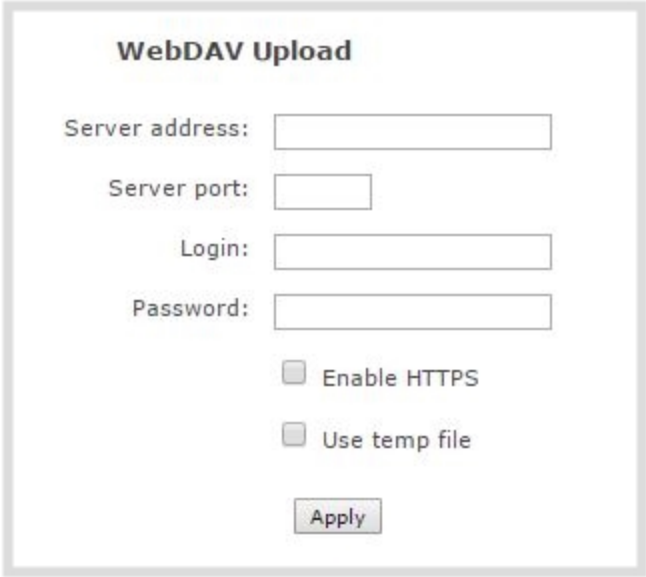
Name	Description / Options
Use temp file	Causes files to be named with .part extension on the server during active upload. When the upload completes, the file is renamed to the appropriate extension (.mov, .mp4 or .avi).

Prerequisites

- Channels and recorders are already added for AFU, see Choose Channels and recorders to include in AFU
- AFU is enabled and the parameters configured, see Enable AFU and set parameters.

To configure upload to a WebDav server:

1. From the Automatic File Upload configuration page, select **WebDav Client** as the protocol transfer type.

2. Specify the target **Server address**. If your system is configured with DHCP or has a valid DNS configuration (see Configure DHCP), you can use the server's fully qualified domain name instead of the IP address.

3. Specify the **Server Port** used for the target WebDav server. The standard port is 21.

4. Enter the FTP account username in the **Login** field.

5. Enter the FTP account password in the **Password** field. The characters are masked with dots.

6. Select **Enable HTTPS** if you need a secure HTTPS link to the WebDav server.

7. Select **Use temp file** to name files with a temporary filename extension (.part) on the server until

upload is complete.

8. Click **Apply**.

AFU or copy to USB

Pearl has USB 2.0 ports that you can use to copy recordings from internal storage to external USB flash drives or hard drives. Use this to conveniently provide speakers with a copy of their presentation before they leave the presentation venue.

The USB storage device must be formatted with one of the following file systems:

- FAT16
- EXT2
- NTFS

- FAT32
- EXT3

- XFS
- EXT4

> **STOP** Do not power up the system with a USB storage device connected. Doing so can cause unpredictable problems with system startup.

There are several different ways you can transfer recordings to a USB storage device:

- AFU to a USB storage device
- Do a one-time copy/move all recordings to USB storage device
- Manually copy recordings to USB storage device

> **STOP** We recommend you only connect one USB device to Pearl at a time. Only one copy or move to USB operation is permitted at a time, even though the UI may appear to let you start a second one. Please wait until the first is complete before starting a new operation.

AFU to a USB storage device

You can transfer recordings to a USB storage device automatically when you select an external USB device as the AFU protocol transfer type using the Admin panel.

USB ports are available on the back panel of the desktop model and on both the front and back panels of the rackmount model.

Prerequisites

- A properly formatted USB device must be connected to one of the USB ports.

- Channels and recorders are already added for AFU, see Choose Channels and recorders to include in AFU

- AFU is enabled and the parameters configured, see Enable AFU and set parameters.

To configure automatic file upload to a USB storage device:

1. From the Automatic File Upload configuration page, select **External USB Drive** as the protocol transfer type.

Table 72 *If your Automatic File Upload setting conflicts with your new USB device setting, a message is displayed. Click the **fix it** link and click **Apply**.*
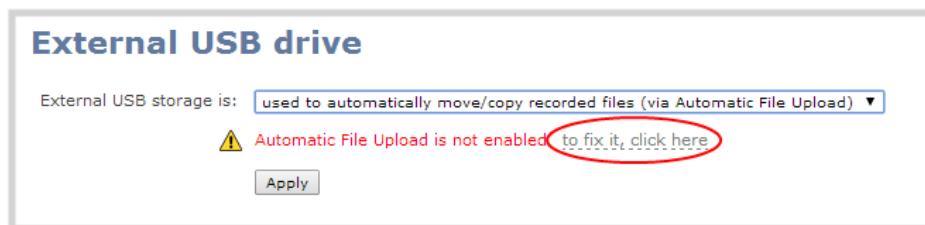
> The fix it link disables any other type of automatic file upload you have configured. When you are done with USB uploads, return to the **Automatic File Upload** configuration page and reconfigure your AFU settings.

2. Select **Create a subfolder for each channel** to have recordings organized by channel.

3. Click **Apply**.

Do a one-time copy/move all recordings to USB storage device

When one-time move/copy of files is configured, Pearl automatically starts copying files as soon as you connect a USB storage device to one of the USB ports.

Newest recordings are copied first. Files continue copying over until one of the following events occur:

- all files are copied

- the specified maximum number of files are copied

- the target drive runs out of storage space

File that are currently recording do not transfer until recording ends.

The following table describes the options available for a one-time move/copy of recordings to a USB storage device.

Table 73 *One-Time Move/Copy File Transfer Options*

Name	Description
create subfolder with serial number (<serial>)	If checked, the transfer process creates a sub-folder with the system's serial number on the USB drive. This is useful if you are using the same drive to collect recordings from multiple systems and want to know which system they came from.
create subfolder for each channel	If checked, the transfer process creates a sub-folder for each channel and recorder (within the subfolder for the serial number, if that option is also selected). Files are copied to their respective folders.
remove after copying	If checked, the file(s) are removed after being copied to the USB drive. Checking this box makes the transfer a move instead of a copy.
mark file as downloaded	If checked, the files that are downloaded are marked with a downloaded icon when viewing file lists. This has no effect if remove after copying is checked.
ignore already downloaded files	If checked, files that were previously downloaded or marked as downloaded are not included in subsequent downloads.

> If your USB drive has no activity indicator to let you know when the transfer is complete, select the one-time move/copy option to **remove after copying** or **mark the file as downloaded** so that you know when the transfer has finished.

Prerequisites

- A properly formatted USB device not connected to a USB port on Pearl.

To configure a one-time copy of all recorded files to a USB storage device:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, select **External USB Drive**. The External USB Drive configuration page opens.

3. Select **used for one-time move/copy of the recorded files (upon insertion)**.

> If a conflict is reported regarding the Automatic file upload settings, click **Fix it** or go to the Automatic File Upload configuration page and either disable automatic file upload or switch to a non-USB based upload type.

4. Check the options you want to use for the one-time move/copy file transfer and click **Apply**.

5. Insert the USB storage device into one of the USB ports. File transfer starts automatically.

6. Follow the steps to Safely eject USB storage device when the activity light on the USB storage device stops flashing. If your USB device doesn't have activity indicators:

   a. Check the **Recording** list for each channel and the **Recorded Files** list for each recorder to verify if there are files that have yet to be copied.

   b. Safely eject USB storage device when you are satisfied all files have been copied, or if you notice the USB storage device is out of space, see View available USB storage space.

Manually copy recordings to USB storage device

You can manually copy recordings to a USB drive connected to Pearl.

The following table describes the options available when manually copying recordings to a USB storage device.

Table 74 *One-Time Move/Copy File Transfer Options*

Name	Description
create subfolder with serial number (<serial>)	If checked, the transfer process creates a sub-folder with the system's serial number on the USB drive. This is useful if you are using the same drive to collect recordings from multiple systems and want to know which system they came from.
create subfolder for each channel	If checked, the transfer process creates a sub-folder for each channel and recorder (within the subfolder for the serial number, if that option is also selected). Files are copied to their respective folders.
File already exists	Choose the action to take if a file with the same name already exists in the copy location: • replace (default) • skip • rename

This procedure is separate from automatic file upload and does not need any pre-configuration in the automatic file upload page.

To manually copy recorded files to a USB device:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, select **External USB Drive link**. The External USB Drive configuration page opens.

3. Select **used to manually move/copy selected files via the Admin panel** and click **Apply**.

External USB drive

External USB storage is:	used to manually move/copy selected files via web interface ▼
	☐ Create subfolder with device name (TSG700558)
	☐ Create subfolder for each channel
File already exists:	replace ▼
	Apply

> If a conflict is reported regarding the Automatic file upload, click **Fix it** or go to the Automatic File Upload configuration page and disable automatic file upload or switch to a non-USB based upload type.

4. Insert your USB storage device into an available USB port on Pearl and do one of the following:

   a. To download files for a specific channel, click **Recording** from the Channels menu.

   b. To download files for a recorder, select a recorder from the Recorders menu.

5. Check the files you want to download and do one of the following:

   a. Click **Copy Selected to external drive** to copy the files to the USB drive.

   b. Click **Move Selected to external drive** to move the files and delete them off of Pearl.

In this example, the first file is currently recording and cannot be downloaded.

6. Follow the steps to Safely eject USB storage device when you're done.

View available USB storage space

When you insert a USB storage device into an available USB port and select an **External USB Drive** action other than **ignored** (i.e. manual copy, automatic copy, etc), the total and free space are calculated and displayed in the Admin panel.

When you insert your USB storage device into an available USB port, an External storage usage information tab appears at the bottom of the menus panel.

Safely eject USB storage device

When you're done saving recordings to the USB storage device, you can safely eject it using the link at the bottom of the Admin panel page.

To safely eject the USB drive:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. At the bottom of the menus panel, click **eject** and click **OK** when prompted.
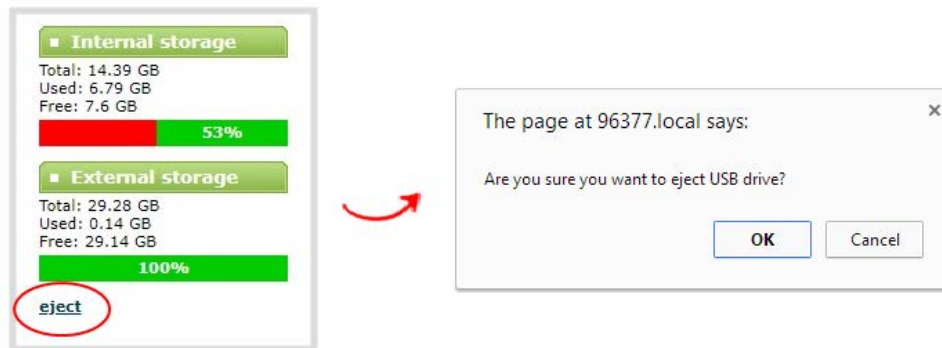
It's now safe to disconnect the USB storage device from Pearl.

Manage USB file transfer queue

You can view USB file transfer information, delete files in the USB file transfer queue, and cancel USB file uploads using the Admin panel.

Information such as the file name and size, start time, duration, and progress are displayed. A history of file transfers displays until either Pearl is restarted or the list is manually cleared. External USB storage must be configured for the USB file transfer status to display.

To view USB file transfer status, delete files in the queue, or cancel file uploads using the Admin panel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, select **External USB Drive**. The External USB Drive configuration page opens. If there are files to be uploaded, they appear in the queue.
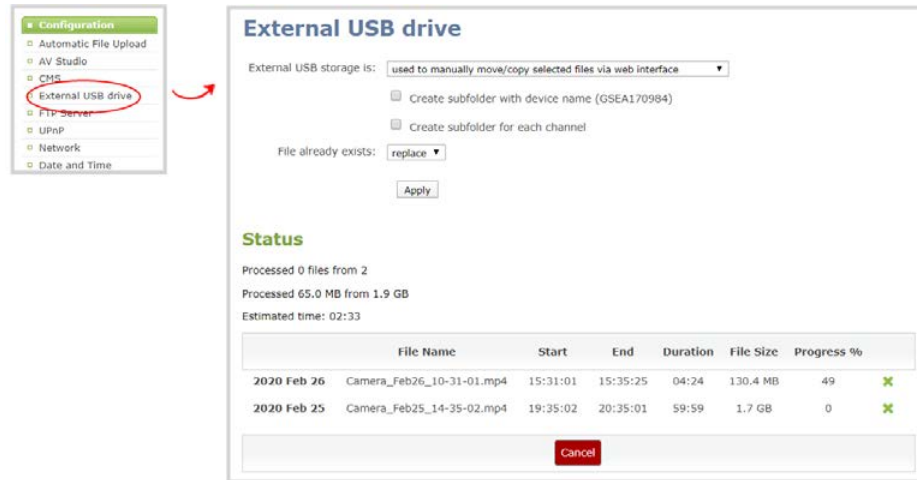
3. To remove a file from the USB transfer queue, click **X** beside the file you want to remove.

4. To cancel the current USB file transfer that's in progress and remove all files that are currently waiting in the USB transfer queue, click **Cancel**.

Add recordings to an AFU queue

You can add previously recorded files to an AFU queue using the Admin panel. Before you can add a previously recorded file, the channel must be enabled for AFU and at least one new recording must have been queued.

> This feature is not available using the local console on Pearl.

To add an existing recording to an AFU queue using the Admin panel:

1. Login to the Admin panel as **admin** or **operator**, see Connect to Admin panel.

2. Find the recordings by channel or by recorder and select the files you want to add to the AFU queue.

3. Select **Add Selected to Automatic file upload**.

What's next?

Add more recorded files to the queue or delete and of the recordings before they are uploaded, see Manage USB file transfer queue.

View the AFU log

A log is kept of automatic file uploads. You can view the AFU log using the Admin panel, If you want to view the AFU status, see View AFU and file transfer progress

To view the AFU log:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, select **Automatic File Upload**. The Automatic File Upload configuration page opens.
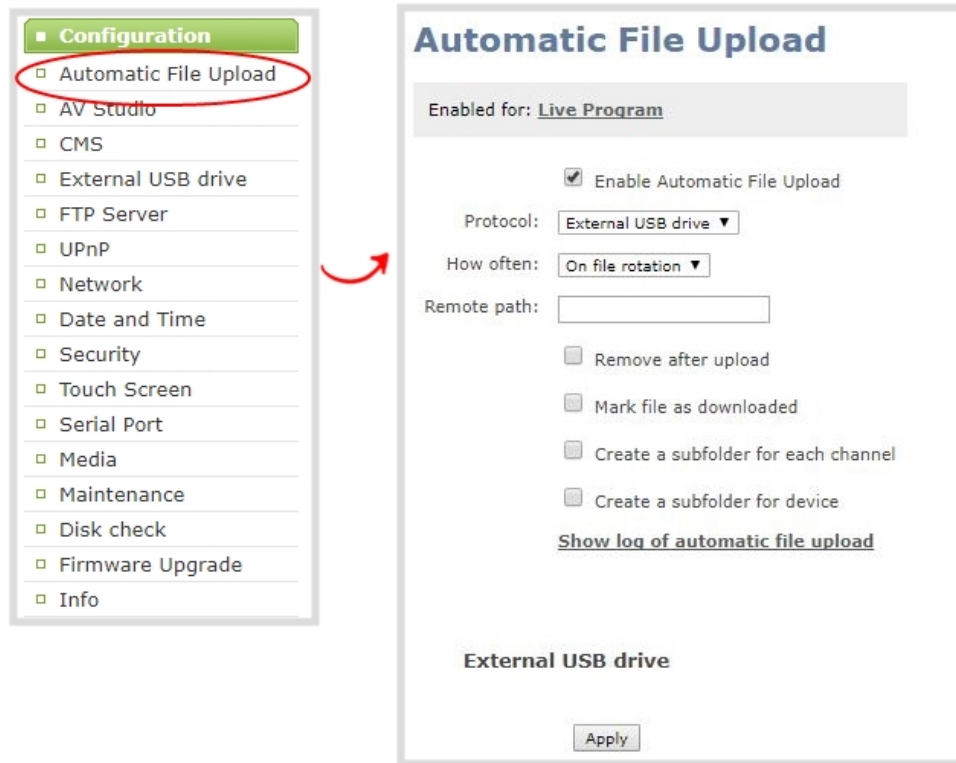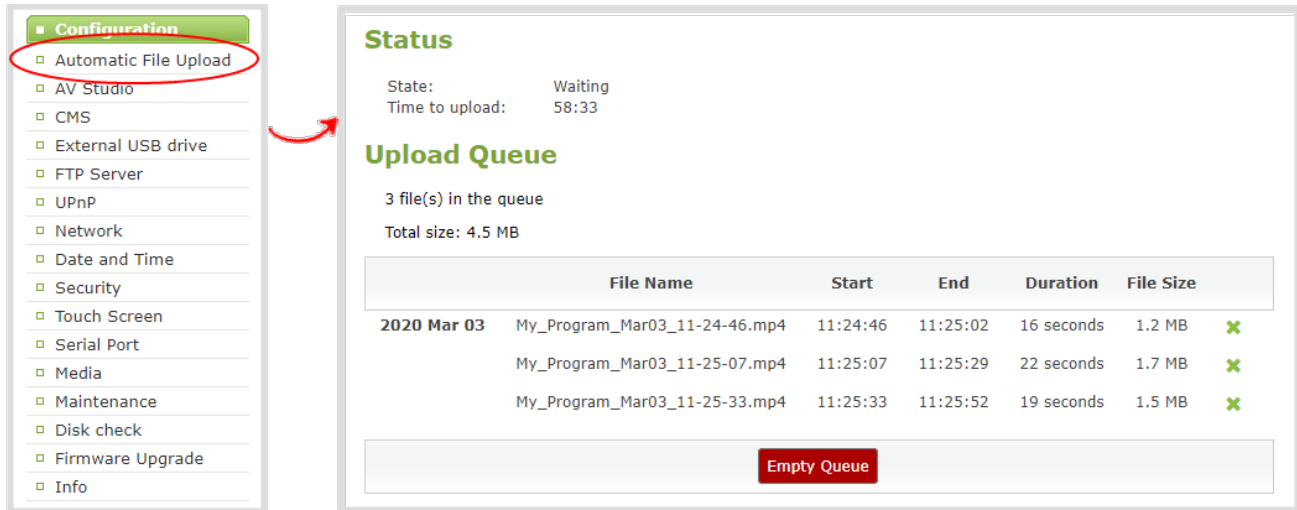
3. Click **Show log of automatic file upload**. The log page opens. If no logs are present, the page is blank.

4. Click the browser's back button when you are done.

Manage the AFU queue

The Automatic File Upload (AFU) queue displays a list of recorded files waiting to be uploaded. You can view the AFU queue and remove files from the queue using the Admin panel. Automatic File Transfer must be configured for the AFU queue to display.

To view the AFU queue and remove files from the queue using the Admin panel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, click **Automatic File Upload**. If there are files to be uploaded, they appear in the queue.

3. To remove a file from the AFU queue, click **X** beside the file you want to remove.

4. To remove all files that are currently waiting in the AFU queue, click **Empty Queue**.

The **Empty Queue** button does not delete an AFU file transfer that's in progress.

Local FTP server

Pearl can act as an FTP server, allowing you to manually or automatically connect to the system and download recordings. Depending on configuration of the FTP server, you may also be able to remotely delete files after download, maximizing available system storage.

> **STOP** When using an FTP server to download a file, it is possible to start the download while that file is still in the process of being recorded. This results in an incomplete file. To avoid this, check the status of the file in the Admin panel before beginning the download process.

Topics include:

- Configure the local FTP server
- Using the local FTP server

Configure the local FTP server

You can setup the local FTP server on Pearl using the Admin panel.
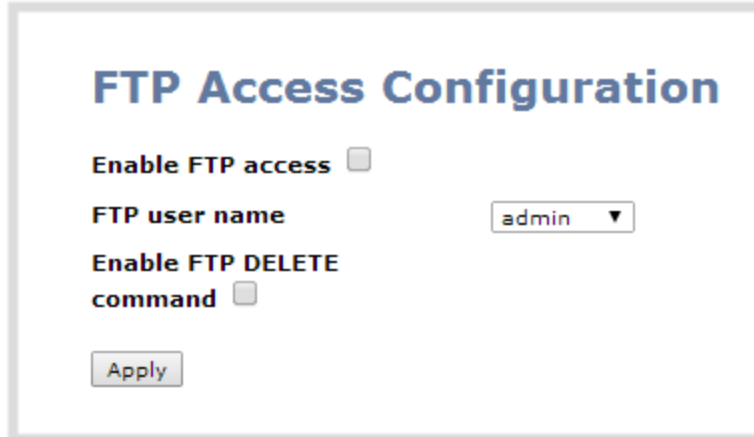
The following table describes the configuration parameters to setup Pearl's local FTP server.

Table 75 FTP Server Configuration Parameters

Name	Description
Enable FTP access	The check box controls whether or not the system acts as an FTP server. By default this is disabled.
FTP user name	Select one of the system users: admin, operator, or viewer. The ftp password will be the access password for the selected user. By default the admin user is selected.
Enable FTP DELETE command	Controls whether or not FTP users can delete files. By default file deletion is not permitted.

To configure Pearl's local FTP server:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, select **FTP Server**. The FTP Server configuration page opens.

3. To enable or disable the FTP server, do one of the following:

    a. Check **Enable FTP access** and select a user from the **FTP user name** drop down. Then click **Apply** to enable the FTP server.

    b. Uncheck **Enable FTP access** and click **Apply** to disable the FTP server.

    > The ftp password is the regular access password for the selected user. See **User administration** for details on user names and passwords.

4. To allow or disable FTP users to delete files, do one of the following:

    a. Check **Enable FTP DELETE command** and click **Apply** to allow users to delete files.

    > Any currently logged in ftp users must log out and back in again to have access to the command.

    b. Uncheck **Enable FTP DELETE command** and click **Apply** to disable file deletion by FTP.

    > Any currently logged in users will continue to have access to the delete command until they log out and log in again.

Using the local FTP server

Once you have configured a local FTP server, you can use the tool of your choice to download files from Pearl.

Files are stored in a folder structure with a folder for each channel and a folder for each recorder. Channel and recorder numbers are displayed next to the name of the channel or sources in the Admin panel.

- Channel folders are labeled *video<channel number>* (i.e. video3 for channel 3)
- Recorder folders are labeled *videom<recorder number>* (i.e. videom1 for the first recorder).
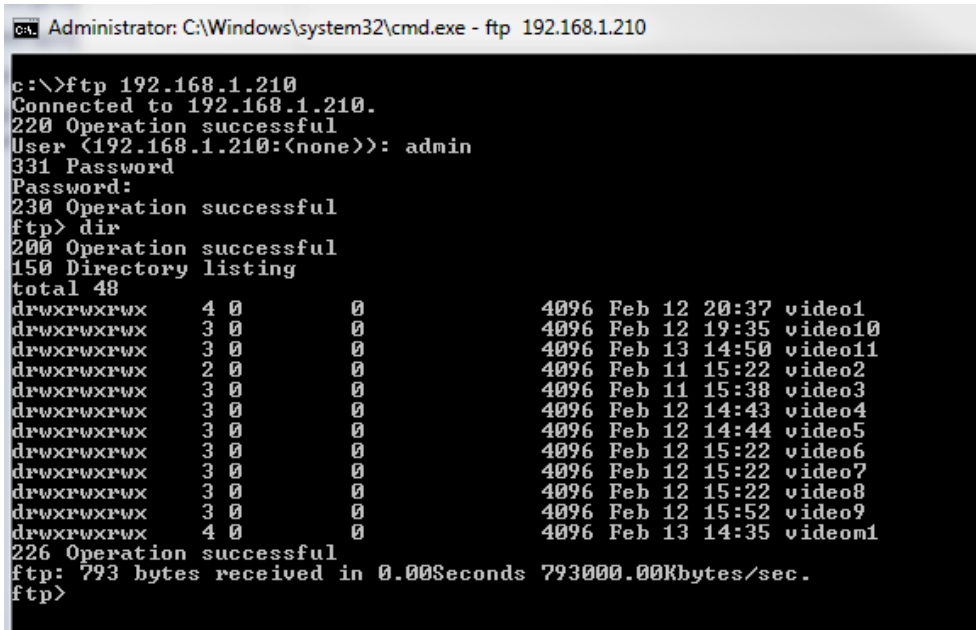
Prerequisites

- The IP address of your Pearl, see Verify IP address and MAC address of Pearl
- An FTP tool
- The username and password for your FTP user, see Configure the local FTP server

In the following example, the IP address of Pearl is 192.168.1.210, the username is **admin**, there is no password, and the Windows command line ftp utility is used.

To connect to the FTP server:

1. Open a command window on Windows (alternatively open a terminal window on Linux/Mac, or open your FTP utility of choice).
2. Establish an ftp connection using the command: **ftp 192.168.1.210**
3. Provide the username: *admin* (provide the username of your FTP user).
4. Provide the password: (provide the correct password for your FTP user).
5. Type **dir** to see the file structure.

6. Use **dir** or your tool's GUI to look in each folder for recordings.
7. Use **get** or your tool's transfer mechanism to transfer files to your computer.

```
ftp> dir videom1
200 Operation successful
150 Directory listing
total 920
-rw-r--r--    1 0        0            934130 Feb 13 14:35 VGA.1392302138.Recorder_1.avi
drwxrwxrwx    2 99       99             4096 Feb 12 20:44 trash
226 Operation successful
ftp: 163 bytes received in 0.00Seconds 163.00Kbytes/sec.
ftp> get videom1/VGA.1392302138.Recorder_1.avi
200 Operation successful
150 Opening BINARY connection for videom1/VGA.1392302138.Recorder_1.avi (934130 bytes)
226 Operation successful
ftp: 934130 bytes received in 0.08Seconds 12131.56Kbytes/sec.
ftp>
```

8. If enabled in the FTP configuration page, delete the file after downloading it by issuing the delete
    command, or using your tool's delete mechanism.

> If the delete command is not enabled, attempting to delete a file will result in an Unknown
> Command error.

PART 5: Integration

Pearl is fully integrated with Kaltura and Panopto Content Management Systems (CMSs). Learn to use the Admin panel to set up and manage Pearl with Kaltura and Panopto, as well as how to record and stream. This section also contains Pearl's HTTP/HTTPS and RS-232 APIs for integrators wanting to control Pearl using other third party tools.

Topics include:

- Kaltura registration
- Panopto registration
- Kaltura recording and webcasting setup
- Panopto recording and webcasting setup
- CMS recording and webcasting using the Admin panel
- Controlling Pearl using RS-232 / serial port
- Controlling Pearl using HTTP/HTTPS commands
- Configuration keys for third party APIs

Kaltura registration

Pearl is fully integrated with Kaltura Content Management Systems (CMSs) for a seamless video recording and webcasting experience. After Pearl is registered, the encoder appears as a resource in Kaltura's MediaSpace and can be selected for scheduled recordings and webcasts, as well as be used for unscheduled ad hoc events. Registering Pearl as a resource with the Kaltura Content Management System (CMS) only needs to be done once.

Topics include:

- Enable CMS and register with Kaltura

- Disable or deregister from Kaltura

- Change the resource name used for Kaltura

- Reassign a registered resource

After Kaltura is registered, proceed to configure which channels on Pearl you want to assign by default to VODs and webcasts, as well as setup authentication for ad hoc events. See Kaltura recording and webcasting setup.

Enable CMS and register with Kaltura

Use the Admin panel to register Pearl as an encoder resource for Kaltura. After Pearl is registered, you can assign it a unique name that appears in the list of resources when creating an event in Kaltura's MediaSpace. The default name includes the serial number of Pearl to ensure the name is unique.

If more than two other resources are already registered with the same name, you're prompted to choose a different name and try to register Pearl again. If only one resource is registered with the same name, you're prompted to take over the events for that other resource. If you do, Kaltura transfers all scheduled events from that other device over to Pearl. For more information, see Reassign a registered resource.

> It may take some time for Kaltura to display a newly registered resource, depending on how busy the Kaltura system is when you register.

There are two methods to register your Pearl:

- Using your Kaltura partner ID and administrator secret

- Using an application token and the token ID

A Kaltura application token can be created from the Kaltura developer website: www.developer.kaltura.com
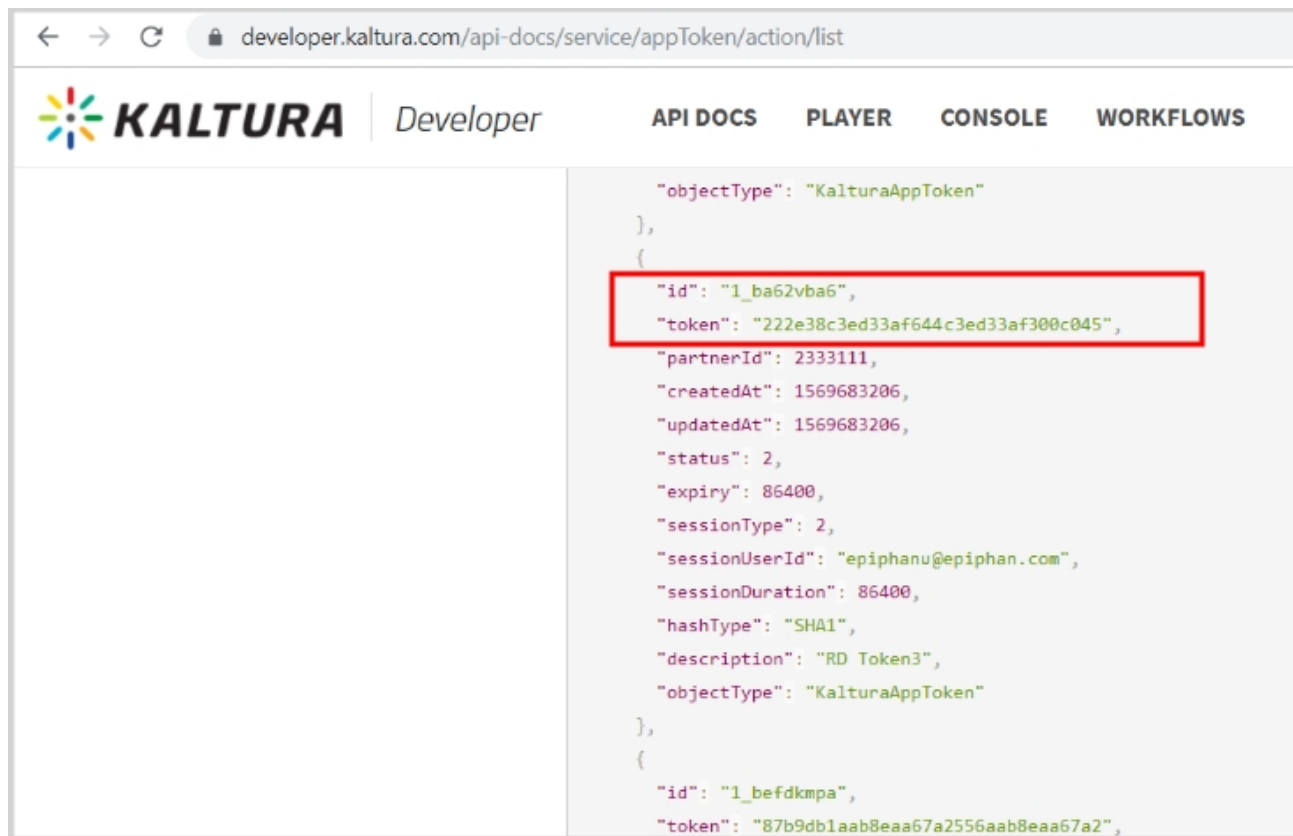
There are two types of Kaltura application tokens you can use with Pearl: an administrative session type and a user session type. With an administrative session token, Pearl uploads event recordings to the respective event owner's account in Kaltura as expected.

A user session token requires the following permissions:

KMC_ACCESS,KMC_READ_ONLY,BASE_USER_SESSION_PERMISSION,WIDGET_SESSION_
PERMISSION,CONTENT_INGEST_BASE,CONTENT_INGEST_UPLOAD,CONTENT_MANAGE_
BASE,cuePoint.MANAGE,CONTENT_MANAGE_SCHEDULE,CAPTURE_DEVICE_PERMISSION,CONTENT_INGEST_
REFERENCE_MODIFY,LIVE_STREAM_ADD

Important considerations for user session application tokens
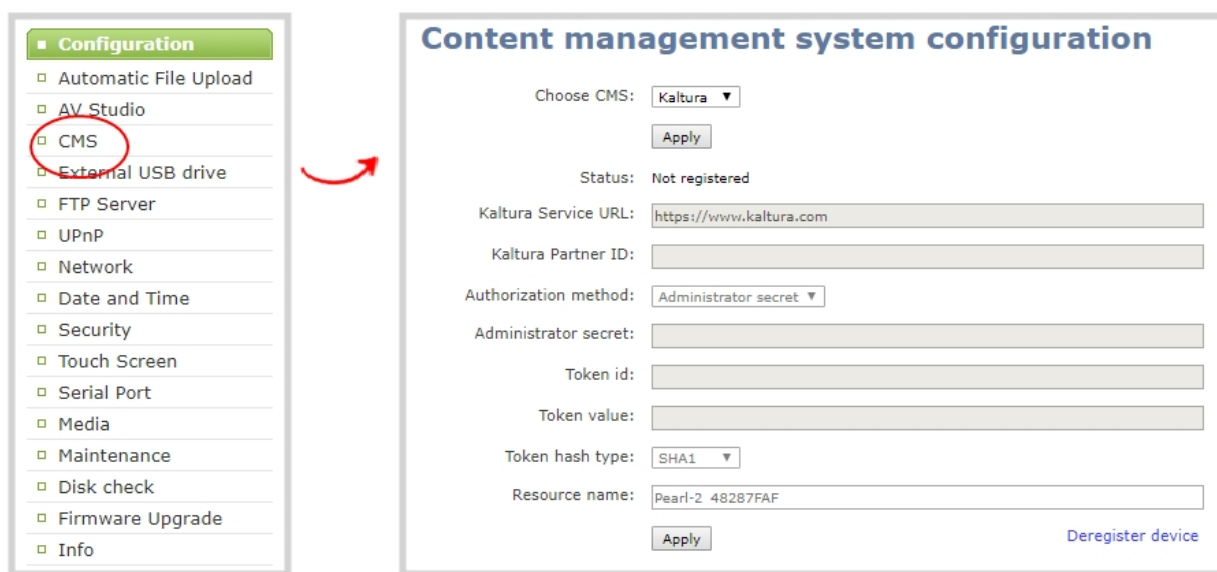
- Pearl uploads all events (scheduled and ad hoc) to the user account ID associated with the user token.

- All event recordings (scheduled and ad hoc) upload to the Kaltura account of the user who created the event if there is no user ID associated with the token.

- Do not include a creation date for the user session token. A creation date in the token causes Pearl to upload events only to the token creator and restricts login using Pearl's touch screen to only the token creator.

Before you begin, you should already have:

- A Kaltura instance created

- Either of the following:

    - Your Kaltura partner ID and administrator secret

    - Your application token ID and token value

To enable Pearl as a resource and register with Kaltura using the Admin panel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, click **CMS**. The Content management system configuration menu opens.

3. From the **Choose CMS** drop down, select **Kaltura** and then click **Apply**.

4. In the Authorization method field, select the authorization method and do one of the following:

    a. If you select **Administrator secret**, enter your Kaltura **Partner ID** and **Administrator secret** that you got from Kaltura.

    b. If you select **Application token**, enter the application **Token ID** and **Token value** .

    > Ensure the **Token hash type** matches the hash type set in the application token. The default is **SHA1**.

5. (Optional) Change the **Resource name** that appears for this device in Kaltura. The default resource name includes the serial number of your Pearl.

6. Click **Register device**.

A calendar icon appears on the touch screen of Pearl to show that Pearl is in CMS mode, see **CMS event controls using the touch screen**.

What's next

Choose which Pearl channels you want this resource to record, assign the channel to use for webcasting, setup authentication for ad hoc events, and specify default ad hoc event parameters. See Kaltura recording and webcasting setup.

Disable or deregister from Kaltura

You can disable CMS for a registered Pearl using the Admin panel and still select Pearl as a resource using Kaltura MediaSpace. However, the events schedule won't synchronize on Pearl and any events that are scheduled to start while CMS is disable do not start on Pearl. If CMS is re-enabled on Pearl before the event is scheduled to end, that event will start automatically after the events schedule is refreshed on Pearl, see View scheduled events and history.

Existing events that are already associated with the device do not lose their association when CMS is disabled. As soon as you re-enable Kaltura CMS on Pearl, you can record and stream events as usual. CMS is disabled by default.

Deregistering removes Pearl from Kaltura's list of resources and any existing events that were associated with that resource lose their association. You must select a new resource for those events using MediaSpace.

Important considerations

- You can not start ad hoc (manual) Kaltura events when CMS is disabled or when Pearl has been deregistered.
- When CMS is disabled or Pearl is deregistered, existing scheduled events that are associated with the device do not record or stream.
- If Pearl is deregistered, existing events associated with that device lose the association. You must select a new resource for those events.
- Ensure the deregistered Pearl entry in the list of encoder devices on Kaltura disappears before registering again if using the same device name.
- Do not disable CMS while an event is in progress.

To disable Pearl as a resource or deregister from Kaltura using the Admin panel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, click **CMS**. The Content management system configuration menu opens.

3. To disable CMS, select **none** from the **Choose CMS** drop down and then click **Apply**.

4. To deregister Pearl, click **Deregister device**.

 The calendar icon disappears from Pearl's touchscreen when CMS is disabled or deregistered.

Change the resource name used for Kaltura

Using the Admin panel, you can change the resource name that's assigned to Pearl while it's registered with Kaltura.

Each Pearl is assigned a unique resource name that includes the serial number of the device by default. You can transfer scheduled VOD and scheduled webcasting events from one resource to another by assigning Pearl the same resource name as another resource.

When a resource with the same name is already registered in Kaltura, a warning message appears when you try to apply the new resource name to Pearl.

- If there's only one other registered resource with that name, you're prompted to choose whether or not to take over the events for that other resource. If you do take them over, Kaltura transfers all scheduled events from that other device over to Pearl.

- If more than two other resources are already registered with the same resource name in Kaltura, the name change fails. You're prompted to choose a different resource name and try again.

To change the Pearl resource name using the Admin panel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, click **CMS**. The Content management system configuration menu opens.

3. Change the **Resource name** and click **Apply**.
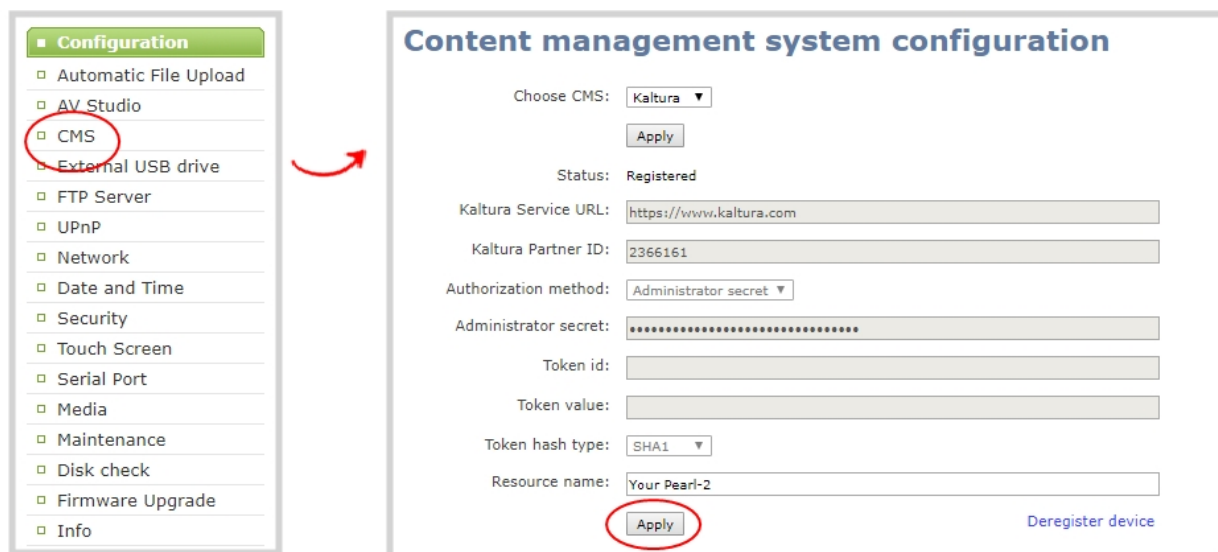
Reassign a registered resource

Every encoder you register with Kaltura has a unique resource name. To swap out one Pearl encoder with another one, you can simply reassign the existing Pearl resource name to the replacement Pearl.

Assigning Pearl the same resource name when you register the encoder transfers all the existing schedules and recordings over to the replacement Pearl. When a resource tries to register using the same name as

another device, a warning message appears and you're asked whether or not you want to take over from the other resource.

- If there's only one other registered resource with that name, you're prompted to choose whether or not to take over the events for that other resource. If you do take them over, Kaltura transfers all scheduled events from that other device.

- If more than two other resources are already registered with the same resource name in Kaltura, registration fails. You're prompted to choose a different resource name and to try registering Pearl again.

This works well when you want to change the encoder in a room but retain all the existing schedules and recordings that are associated with the encoder for that room.

Alternatively, you can avoid having to register the replacement Pearl with Kaltura. If you apply a configuration preset to set up the replacement Pearl with the settings from the currently registered Pearl, the replacement Pearl assumes the identity of the registered resource. For more information about configuration presets, see About configuration presets.

> **STOP** Using a configuration preset can result in two Pearl resources with the same identity, which can effect recording and the content that's uploaded to Kaltura for scheduled events. Power down, disconnect from the network, and consider performing a factory reset on one of the Pearl resources to remove the possibility of having duplicate resources.

You can also use this procedure if you've performed a factory reset, which resulted in an orphaned Kaltura resource registration and you need to reregister your Pearl using the same resource name to take over the resource instance that is still registered in Kaltura.
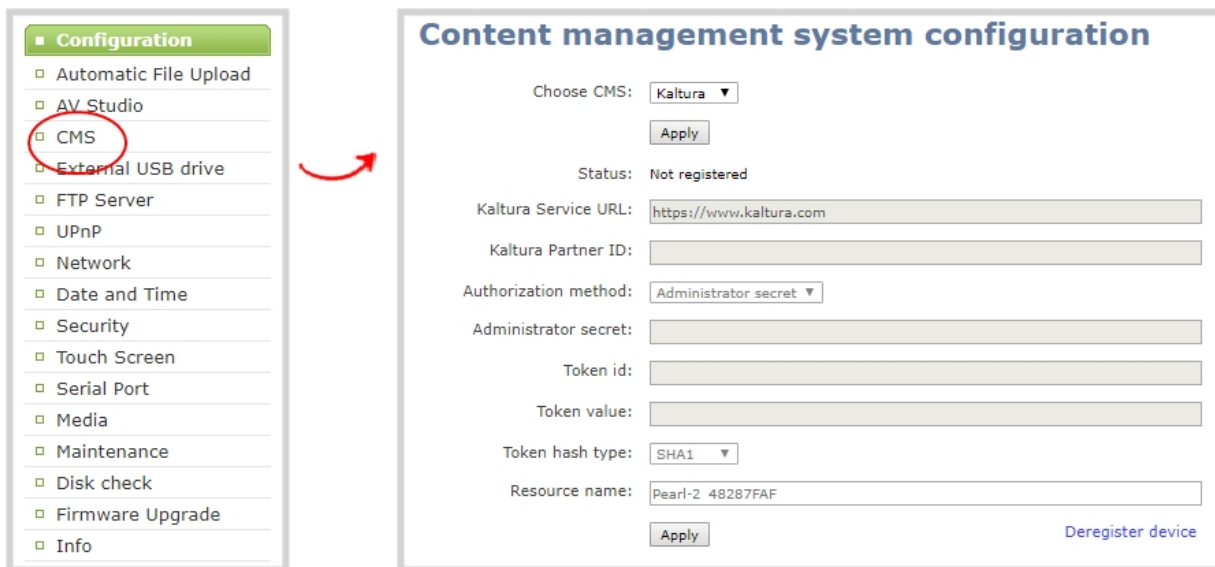
Before you begin, you should already have:

- A Kaltura instance created

- Access to the Kaltura Management Console (KMC)

- Your Kaltura partner ID

- Your Kaltura administrator secret

To enable Pearl as a resource and register with an existing resource name using the Admin panel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, click **CMS**. The Content management system configuration menu opens.

3. From the **Choose CMS** drop down, select **Kaltura** and then click **Apply**.

4. Enter your **Partner ID** and **Administrator secret** that you got from Kaltura.

5. Change the **Resource name** to the resource name of the Pearl you are replacing and click **Register device**.

6. When you're prompted to take over the events from the existing resource with that same name, click **Yes**.

Kaltura recording and webcasting setup

Pearl appears as an available resource as soon as the device is registered with Kaltura. Connect multiple audio and video sources directly to Pearl and assign them to separate channels. Each channel you configure on Pearl is treated as a separate video source. For more information about using the auto channel feature, creating channels or using custom layouts, see What is a channel?.

Topics include:

- About Kaltura recording and webcasting
- Select channels for Kaltura VOD events
- Select channel for Kaltura webcasting events
- Set Kaltura ad hoc event parameters
- Change the events schedule refresh interval
- Use RTMPS for a Kaltura webcasting event

About Kaltura recording and webcasting

Pearl supports scheduled, recurring, and unscheduled multiple source ad hoc recordings and webcasts. After Pearl is registered, Kaltura users can simply assign Pearl as a resource when setting up an event using MediaSpace.

Scheduled events start and end automatically. No manual intervention is required. After the event ends, the recording automatically uploads. Back up recordings for each channel are also saved locally on Pearl. If the network connection or the CMS goes down during an event, Pearl continues to record locally and uploads the recording when network connectivity resumes. Depending on how busy the Kaltura CMS system is when the files upload, it may take some time for the files to appear in Kaltura's media lists.

You can start and stop events earlier than the scheduled time using either the Admin panel or the touch screen on Pearl, as well as create ad hoc events.

> Starting or stopping a scheduled VOD event before the scheduled start or stop time does not change the event in to an ad hoc event.

Using multiple Pearl channels is how you get multiple views for a Kaltura event. Each channel is treated as a separate video source. Using the Admin panel, Pearl administrators can choose up to four channels on Pearl for multiple source recordings. For webcasting, you can select only one channel at a time.

For example, if you have a main camera and a presentation laptop that you want to capture as a multiple source recording, you'd create two channels on Pearl: one for the main camera and another one for the presentation laptop. To learn how to create a channel or to use the Auto channels, see Channel configuration.

For events with multiple sources, the recording for each source is uploaded to Kaltura and appears as a single, multi-view entry in the Kaltura media list with each source (i.e. view) listed as a separate "child" sub-entry. The name of each file includes the name of the channel plus the date and time the file was recorded. For example: **Channel 1_May23_10-12-05**

Pearl administrators can:

- Set the video source that is used as the default main entry. The channel selected as the main entry becomes the default view that people see when watching the VOD, as well as the main view (i.e. the large screen) for PiP.

- Set which Pearl channels are used for scheduled and ad hoc recordings and webcasts.

- Set the channel used for scheduled and ad hoc webcasts.

- Set ad hoc event parameters.

- Change how often Pearl polls Kaltura for an updated list of Events.

Pearl administrators and operators can use the Admin panel to:

- Create ad hoc events, see Create ad hoc events using the Admin panel.

- View the Events page to see all upcoming scheduled sessions and completed sessions, see View scheduled events and history.

- Download local recordings for each channel, see Recover channel backup recordings.

- Start and stop scheduled events before the scheduled time, see Start/stop scheduled events using the Admin panel.

To use the touchscreen on Pearl to start, stop, and create events, see CMS event controls using the touch screen.

Important considerations:

- Pearl must be registered with Kaltura to record and stream Kaltura events, see Enable CMS and register with Kaltura.

- Scheduled events have priority over ad hoc events. If an ad hoc event is still in progress when it's time to start a scheduled event, the ad hoc event is stopped and the scheduled event starts.

- Scheduled events automatically start recording locally on Pearl even If the network is down or Kaltura is unavailable. After the session ends, the locally recorded files upload automatically to your Kaltura media list when the network link to Panopto is re-established.

- After the event ends, it may take a while for content to show up in Kaltura's media lists, depending on how busy the Kaltura CMS system is at that time.

- If the network connection is lost during a file upload to Kaltura, the transfer automatically restarts when the network connection re-establishes.

- If Pearl loses power while a scheduled event is being recorded, the recording stops. If Pearl is powered back on before the scheduled end time for the event, recording of the scheduled event restarts automatically and a second set of files are created. When the event ends, both files automatically upload to Kaltura.

- If Pearl was unavailable on the network or powered down and misses a scheduled event, the status of that event appears as **Skipped** on the Events page in the Admin panel.

- Do not schedule recordings that are longer than the capacity of Pearl to store the recording on the local drive.

- If the time and zone settings of Pearl are out of synchronization with Kaltura's scheduling server, an error appears on the Events page and you're prompted to reconfigure the time settings on Pearl, see Configure date and time.

- We recommend that you configure the channel that is selected as the main entry as well as the other channels in a multi-view scheduled VOD event to include all audio sources. Audio is taken from the channel configured as the main entry in the Kaltura CMS.

- Do not use the One Touch recording control, AFU, or configure recording file size, type and other channel recording settings when CMS is enabled on Pearl.

- To monitor a channel during an event, you can go to the Channel view using the touch screen, see Channel monitoring using the touch screen or monitor channels using the Admin panel. You can also monitor channels directly on the Events screen using the touch screen, see View scheduled events and history.

- If you modify a particular recurring lecture capture plus live webcasting event (e.g. a VOD + Live Stream event in a recurring series), Kaltura excludes that event from the recurring series and the webcast doesn't stream. That's because the RMTP URLs for the modified event looses it's mandatory tokens. However, the recurring Kaltura event does record as scheduled and other events in the series are not affected.
  Workarounds: To regenerate the RTMP tokens for a live event, go to MediaSpace, find the modified live event entry and uncheck the Live event checkbox - and save. Then re-check it and save the event again. Alternatively, you can go to the Kaltura Management Console (KMC), find the modified live event entry and then, in the Live stream tab, click **Re-generate Stream Token**.

Select channels for Kaltura VOD events

You can select which Pearl channels are included in scheduled and ad hoc recordings using the Admin panel. Each channel that is configure on Pearl is treated as a separate video source for all VOD events. Using multiple channels is how you record multiple views for a scheduled or ad hoc VOD event.

For example, if you have a main camera and a presentation laptop that you want to capture as a multi-source recording, you'd create two channels on Pearl: one for the main camera and another one for the presentation laptop.

> Set up your channels before performing this task. To learn how to create a channel, see **Create a channel**.
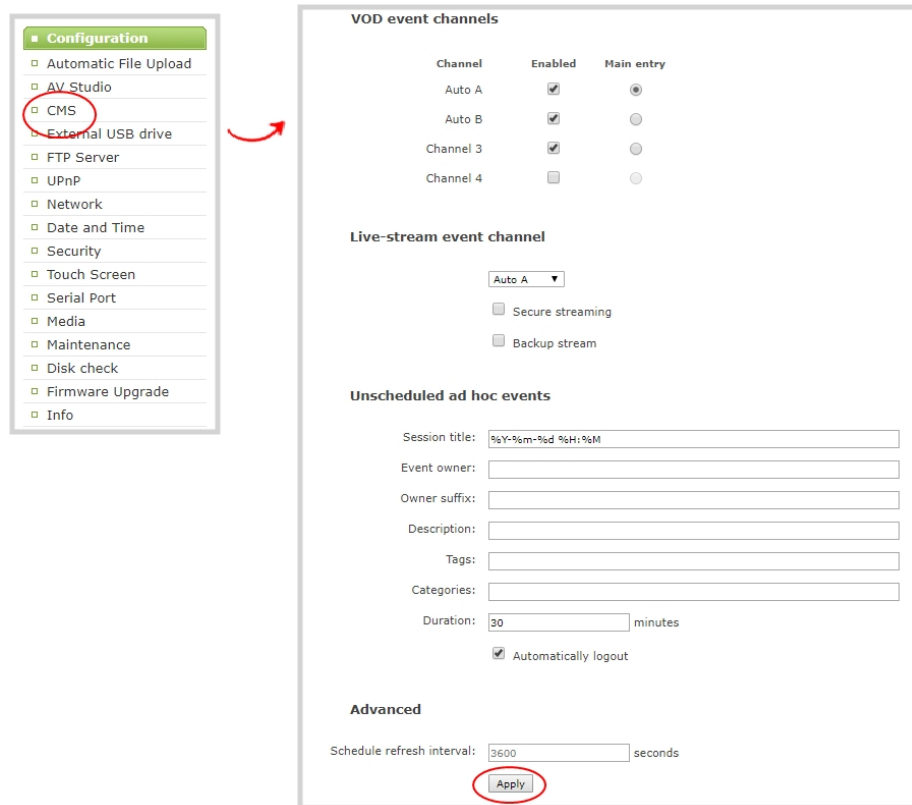
The main entry is the default view that people see when they are watching, as well as the main view (i.e. the large screen) for PiP. The main view, VOD metadata, and edits like trimning the VOD can be done later in Kaltura after the recording has uploaded.

Important consideration

- Ensure that all the same audio sources are selected for each channel if a multi-view event with multiple channels is configured.

To select channels for event views using the Admin panel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, click **CMS**. The Content management system configuration menu opens.

3. Under **VOD event channels**, check the channels to include.

4. (Optional) Select a different **Main entry** channel for multi-view recordings.

5. Click **Apply**.

> 🛑 Failing to apply the changes could result in recording unwanted channels.

Select channel for Kaltura webcasting events

You can select which Pearl channel is used for scheduled and ad hoc webcasting events. Optionally, you can stream the event to the secondary backup stream URL.

When a webcasting event is scheduled in Kaltura or started from Pearl as an unscheduled ad hoc event, the stream url and other event settings are sent to Pearl. When the event is scheduled to start, the ingestion settings are applied automatically to Pearl. Only the primary URL from Kaltura is used by default, but you can optionally enable a secondary backup stream URL.

> Ensure that you have selected the channel on Pearl that you want to use for your scheduled webcasting event well in advanced of the event start time. The first channel on Pearl is selected by default.

When it's time for the scheduled webcasting event to start, Pearl automatically sends an RTMP (or RTMPS) stream to the primary URL associated with that event. If you've enabled the backup stream, then Pearl sends an RTMP stream to both the primary URL and the secondary backup URL associated with that event. If the primary URL stream fails for any reason, Kaltura automatically switches over to the backup URL.

The channel you're streaming should have at least one layout, see Create a channel. For the correct encoding settings to use for the channel, see Kaltura's requirements.

During the webcast, you can switch layouts using Pearl for a more dynamic live broadcast. For information about creating layouts for a channel and switching, see: Custom layout configuration.

You can start a scheduled webcasting event before the scheduled start time using the touch screen on Pearl or the Admin panel.
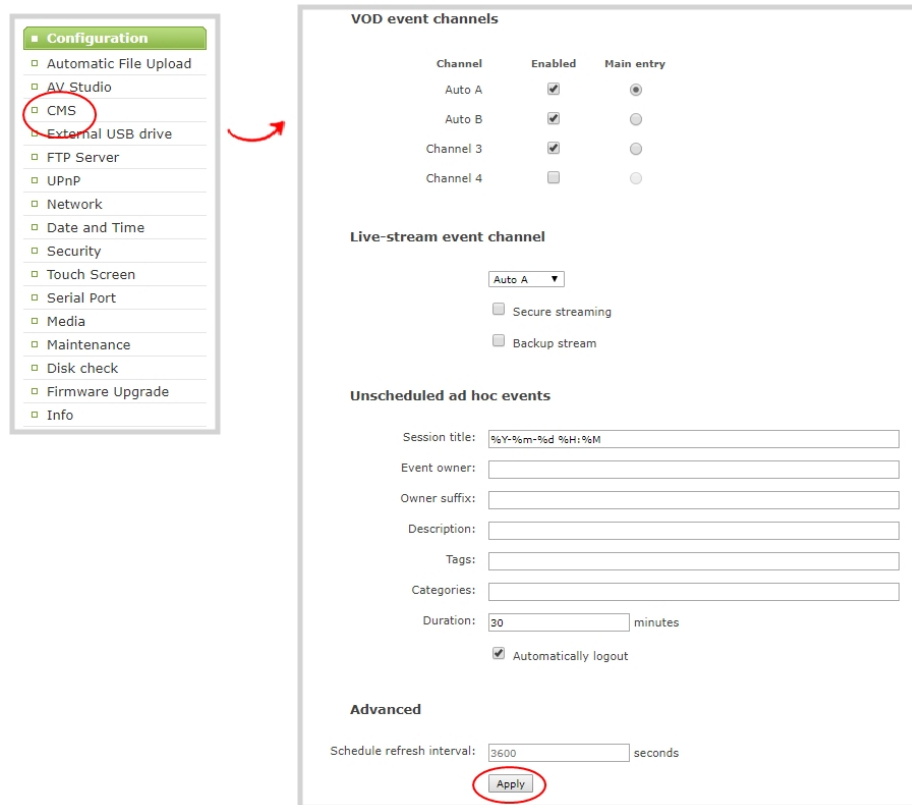
> You can preview the channel that is included for a scheduled webcasting event from the Events touch screen, see **View scheduled events and history**.

Important considerations

- Ensure that the same audio sources are selected on each layout if the channel is configured with multiple layouts for live switching.

To set up a channel in Pearl for a scheduled webcasting event using the Admin panel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.
2. From the Configuration menu, click **CMS**. The Content management system configuration menu opens.
3. Under **Live-stream event channel**, select the channel you want to stream.
4. (Optionally) Check **Backup stream** to enable streaming to the secondary backup stream URL for this event.
5. Click **Apply**.

Set Kaltura ad hoc event parameters

CMS must be enabled and Pearl registered with Kaltura to create ad hoc events. The same channels that you select for scheduled VOD events using the Admin panel are the channels that are recorded for ad hoc events, see Select channels for Kaltura VOD events. Similarly, the channel you selected for scheduled webcasts is used for ad hoc webcast events, see Select channel for Kaltura webcasting events.

For ad hoc events, you can enter the metadata to associate with the uploaded media using the Admin panel. However, you can modify the metadata at any time using the Kaltura Management Console (KMC) after the content is uploaded.

- **Session title**: This assigns a default title for ad hoc events. Default variables specify the current date and time as the title using the format **yyy-mm-dd hh:mm**. This default title can be changed when an ad hoc event is created.

- **Event owner**: This assigns an owner to ad hoc events created using Pearl. The owner you enter here appears on the Login touch screen by default and can be overwritten when authenticating from Pearl.
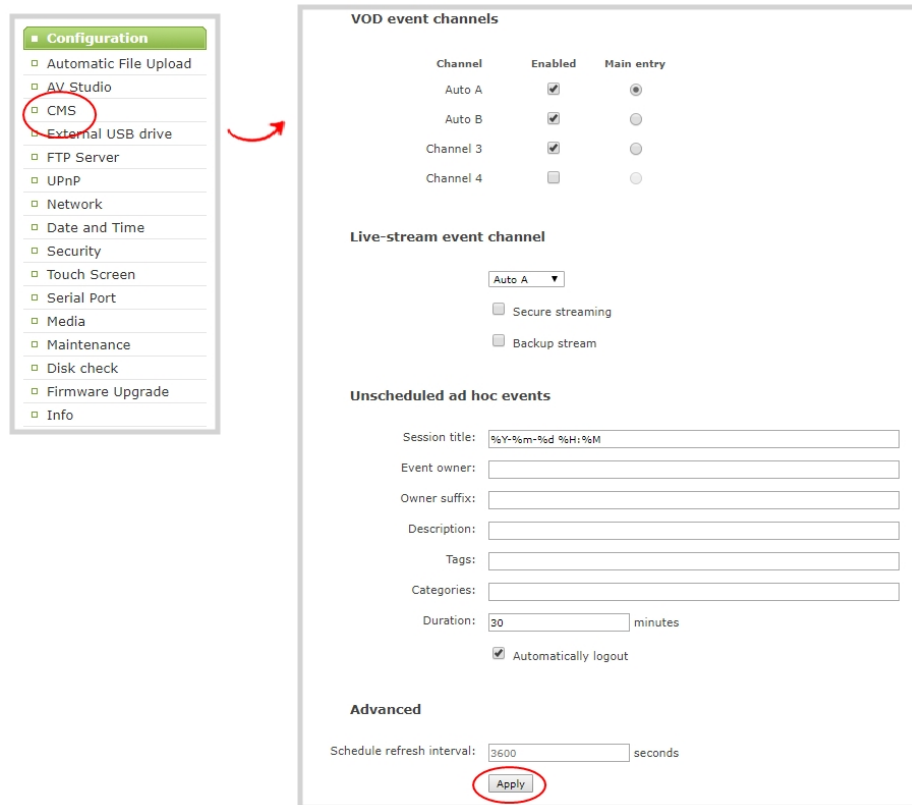
- **Owner suffix**: Enter a suffix to be automatically applied to the Event owner field when users authenticate with Kaltura from Pearl. For example, if the owner account is *wilson@myorg.com*, enter the suffix *@myorg.com* here so that the user only needs to enter *wilson* to authenticate.

- **Description**: The description of the uploaded media that appears in Kaltura.

- **Tags**: Assign tags to the uploaded media for use by Kaltura.

- **Categories**: Assign Kaltura categories to the uploaded media.

- **Duration**: Assign a default duration for ad hoc events. This value can be changed when an ad hoc event is created.

- **Automatic logout**: Automatically logs out the ad hoc event creator when the ad hoc event ends if the touch screen was used to create the ad hoc event. This is disabled by default.

Important considerations

- Before you start recording, we recommend that you enter the event parameters you want associated with ad hoc events using the Admin panel. However, users can modify or add this metadata later using the Kaltura Management Console.

To enter metadata for an ad hoc event using the Admin panel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, click **CMS**. The Content management system configuration menu opens.

3. Under **Unscheduled ad hoc events**, enter the information you want associated with this ad hoc event and click **Apply**.

Change the events schedule refresh interval

Using the Admin panel, you can change how frequently Pearl polls Kaltura for the latest event information to refresh the events listed on the Events page. The default interval is once every 3600 seconds (1 hour).

> **STOP** Requesting updated information too frequently can impact performance. We recommend setting an interval of no less than 120 seconds (once every 2 minutes). The longest interval supported is 604800 seconds (once a week).

To change how often Pearl polls Kaltura for the latest event information:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, click **CMS**. The Content management system configuration menu opens.

3. Under **Advanced**, enter the Schedule refresh interval in seconds or choose a value from the drop down list. Click **Apply**.

Use RTMPS for a Kaltura webcasting event

Pearl sends an RTMP stream to the primary URL associated with the webcasting event, or to both the primary URL and the secondary backup URL if you've enabled the backup stream, see Select channel for Kaltura webcasting events.

You can configure Pearl to send an RTMPS stream instead using the Admin panel.

To configure Pearl to send an RTMPS stream using the Admin panel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, click **CMS**. The Content management system configuration menu opens.

3. Under **Live-stream event channel**, check **Secure streaming** and click **Apply**.

Panopto registration

Pearl is fully integrated with Panopto Content Management Systems (CMSs) for a seamless video recording and webcasting experience. After a simple registration process, Pearl is available for your CMS users to select as a remote recorder resource or capture device for scheduled, recurring, and ad hoc events. Completed recordings automatically upload to the CMS. Registering Pearl as a remote recorder for Panopto only needs to be done once.

Topics include:

- Enable CMS and register with Panopto

- Disable CMS and disconnect from Panopto

After Pearl is registered, proceed to create URL redirects for Pearl, setup authentication for ad hoc events, and select default settings. See Panopto recording and webcasting setup.

Enable CMS and register with Panopto

Use the Admin panel to register Pearl as a remote recorder for scheduled, recurring, and ad hoc recordings and webcasts. When you register Pearl, a default name is assigned that includes the serial number of Pearl. This name appears in the list of remote recorders in Panopto. You can change the remote recorder name using the Admin panel.

Before you begin, you need:

- Your Panopto service URL, for example: `https://<myorg>.hosted.panopto.com/`

- A Panopto-generated registration key for the remote recorder.

- The Epiphan API key from Panopto is required for on-premise versions of Panopto version 6 or earlier. Contact Panopto support for assistance to install the Epiphan API key.

Important considerations

- You create a registration key in Panopto from **System > Remote Recorders** when you click **Manage registration keys**. Record the key somewhere safe before closing the screen in Panopto. The key cannot be retrieved after the screen is closed. If you lose the registration key, you must create a new one to register Pearl as a remote recorder.

- Scheduled recordings are associated to a remote recorder using the registration key and not the device name.

- If you disconnect Pearl and register again using a different registration key, the scheduled sessions previously associated with the original key do not migrate over.

- If you're using the on-premise version of Panopto version 6 or earlier, you must manually add the API key for Pearl. Contact Panopto support for assistance.

- If you are unable to register Pearl, contact your Panopto administrator or Epiphan support.

- If you want a different name for this Pearl to appear in Panopto, enter the name into the Device name field before you register Pearl. Changes after Pearl is registered do not appear in Panopto.

To enable Pearl as a remote recorder and register with Panopto using the Admin panel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, click **CMS**. The Content management system configuration page opens.

3. From the **Choose CMS** drop down, select **Panopto** and then click **Apply**.
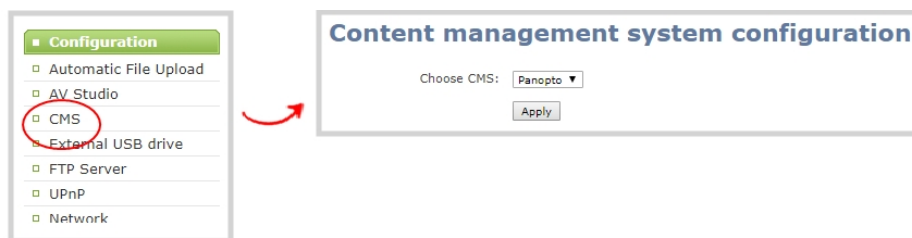
4. Enter the Panopto **Service URL**, **Registration key**, and optionally enter a **Device name** you want to appear in Panopto for this device, then click **Apply**. The Status updates to Connected.

> ✅ Changing Panopto's device name for Pearl does not change the name that is assigned to Pearl in the Device info fields, see Configure device info, name, description, and location

What's next?

For Panopto, proceed to create URL redirects for Pearl, setup authentication for ad hoc events, and select default settings. See Panopto recording and webcasting setup.

> ✅ An API client ID with two URL redirects are required to enable authentication on Pearl, see Setup Panopto authentication for ad hoc events

Disable CMS and disconnect from Panopto

When you use the Admin panel to disable CMS for a registered Pearl, the remote recorder disconnects from Panopto. As long as Pearl is still registered, you can create new scheduled sessions in Panopto for this remote recorder, but the events schedule won't synchronize until CMS is re-enabled.

If CMS is re-enabled on Pearl before a VOD session is scheduled to end, recording starts automatically on Pearl when the connection to Panopto is re-established. However, when the start of a scheduled webcasting event is missed, the stream does not automatically start when the connection is re-established. A new webcasting event should be created.

Revoking the registration key and deleting Pearl as a remote recorder is performed in Panopto, see Panopto's documentation for instructions. If you delete Pearl in Panopto, all scheduled and recurring events that were associated with Pearl are permanently deleted.

Important considerations

- You can not start unscheduled ad hoc events when CMS is disabled on Pearl.
- Sessions that are scheduled to start while CMS is disabled on Pearl do not start on Pearl.
- Scheduled webcasting events do not start if Pearl's connection to Panopto is not available.
- Deleting Pearl in Panopto permanently deletes future scheduled and recurring sessions associated with that remote recorder.
- Do not disable CMS while an event is in progress.

To disconnect Pearl using the Admin panel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, click **CMS**. The Content management system configuration menu opens.

3. To disconnect Pearl, select **none** from the **Choose CMS** drop down and then click **Apply**.

Panopto recording and webcasting setup

Pearl appears as an available resource as soon as the device is registered with Panopto. Now you must setup authentication for ad hoc events to create ad hoc events from Pearl. After that, you're ready to select video sources for multiple source recordings and webcasts. Video sources must be connected to Pearl and assigned to channels. Each channel configure on Pearl is treated as a separate video source for multiple source events in Panopto. For more information about using the auto channel feature, creating channels or using custom layouts, see What is a channel?.

Topics include:

- About Panopto recording and webcasting

- Setup Panopto authentication for ad hoc events

- Set Panopto ad hoc event parameters

About Panopto recording and webcasting

Pearl supports scheduled, recurring, and unscheduled multiple source ad hoc recordings and webcasts. Each Pearl channel is treated as a separate video source that Panopto users can select when scheduling an event in Panopto.

Scheduled events start and end automatically. No manual intervention is required. After the event ends, recorded files automatically upload to the event owner's folder in Panopto. Back up recordings for each channel are also saved locally on Pearl. If the network connection or the CMS goes down during an event, Pearl continues to record locally and uploads the recording when network connectivity resumes.

You can start and stop events earlier than the scheduled time using either the Admin panel or the touch screen on Pearl, as well as create ad hoc events.

> 📋 Starting or stopping a scheduled VOD event before the scheduled start or stop time does not change the event into an ad hoc event.

Using multiple Pearl channels is how you get multiple views for a Panopto event. Each channel is treated as a separate video source. Using the Admin panel, Pearl administrators can configure up to up to four channels on Pearl for multiple source recordings and up to three separate channels for webcasts.

For example, if you have a main camera and a presentation laptop that you want to capture as a multiple source recording, you'd create two channels on Pearl: one for the main camera and another one for the presentation laptop. To learn how to create a channel or to use the Auto channels, see Channel configuration.

For ad hoc events, the default name of the multi-view file includes the date and start time of the event. For example: **2019-07-15 08:00**. A more intuitive name can be entered when the ad hoc event is created.

Pearl administrators can:

- Setup Panopto authentication for ad hoc events, see Setup Panopto authentication for ad hoc events.

- Set Panopto ad hoc event parameters, Set Panopto ad hoc event parameters.

Pearl administrators and operators can use the Admin panel to:

- Create ad hoc events, see Create ad hoc events using the Admin panel.

- View the Events page to see all upcoming scheduled sessions and completed sessions, see View scheduled events and history.

- Download local recordings for each channel, see Recover channel backup recordings.

- Start and stop scheduled events before the scheduled time, see Start/stop scheduled events using the Admin panel.

To use the touchscreen on Pearl to start, stop, and create events, see CMS event controls using the touch screen.

> Panopto users select the channel resolution in Panopto when creating a new scheduled or recurring session. The Panopto encoding settings are applied automatically to the channel and overrides the channel encoding settings made using the Admin panel.

Important considerations:

- Pearl must be registered with Panopto to record and stream Panopto events, see Enable CMS and register with Panopto.

- You can configure up to up to four channels on Pearl for multiple source recordings and up to three separate channels for webcasts.

- If you choose more than four Pearl channels for a webcast in Panopto, then Panopto arbitrarily chooses a maximum of four channels to webcast.

- For VOD recordings, Pearl doubles the bitrate that is set in Panopto to create a better quality recording. For example, when creating a scheduled VOD event in Panopto, if you set the target resolution to a quality of 1920 x 1080 60 fps Bitrate: 4000 kbps, Pearl records the event at a bitrate of 8000 kbps.

- The maximum allowed bitrate for webcasts in Panopto is 2.5 Mbps, regardless of what bitrate is actually set as the target resolution for the remote recorder in Panopto. For example, when creating a scheduled webcasting event in Panopto, if you set the target resolution to a quality of 1920 x 1080 60 fps Bitrate: 4000 kbps, Pearl streams the event at the maximum bitrate of 2500 kbps.

- For webcasts, we recommend setting a target resolution quality of 1280 x 720 30 fps Bitrate: 1500 kbps in Panopto. Pearl automatically increases the bitrate to the maximum allowed bitrate of 2.5 Mbps for a better quality live stream. If a lower quality setting is selected, Pearl doubles the bitrate set in Panopto up to the maximum of 2.5 Mbps. You can stream at 1920x1080; however, due to the bitrate limitation of 2.5 Mbps in Panopto, some artifacts are visible in the stream.

- Scheduled events have priority over ad hoc events. If an ad hoc event is still in progress when it's time to start a scheduled event, the ad hoc event is stopped and the scheduled event starts.

- Scheduled VOD events automatically start recording locally on Pearl even If the network is down or Panopto is unavailable. After the session ends, the locally recorded files upload automatically to your folder in Panopto when the network link to Panopto is re-established.

- Scheduled webcasting events do not start if Pearl's connection to the CMS is not available.

- If the network connection is lost during a file upload to Panopto, the transfer automatically restarts when the network connection re-establishes.

- If Pearl loses power while a scheduled event is being recorded, the recording stops. If Pearl is powered back on before the scheduled end time for the event, recording of the scheduled event restarts automatically and a second set of files are created. When the event ends, both sets of files are uploaded to Panopto.

- If Pearl was unavailable on the network or powered down and misses a scheduled event, the status of that event appears as **Skipped** on the Events page in the Admin panel.

- For recurring events with more sessions than can be displayed at any one time on the CMS Events page in the Admin panel, upcoming events are added as room becomes available and the list automatically refreshes once every six hours.

- Do not use the One Touch recording control, AFU, or configure recording file size, type and other channel recording settings when CMS is enabled on Pearl.

- Do not schedule recordings that are longer than the capacity of Pearl to store the recording on the local drive.

- Channel encoding settings you make on Pearl are overridden by the default encoding settings the system uses to record to Panopto.

- To monitor the health of the video and audio, you can go to the Channel view using the touch screen, see Channel monitoring using the touch screen or monitor channels using the Admin panel. Thumbnails of your video sources display on the Events screen so you can see the status of your video sources from the touch screen, see View scheduled events and history. It's also possible to see a live preview of the channels and the audio level from the remote recorder page in Panopto.

- For multiple-source Panopto events that are manually stopped or have ended, if you use the Admin panel to delete a locally saved recording for any channel on Pearl that hasn't yet uploaded to Panopto as part of the multiple-source event, that event remains in the In Progress state indefinitely in Panopto.

> **STOP** For Panopto VOD events, if you manually stop a scheduled VOD event before the scheduled end time when Pearl doesn't have network connectivity, Pearl uploads the completed event's recording when network connectivity resumes. However, Panopto does not recognize that the event has ended. The event remains in the In Progress state in Panopto and you must wait until the original event's scheduled end time before creating a new event using that Pearl.

Setup Panopto authentication for ad hoc events

Panopto users can create unscheduled ad hoc events directly from the touch screen on Pearl or using the Admin panel. You can set up Pearl to allow users to authenticate using their local Panopto login credentials, their credentials for a third-party LMS integrated with Panopto (like Canvas), and SAML 2.0 credentials if configured on Panopto.

Pearl uses a JavaScript web application to negotiate authentication with Panopto. You must create a new API client ID and add two URL redirects in Panopto for ad hoc event authentication to work.

- One API client URL redirect is for Pearl.
- The other API client URL redirect is for the web-based Admin UI.

> An API client ID and both URL redirects are required to enable ad hoc authentication on Pearl.

Before you begin, you need:

- Admin access to Panopto.
- A Pearl remote recorder that's registered with Panopto.

Important considerations

- Record all API client IDs and secret keys that are generated in Panopto somewhere safe. The ID and key cannot be retrieved after the screen is closed and must be regenerated if lost.
- You can use the same API Client ID to enable ad hoc authentication on multiple Pearl systems; however, you must create a separate API client URL redirect for the web-based Admin UI of each individual Pearl device.
- Third-party application authentication for ad hoc events is only supported for Panopto.

To enable ad hoc authentication on Pearl:

4. Login to Panopto as an administrator.

5. In the header bar, click the arrow beside your user name and select **User Settings**. The User Settings page opens.
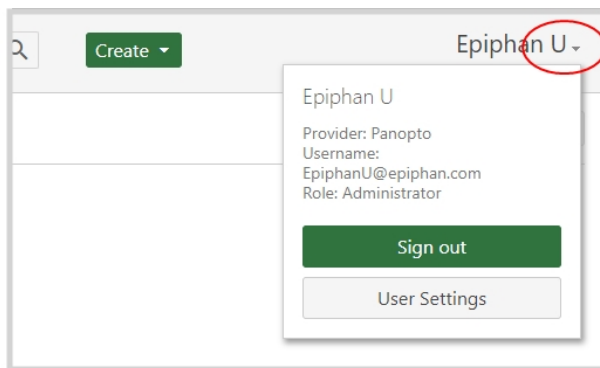
6. Create the API Client ID and URL redirect for Pearl. Do the following:

    a. From the User Settings page, click **API Clients**, and then click **Create a new API Client**. The Create API Client page opens.
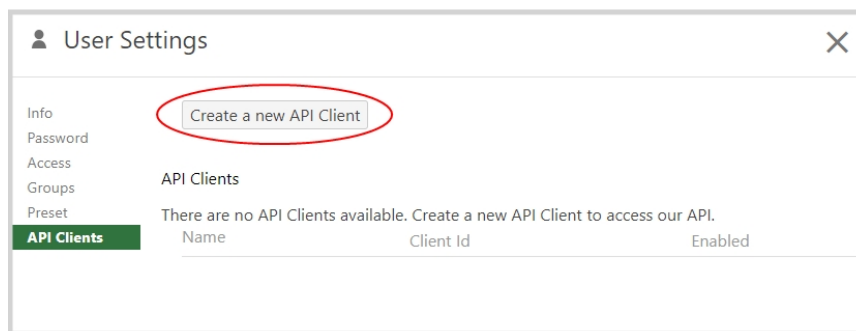
    b. From the Create API Client page, enter a unique name for the Pearl API client in the **Client Name field**. If a client already exists in Panopto with that name, choose a different name.

    c. In the **Client Type** field, select JavaScript Web Application.

    d. In the **Redirect URL** field, enter `http://pearl/sso` and then click **Create API Client**.

e. On the **New API Client created** pop-up, record the Client ID and the Client Secret for future reference, and then click **OK**. The new Pearl API Client appears in your list of API clients.

7. Add a URL redirect for the web-based Admin panel to the Pearl API Client. Do the following:

a. From the User Settings page under API Clients, click **Edit** beside the **Pearl API Client** that you just created.

b. In the Allowed Redirect URLs field, enter `http://<device_ip>/admin/events` where `<device_ip>` is the IP address of Pearl.

> If Pearl is configured for https, enter `https://` instead of `http://`.

c. In the URL Type field, select **Redirect URL**.

d. Click **Add URL**. The Admin panel URL redirect appears in the Allowed URL list.

8. Login to the Admin panel as **admin**, see Connect to Admin panel.

9. From the Configuration menu, click **CMS**. The Content management system configuration page opens.

10. In the **Unscheduled ad hoc events** section, enter the Pearl **API client id** that was generated earlier, and then click **Apply**.
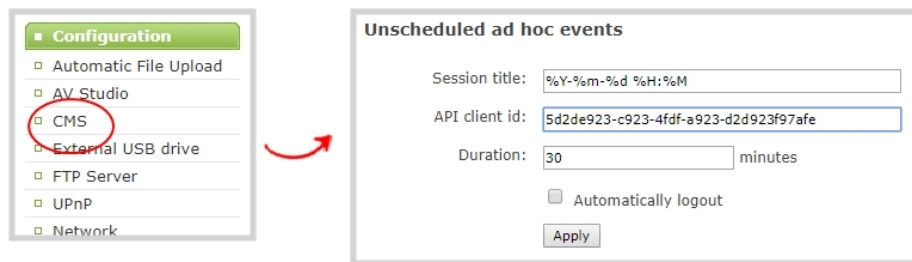
Set Panopto ad hoc event parameters

Using the Admin panel, you can set parameters that are associated with ad hoc events, including:
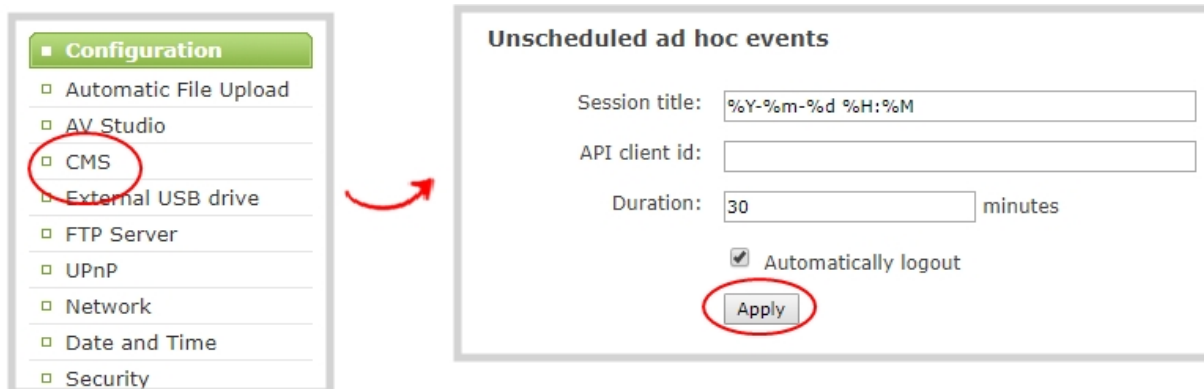
- **Session title**: This assigns a default title for ad hoc events. Default variables specify the current date and time as the title using the format **yyy-mm-dd hh:mm**. This default title can be changed when an ad hoc event is created.

- **API client id**: This is the API client ID that was generated for ad hoc event authentication, see Setup Panopto authentication for ad hoc events.

- **Duration**: Assign a default duration for ad hoc events. This value can be changed when an ad hoc event is created.

- **Automatic logout**: Automatically logs out the ad hoc event creator when the ad hoc event ends if the touch screen was used to create the ad hoc event.

> Pearl must be connected to Panopto for this procedure to work.

To enter ad hoc event parameters using the Admin panel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, click **CMS**. The Content management system configuration menu opens.

3. Under **Unscheduled ad hoc events**, enter the information you want associated with this ad hoc event and click **Apply**

CMS recording and webcasting using the Admin panel

Pearl records scheduled, recurring, and unscheduled ad hoc events for Kaltura and Panopto CMSs. Pearl appears as an available resource as soon as the device is registered with your CMS. Connect multiple audio and video sources directly to Pearl and record content from HD cameras, document cameras, HDMI output from computers, and even digital microscope cameras.

Scheduled events start and end automatically. No manual intervention is required. After the event ends, recorded files automatically upload to the CMS. If the network connection or the CMS goes down during an event, it records locally on Pearl and uploads automatically when network connectivity resumes. Back up recordings of each channel can easily be recovered using the Admin panel.

> 🛑 Do not schedule recordings that are longer than the capacity of Pearl to store the recording on it's local drive.

Topics include:

- Create ad hoc events using the Admin panel

- Start/stop scheduled events using the Admin panel

- Logout of an ad hoc session

- Recover channel backup recordings

To start/stop scheduled events and create ad hoc events using the touch screen, see CMS event controls using the touch screen.

For important considerations before recording or webcasting to a CMS, see About Kaltura recording and webcasting and About Panopto recording and webcasting.

Start/stop scheduled events using the Admin panel
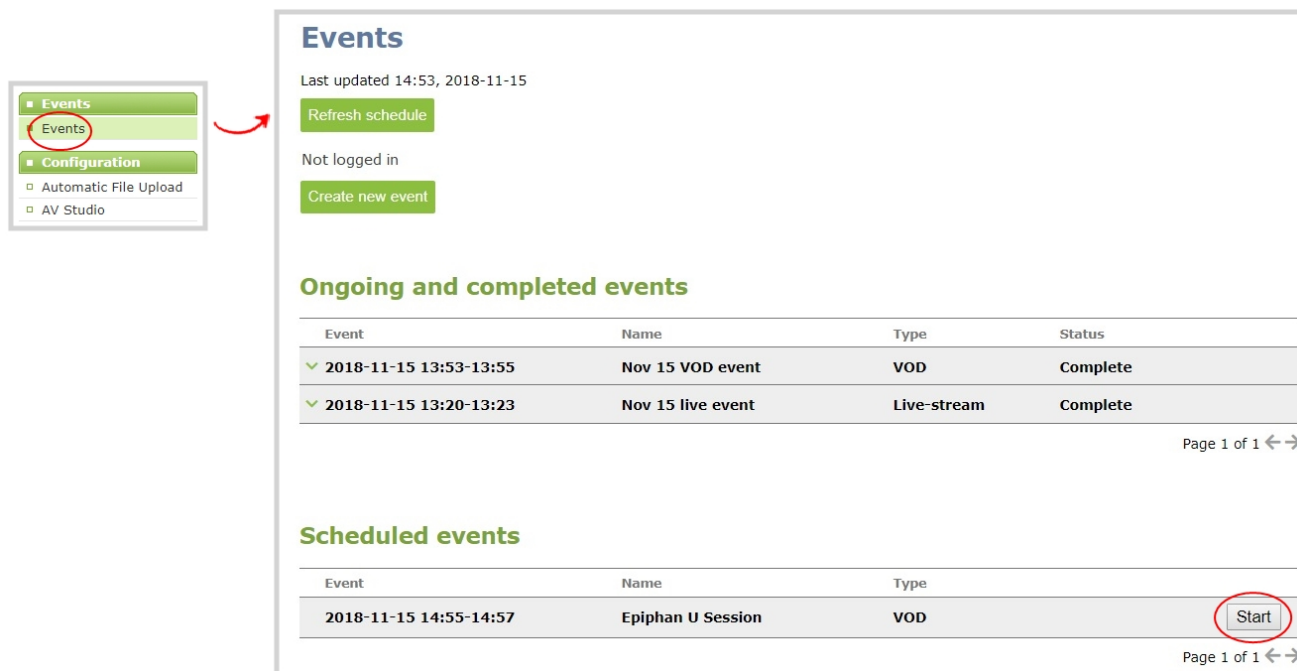
After an event ends, the recorded video files upload automatically to the CMS.

Important considerations

- If you manually stop a scheduled Panopto VOD event before the scheduled end time when Pearl doesn't have network connectivity, Pearl uploads the completed event's recording when network connectivity resumes. However, Panopto does not recognize that the event has ended. The event remains in the In Progress state in Panopto and you must wait until the original event's scheduled end time before creating a new event using that Pearl.

- For multiple-source Panopto events that are manually stopped or have ended, if you use the Admin panel to delete a locally saved recording for any channel on Pearl that hasn't yet uploaded to Panopto as part of the multiple-source event, that event remains in the In Progress state indefinitely in Panopto.

From the Admin panel, select the Events menu and click **Start** beside the event on the Events page.

A **Stop** button appears beside the event while the event is recording. You can click that to stop the event before the scheduled end time.

In the Admin panel, you can click **Refresh schedule** at any time to manually update the events listed on the Events page.

After the event ends, it may take a while for content to show up in Kaltura's media lists, depending on how busy the Kaltura CMS system is at the time.

Create ad hoc events using the Admin panel

You can create and start an ad hoc recording or webcast using the Admin panel. Pearl must be registered with your CMS to create ad hoc events, see Integration.

You must authenticate using your CMS login credentials before you can enter the ad hoc event details and start the event. Contact your CMS administrator if authentication fails and login is denied.

> User accounts must be defined on the CMS itself and not a subsidiary system such as an LMS.

Kaltura event details

Table 76 *Kaltura ad hoc event details*

Item	Description
Session title	Enter a unique name for the ad hoc event. If no name is entered, a default event consisting of the current date and time is applied. For example: 2019-07-04 13:22
Description	Enter a description of the event.

Item	Description
Tags	Add Kaltura search tags separated by commas. For example: tag1, tag2, tag3.
Category	Add a Kaltura category.
Duration	Select the event duration in minutes from the drop down list or enter a value using your keyboard. Select a value from 5 to 240 minutes or enter a value using your keyboard.
Event type	Choose either VOD (Video on Demand), Live-stream, or VOD + Live-stream as the ad hoc event type.

Panopto event details

Table 77 *Panopto ad hoc event details*

Item	Description
Session title	Enter a unique name for the ad hoc event. If no name is entered, a default event consisting of the current date and time is applied. For example: 2019-07-04 13:22
Folder	Select the folder in Panopto where you want the recorded file to upload. Your Panopto MyFolder is the default folder.
Duration	Select the event duration in minutes from the drop down list or enter a value using your keyboard. Select a value from 5 to 240 minutes or enter a value using your keyboard.
Event type	Choose either VOD or Live-stream as the ad hoc event type.

To create an ad hoc event using the Admin panel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Events menu, click **Events**. The Events page opens.

3. Click **Create new event**.

   a. For Kaltura, enter your Kaltura user ID as your CMS login credentials in the pop up window, then click **Login**. After you're authenticated, your user name appears in the **Full name** field and you can enter the ad hoc event details.

   b. For Panopto, enter your Panopto CMS user name and password in the login window, then click **Sign in**. In the events details pop up, your user name appears in the **Full name** field and you can enter the ad hoc event details.

   > If you get the login error that your account is not active, your CMS has blocked your account. If login to the CMS is denied, the account you entered may not exist or may not have access rights to create an ad hoc event using Pearl. Contact your CMS administrator for CMS related login and account issues.

4. Click **Start event now** when you're ready to start recording or Live-streaming. Or click **Cancel**.

Logout of an ad hoc session

After you've logged into your CMS from the touch screen on Pearl and started an unscheduled ad hoc event, you're automatically logged out after the ad hoc event ends. If your Pearl administrator has not enabled the automatic logout feature, then your login session stays active for one hour after the event ends.

For Panopto ad hoc events that you start using the web-based Admin panel, Panopto preserves your login credentials after the ad hoc event ends. To avoid someone else from using your account to create ad hoc Panopto events from the Admin panel, manually logout after you're ad hoc event ends.

Before you begin, you need your Panopto server URL, for example:
`https://<myorg>.hosted.panopto.com/`

To manually logout of an ad hoc session with Panopto using the Admin panel:

1. From the Events menu, click **Events**. The Events page opens.
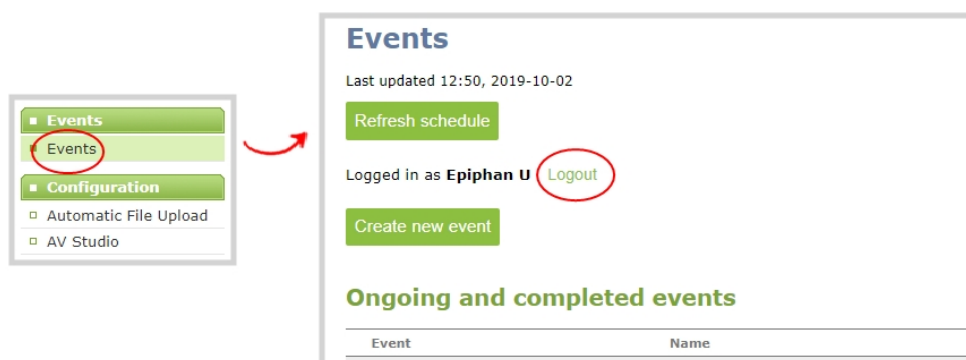
2. Click **Logout** beside your login user name.

3. To close the authentication session with the Panopto server, open a new tab in the same browser that you used to login and go to:
   `https://<PanoptoServerURL>/Panopto/Pages/Auth/Logout.aspx`

   > Closing the authentication session with the Panopto server may not close the authentication session with the third-party LMS.

4. Return to the Admin panel and click **Create new event** on the Events page to confirm that you're logged out of Panopto. A blank login page should appear.
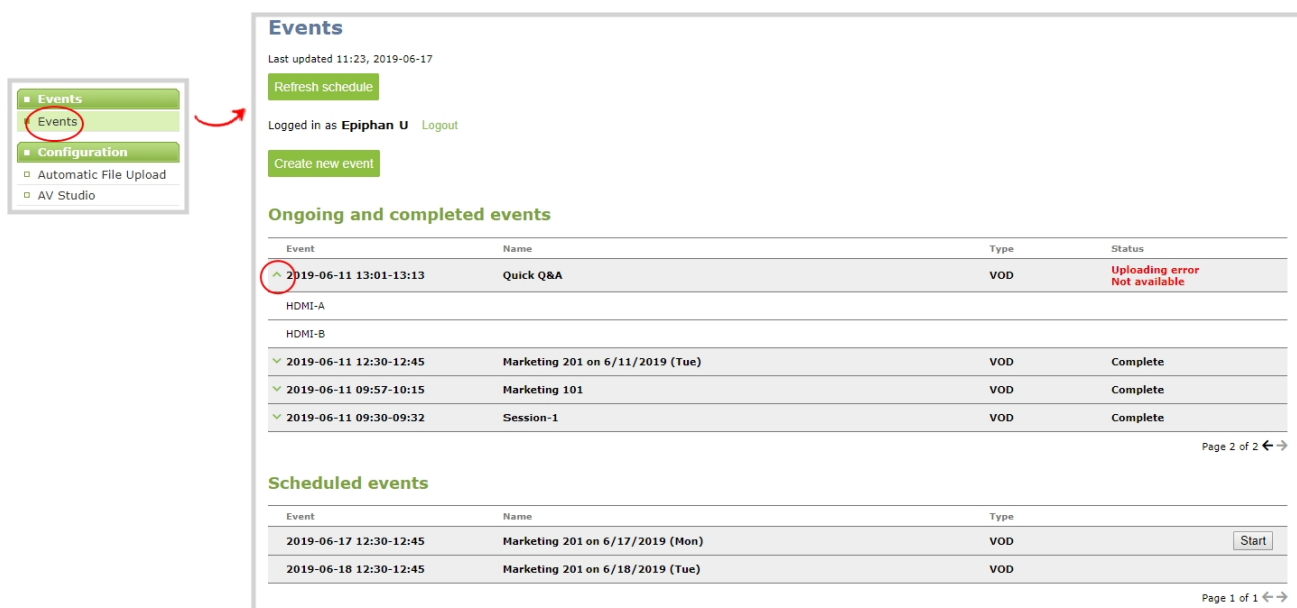
Recover channel backup recordings

Recordings automatically upload to Kaltura or Panopto after the event ends. If for some reason the recordings are not available in the CMS, administrators can manually download backup recordings for each channel on Pearl.

Pearl saves a local backup of recordings automatically in a round-robin fashion. When the record drive is full, new recordings overwrite the oldest ones. Pearl administrators and operators can use the Admin panel to manually download and delete channel recordings. For more details about managing recordings, see Manage recorded files.

To download and delete channel recordings using the Admin panel:

1. Login to the Admin panel as **admin** or **operator**, see Connect to Admin panel.

2. From the Events menu, click the arrow icon beside the event to see which channels were included for that event.

3. To download recordings for each channel included in the event.

   a. From the Channels menu, click **Recording**. The Recordings page for that channel opens with a list of recorded files.

   b. Click the name of the recording to download the file or select multiple files and click **Download Selected**.

   c. Repeat for each additional channel.

4. To delete recordings, do one of the following:

   a. To delete a single recording, click the X icon to the right of a recording and click **OK** when prompted.

   b. To delete multiple recordings, check the check box beside the recordings you want to delete and click **OK** when prompted.

   c. To delete all recordings for the selected channel or recorder, click **Delete Selected** and click **OK** when prompted.

The list may not update immediately. You can refresh the list by reloading the Recording page (for channels) or the recorder settings page (for recorders).

Controlling Pearl using RS-232 / serial port

Pearl has an RS-232 / serial port control interface (via USB) for integration with existing control room and board room equipment.

Important considerations

- Each command sent to Pearl over RS-232 must be terminated with a line feed (LF) character (ASCII code 10). Make sure that your software adds the line feed to each command.

- Ensure your terminal program is configured for UTF-8, which is required if any data includes non ASCII characters.

- For values with spaces, enclose the value in quotation marks. For empty values, use empty quotation marks with nothing between.

- You must always follow a SET command in RS-232 with the SAVECFG command. Otherwise the new configuration setting(s) will not take effect. See the SET examples that follow.

- The `publish_enabled` on/off command does not work on multiple publish destinations and only starts/stops the first instance.

For a complete list of supported SET and GET parameters, see Configuration keys for third party APIs . To connect the RS-232 cable and configure RS-232 on Pearl, see Connect and configure the RS-232 port

The following examples show how to use RS-232 commands to control Pearl:

To start recording on channel 2:

> START.2

To stop recording on channel 2:

> STOP.2

To start recording on all channels and recorders:

> START

To get the value of the frame size (resolution) for channel 2:

> GET.2.framesize

To set the frame size (resolution) on channel 2, enclose the parameter in quotes to preserve the spaces:

> SET.2.framesize="640 x 480"
> SAVECFG

To enable broadcasting audio on channel 2:

> SET.2.audio=on
> SAVECFG

To disable broadcasting audio on channel 2:

> SET.2.audio=""
> SAVECFG

Connect and configure the RS-232 port

To connect your control equipment to Pearl, you need a standard RS-232 null-modem cable and a USB to RS-232 serial adapter cable. Adapter cables are not included with Pearl.

Only certain adapter chipsets are supported, Epiphan recommends this adapter cable from Startech.

To connect the serial port cable:

1. Attach the cable to the control interface.

2. Connect the USB to RS-232 serial adapter to the null-modem cable.

3. Connect the USB to RS-232 serial adapter to one of the system's USB ports.

The only configuration available for the serial port is flow control. Flow control changes the rate of data transfer over the cable. Some communication settings are static and cannot be changed. The static settings are:

- Baud rate set at 19200

- Parity set to none

- Stop bits set to one

To configure serial port flow control:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, click **Serial Port** . The serial port configuration page opens.

3. Select **Hardware**, **Software**, or **None** from the drop-down menu.

Table 78 *Serial Port Flow Control Options*

Label	Description / Options
Hardware	A hardware handshake is used for flow control, which is also called RTS / CTS flow control. See the manual for your control terminal to check if a hardware handshake is needed.
Software	A software handshake that uses XON/XOFF characters to control the flow of data. See the manual for your control terminal to check if a software handshake is needed.
None	No flow control is used. Only select this if your control terminal doesn't use a handshake.

4. Click **Apply**.

Control Pearl with RS-232

You can use the null-modem cable and your control terminal software to issue commands to Pearl, such as when to start or stop recording, and to retrieve or set the value of certain parameters.

> **STOP** Each command sent to Pearl over RS 232 must be terminated with a line feed (LF) character (ASCII code 10). Make sure that your software adds the line feed to each command.

Some commands require a *channel* or *recorder* name as an argument. In those commands, the channel or recorder name is separated from the command name by a period. The channel name value can be either the name or the index of the recorder or channel. Use of the index is recommended.

A channel's index number is located in the Channels Menu using the Admin panel. The channel index number turns red to indicate it is recording. For example, to address this channel using RS-232 commands, use the index **1**.
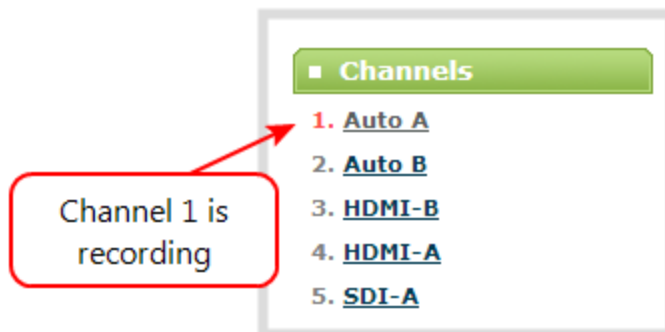
For recorders, combine the recorder's number with the prefix **m**. In the following example, the second recorder's index is 2. To address this recorder using RS-232 commands, use the index **m2**.
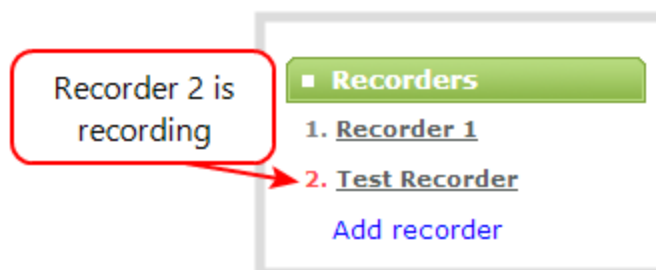
The following table describes the supported RS-232 commands.

Table 79 *Supported RS-232 Commands*

Command Name	Description
Recording Commands	
START.*<channel>* START.*<recorder>*	Starts recording for the provided channel or recorder. This can alternatively be accomplished with the following set commands: SET.*<channel>*.rec_enabled=on SAVECFG If the channel is already recording, the current recording is continued.
START	Starts recording for all channels and recorders. There is no RS-232 command to restart recording. If recording is already active when the start command is issued, the recording continues.
STOP.*<channel>* STOP.*<recorder>*	Stops recording for the provided channel or recorder. This can alternatively be accomplished with the following set commands: SET.*<channel>*.rec_enabled="" SAVECFG
STOP	Stops recording for all channels and recorders.
SNAPSHOT.*<channel>*	Takes a snapshot image of the current channel (supported only if the channel is configured to use the Motion JPEG codec). Snapshots are saved with recording files on the system.

Command Name	Description
SNAPSHOT	Takes a snapshot image of all channels (supported only for channels configured to use the Motion JPEG codec). Snapshots are saved with recording files on the system.
Configuration Commands (see Configuration keys for third party APIs for available keys)	
GET.*<channel>.<key>* GET.*<recorder>.<key>*	Gets the saved value of a given parameter for the specified channel or recorder.
SET.*<channel>.<key>* SET.*<recorder>.<key>*	Sets the value of a given parameter for the specified channel or recorder. The value is not saved until the SAVECFG command is sent.
Global Variable Commands	
VAR.GET.*<name>*[1]	Gets the specified global variable, where *<name>* is the unique name for each variable.
VAR.SET. *<name>*[2]=*<value>*	Saves the global variable modified by the SET command, where *<name>* is the unique name for each variable and *<value>* is the text/character content stored in each variable. Example: `VAR.SET.gpsvar0=N103 68201 W765 29712` where *<name>* is **gpsvar0** and *<value>* is **N103 68201 W765 29712**.
Status Commands	
STATUS.*<channel>* STATUS.*<recorder>*	Reports the recording status of the specified channel or recorder. Status is one of: • RUNNING • STOPPED • UNINITIALIZED
STATUS	Reports the recording status of each channel and recorder. Status is one of: • RUNNING • STOPPED • UNINITIALIZED

Command Name	Description
FREESPACE	Reports the free storage space, in bytes.
RECTIME.*<channel>* RECTIME.*<recorder>*	Reports the elapsed recording time in seconds for the current file on the specified channel or recorder.
RECTIME	Reports the elapsed recording time in seconds for the current file on each channel.

[1]Variable *<name>* can be up to 32 alphanumerical characters long including underscores. Name must start with a letter or underscore.

[2]If the equal sign "=" is omitted, VAR.SET assigns an empty value.

Pearl returns a status change message whenever changes are made.

Table 80 *RS-232 Status Changed Messages*

Command Name	Description
STATUS.*<channel>* *<status>*	Provides the status of the recording service for the channel as either: • Running • Stopped • Uninitialized The Uninitialized status is sent when there is an internal error. Check the system for more details.

Global variable RS-232 commands for custom layouts

Pearl can create global variables using RS-232 commands embedded in a custom layout as responsive text overlay elements. See Add a text overlay for information about adding a global variable into a custom layout.

Important considerations

- Each system variable must have its own unique name.

- System variable names and variable values are case sensitive.

- Each variable name must start with a letter or underscore and can be up to 32 alphanumeric characters length, including underscores.

- Setting an empty variable name clears the variable value.

- Ensure your terminal program is configured for UTF-8; otherwise, any special characters used in the RS-232 global variable command will cause the RS-232 command string to be ignored.

- There is a limit of 1024 total unique system variables per Pearl system.

- System variables can be used in text labels across any number of channels.

- System variables are considered volatile data and are erased when Pearl reboots.

- You can set only one variable at a time using the RS-232 SET command.

- Quotes are not ignored. For example, the following RS-232 SET commands are different:

  - VAR.SET.myname=some value

  - VAR.SET.myname="some value"

RS-232 GET / SET variables – syntax and examples

A get command retrieves a variable using the syntax **VAR.SET.<name>**, where *<name>* is the unique name for each variable up to 32 alphanumerical characters long including underscores. Name must start with a letter or underscore.

RS-232 GET example:

> **Example:** VAR.gpsvar1

A set command saves a variable value using the syntax **VAR.SET.<name>=<value>**, where *<name>* is the unique variable name, and *<value>* can be up to 32 alphanumerical characters including underscores.

RS-232 SET example:

> **Example:** VAR.SET.gpsvar1=N103 68201 W765 29712

If *<value>* contains spaces, quotes must not be used.

To erase a previously set variable, set the value with an empty space

If the equal sign "=" is omitted, VAR.SET assigns an empty value.

Controlling Pearl using HTTP/HTTPS commands

Pearl has an HTTP API interface. You can swap the HTTP for HTTPS in the URL without affecting the API commands. The HTTP/HTTPS API is used for configuration and control by third party applications or scripts that send commands as a series of URLs. Commands are sent to one of two URLs and specify the target configuration item.

Some commands require a *channel* or *recorder* name as an argument. A channel's index is found by looking at the Channels list in the Admin panel. In the following example, the channel with index 1 is currently recording (its index number is red). To address this channel using http commands, use the index **channel1**.
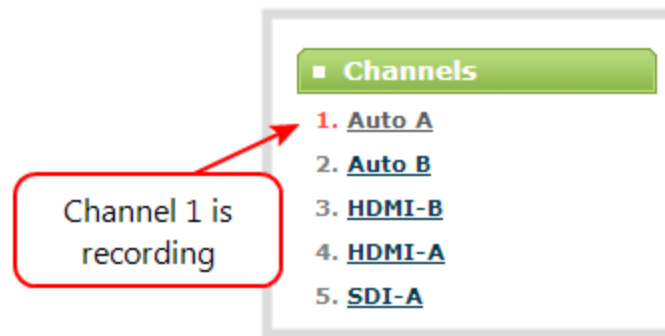
For recorders, combine the recorder's number with the prefix **m**, as in *channelm*. In the following example, the second recorder's index is 2. To access this recorder using http commands, use the index **channelm2**.
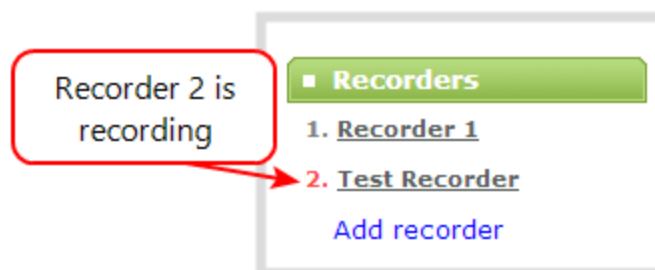
> **Sample Get configuration settings:**
>
> http://*<address>*/admin/channel*<N>*/**get_params.cgi**?*key*
>
> or

https://*<address>*/admin/channel*<N>*/**get_params.cgi**?*key*

For recorders, add 'm' before the recorder number (i.e. channelm1 for recorder 1), for example:

http://*<address>*/admin/channelm*<N>*/**get_params.cgi**?*key*

Sample Set configuration settings:

http://*<address>*/admin/channel*<N>*/**set_params.cgi**?key=*value*

or

https://*<address>*/admin/channel*<N>*/**set_params.cgi**?key=*value*

For recorders, add 'm' before the recorder number (i.e. channelm1 for recorder 1), for example:

http://*<address>*/admin/channelm*<N>*/**set_params.cgi**?*key*

Where *<address>* is the IP address of the Pearl, channel*<N>* is the channel number (i.e. *channel2* for channel number two), and channelm*<N>* is for recorders (i.e. *channelm2* for recorder two), *key* is the configuration key for the item being checked or changed (see Configuration keys for third party APIs), and *value* is the value to set for the configuration item.

The following examples show how to use wget to exercise some of the supported HTTP/HTTPS commands. You can substitute *https* for *http* in the urls.

For values with spaces, encode space as %20. i.e.: set_params.cgi?framesize=640%20x%20480

The examples assume a system IP address of 192.30.23.45 and admin password is pass123.

To get the type of stream being published and frame size for channel 1:

wget --http-user=admin --http-passwd=pass123 http://192.30.23.45/admin/channel1/get_params.cgi?publish_type&framesize

To set the publish stream type to RTMP Push (6) and at the title "System Stream" for channel 2:

> wget --http-user=admin --http-passwd=pass123 http://192.30.23.45/admin/channel2/set_
> params.cgi?publish_type=6&title=System%20Stream

To start recording on channel 2:

> wget --http-user=admin --http-passwd=pass123 http://192.30.23.45/admin/channel2/set_
> params.cgi?rec_enabled=on

To stop recording on channel 2:

> wget --http-user=admin --http-passwd=pass123 http://192.30.23.45/admin/channel2/set_
> params.cgi?rec_enabled=""

To start recording on recorder 2:

> wget --http-user=admin --http-passwd=pass123 http://192.30.23.45/admin/channelm2/set_
> params.cgi?rec_enabled=on

Multiple requests

You can include multiple key/value pairs in a single command by separating the statements with *&*. For example, the key for product name is **product_name** and the key for firmware version is **firmware_version**.

The command to request both the product name and the firmware version is:

> http://<*address*>/admin/channel1/get_params.cgi?product_name&firmware_version

To turn off publishing (i.e. set to 0) and set the bitrate (vbitrate) to 256,000:

> http://<*address*>/admin/channel1/set_params.cgi?publish_type=0&vbitrate=256K

> ✅ You can substitute *https* for *http* in the urls.

Third party applications like wget

If you're using a third party application like wget to send commands to Pearl, always include the admin username and password when viewing or setting configuration items.

Specify your Pearl's IP address, password and the key(s) or value(s) you want to query using the following syntax. Note that your system may require use of single quotes around the password to handle special characters such as exclamation marks. You can substitute *https* for *http* in the urls.

> get_param using wget:
>
> wget --http-user=admin --http-passwd=<*password*> http://<*address*>/admin/channel<*N*>/get_params.cgi?<*key*>[&<*key*>]

> set_param using wget:
>
> wget --http-user=admin --http-passwd=<*password*> http://<*address*>/admin/channel<*N*>/set_params.cgi?<*key*>=<*value*>[&<*key*>=<*value*>]

Where <*address*> is the IP address of the Pearl, channel<*N*> is the channel number (i.e. *channel2* for channel number two), *key* is the configuration key for the item being checked or changed (see Configuration keys for third party APIs), and *value* is the value to set for the configuration item.

Global variable HTTP commands for custom layouts

Pearl can create global variables using HTTP commands embedded in custom layout as responsive text overlay elements. See Add a text overlay for information about adding a global variable into a custom layout. You cannot substitute *https* for *http* in the global variable HTTP commands.

Important considerations for global custom layout variables

- Each system variable must have its own unique name

- System variable names and variable values are case sensitive

- Each variable name must start with a letter or underscore sign and is followed by any combination of letters, digits and underscore characters [A-Za-z_0-9]{0,32} to a limit of 32 total characters (note that saving an empty string to a variable will clear the variable value)

- There is a limit of 1024 total unique system variables per Pearl system.

- System variables can be used in text labels across any number of channels.

- System variable commands can be issued at a frequency of 5 per second, and up to 6 variables may be set in a single command (for example, variables "gpsvar1", "gpsvar2" and "gpsvar3" can be updated in a single command, five times per second). After issuing a set command, all channels using the specified variable(s) are updated. The frequency of commands issued is not influenced by the number of channels on Pearl.

- System variables are considered volatile data and are erased when Pearl reboots.

Set variables – syntax and example

A set command saves a value to a variable, where *<address>* is the IP address of Pearl, *name* is the unique name for each variable, and *value* is the text/character content stored in each variable.

You can set multiple variables at the same time by separating each variable with an "&".

To "set" variables, use the following syntax:

> **http://*<address>*/admin/set_variables.cgi?*name1=value1*[&*nameN=valueN*]**
>
> For values with spaces, encode space as %20. (i.e.: set_variables.cgi?name1=640%20x%20480)
>
> To erase a previously set variable, simply set the variable's name with an empty space.

```
Example: "http://192.168.0.129/admin/set_
variables.cgi?gpsvar1=N103%2068201%20W765%2029712&gpsvar2=S490%2018731%
20E756%2019890&gpsvar3=N123%2046891%20W345%2065431&gpsvar4=S767%2033410
%20E770%2004513"

sets:
"gpsvar1" to "N103 68201 W765 29712"
"gpsvar2" to "S490 18731 E756 19890"
"gpsvar3" to "N123 46891 W345 65431"
"gpsvar4" to "S767 33410 E770 04513"
```

Get variables – syntax and example

A get command returns the value of a variable called *name*. You can return multiple variables at the same time by separating each variable with an "&".

To "get" a variable or a list of specific variablesx:

> **http://*<address>*/admin/get_variables.cgi?*name1*[&*nameN*]**

```
Example: "http://192.168.0.129/admin/get_variables.cgi?gpsvar1"

returns:
"gpsvar1=N103 68201 W765 29712"
```

To "get" a list of **all** variables saved to Pearl:

http://<address>/admin/get_variables.cgi

```
Example: "http://192.168.0.129/admin/get_variables.cgi"

returns:
"gpsvar1=N103 68201 W765 29712
gpsvar2=S490 18731 E756 19890
gpsvar3=N123 46891 W345 65431
gpsvar4=S767 33410 E770 04513"
```

To learn how to use global variables as text overlays in custom channels, see Add a text overlay .

Configuration keys for third party APIs

Using HTTP/HTTPS or RS-232, you can send query and configuration commands to Pearl. For the RS-232 and HTTP/HTTPS syntax, see Controlling Pearl using RS-232 / serial port and Controlling Pearl using HTTP/HTTPS commands.

> 🛑 Using a "SET" command in RS-232 must always follow with the "SAVECFG" command for the new configuration setting(s) to take effect.

When setting keys to values with spaces, use the following syntax.

For RS-232, enclose in quotes:

SET.2.framesize="640 x 480"

For HTTP/HTTPS, encode each space:

%20: set_params.cgi?framesize=640%20x%20480

The following categories of API keys are supported:

- System-level settings keys (read-only)
- System-level settings keys (read/write)
- System-level custom layout keys (read/write)
- Touch screen settings keys (read/write)
- Recording configuration keys
- HTTP server configuration keys
- IP-based access control configuration keys
- UPnP configuration keys
- Broadcast configuration keys
- Channel encoder configuration keys
- Channel layout configuration keys
- Audio configuration keys
- Stream publishing configuration keys
- RTSP Announce configuration keys (Publish type 2)
- RTP/UDP configuration keys (Publish type 3)
- MPEG-TS configuration keys (Publish types 4 and 5)

- RTMP push configuration keys (Publish type 6 and 7)
- Content metadata configuration keys

You can also see the list of supported keys from Pearl when you browse to the following URL, where *<address>* is the IP address of Pearl:

```
http://<address>/admin/http_api.cgi
```

System-level settings keys (read-only)

The following read-only system-level setting keys are supported. The channel number can be omitted from the command when requesting the value for these keys.

Table 81 *Supported Read-Only System-level Settings configuration keys*

Key	Values	Description
firmware_version	String, including the text FIRMWARE_VERSION=.	The system's firmware version. The value is read-only.
mac_address	String	The system's mac address. Useful for debugging. The value is read-only.
product_name	String	The product's name. Useful to confirm you are communicating with the right product or for debugging purposes. The value is read-only.
vendor	Epiphan Video	Name of the vendor. The value is always "Epiphan Video". The value is read-only.

System-level settings keys (read/write)

The following read/write system-level setting keys are supported. The channel number can be omitted from the command when requesting the value for these keys.

Table 82 *Supported Read/Write System-level Settings configuration keys*

Key	Values	Description
frmcheck_ enabled	on empty string ("")	Enables or disables automatic firmware update checking. To enable firmware update checking, set to on. To disable firmware update checking, set to an empty string ("").
description	string	To give this system a name in the Epiphan discovery utility, specify a description string.

System-level custom layout keys (read/write)

The following read/write system-level custom layout keys are supported.

Table 83 *Supported read/write system-level custom layout keys*

Key	Values	Description
name	Any combination of letters, digits and underscore characters [A-Za-z_0-9]{0,32} to a limit of 32 total characters	Each unique name key contains a variable value. Used for dynamic overlay text in custom layouts (see Controlling Pearl using HTTP/HTTPS commands and Add a text overlay)

Touch screen settings keys (read/write)

The following configuration keys are supported for modifying the touch screen configuration. The channel number can be omitted from the command when requesting or setting the value for these keys.

Table 84 *Supported Touch Screen Settings configuration keys*

Key	Values	Description
touchscreen_backlight	integer(0...255)	Specify the touchscreen backlight level.
touchscreen_enabled	on empty string ("")	Enables or disables the touch screen. To enable the touch screen, set to on. To disable the touch screen, set to an empty string ("").
touchscreen_info	on	Enables or disables system information from the touch

Key	Values	Description
	empty string ("")	screen. To enable system info from the touch screen, set to on. To disable system info from the touch screen, set to an empty string ("").
touchscreen_preview	on empty string ("")	Enables or disables channel preview on the touch screen. To enable preview on the touch screen, set to on. To disable preview on the touch screen, set to an empty string ("").
touchscreen_recordctl	on empty string ("")	Enables or disables recording control from the touch screen. To enable recording from the touch screen, set to on. To disable recording from the touch screen, set to an empty string ("").
touchscreen_settings	on empty string ("")	Enables or disables settings changes from the touch screen. To enable settings changes from the touch screen, set to on. To disable settings changes from the touch screen, set to an empty string ("").
touchscreen_timeout	integer	Specify the time in seconds before the touchsreen times out. For no timeout, use 0.

Recording configuration keys

The following recording settings are supported. Specify the channel or recorder you want to configure.

Table 85 *Supported Recording configuration keys*

Key	Values	Description
rec_enabled	on empty string ("")	Enables or disables recording. To enable recording, set to on. To disable recording, set to an empty string ("").
rec_format	avi mov mp4 mp4f ts	Specifies the format of the saved file. (mp4 is used for the progressive mp4 file format, mp4f for fragmented)

Key	Values	Description
rec_prefix	string	Specifies a prefix for the recorded filenames.
rec_sizelimit	integer	Specifies the file size limit, in kilobytes (kB).
rec_timelimit	string (no quotes) hh:mm:ss	Specifies the time limit before a new recording file is created. For example, for 3 hour recordings, use 3:00:00
rec_upnp	on off	Specifies whether or not recordings should be available over UPnP.

HTTP server configuration keys

The following settings are supported for configuration of the HTTP server run by Pearl.

Table 86 Supported HTTP Server configuration keys

Key	Values	Description
http_port	integer	Specifies the HTTP server port.
http_sport	integer	Specifies the HTTP server SSL port (HTTPS port).
http_usessl	on empty string ("")	Enables or disables HTTPS (SSL Server) To enable SSL, set to on. To disable SSL, set to an empty string ("").

IP-based access control configuration keys

The following settings are supported for configuring allowed and denied IP addresses for Pearl only, not for individual channels. See Restrict viewers by IP address for more information about Allow and Deny lists.

Table 87 Supported IP-Based Access configuration keys

Key	Values	Description
allowips	string: comma-separated list of IP addresses and/or ranges. empty string("")	Specifies the IP addresses to permit access. To restrict access, provide a list of permitted IP addresses. To clear allowed IP restriction, set to an empty string ("").
denyips	string: comma-	Specifies the IP addresses to deny access.

Key	Values	Description
	separated list of IP addresses and/or ranges. empty string("")	To restrict access, provide a list of denied IP addresses. To clear denied IP restriction, set to an empty string ("").

UPnP configuration keys

The following settings are supported for UPnP streaming.

Table 88 *Supported UPnP Streaming configuration keys*

Key	Values	Description
share_archive	on empty string ("")	Enables sharing of recorded files via UPnP. To enable sharing files over UPnP, set to on. To disable sharing files over UPnP, set to an empty string ("").
share_livestreams	on empty string ("")	Enables sharing of the live stream via UPnP. To enable stream sharing over UPnP, set to on. To disable stream sharing over UPnP, set to an empty string ("").
server_name	string	Specifies the UPnP server name. To use the system name, set to an empty string ("").

Broadcast configuration keys

The following settings for streaming to viewers (broadcasting) are supported, including stream access control settings.

Table 89 *Supported Broadcast configuration keys*

Key	Values	Description
bcast_disabled	on empty string ("")	Enables or disables the broadcast. To disable broadcast, set to on. To enable broadcast, set to empty string ("").
rtsp_port	1000...65535, but not 5557	Specifies the port for RTSP streaming. Note port 5557 is used for network discovery and cannot be used for streaming.

Key	Values	Description
streamport	1000...65535, but not 5557	Specifies the port used for streaming. Note port 5557 is used for network discovery and cannot be used for streaming.
ac_override	on empty string ("")	Overrides the global stream access settings or uses global stream access settings. To use global stream access settings, set to empty string (""). To override global stream access settings and use local viewer access permtions, set to on.
ac_viewerpwd	string	Specifies the password for Viewers.
ac_allowips	integer	Displays a list of the allowed IP addresses for live streams
ac_denyips	integer	Displays a list of the denied IP addresses for live streams

Channel encoder configuration keys

The following encoder settings are supported for each channel. For more information on individual items listed, see Configure encoding.

Table 90 *Supported channel encoder configuration keys*

Key	Values	Description
autoframesize	on empty string ("")	Enables or disables use of the current signal's resolution as the frame size. Is switched to off if a frame size is manually specified. To use current signal's frame size, set to on. To specify frame size directly, set to empty string ("").
codec	h.264 mjpeg	Specifies the stream codec.
fpslimit	1-60	Specifies the frame per second limit. Set to your desired limit.
framesize	wxh for example: 640x480, 720x400, 1024x768, 1920x1080	Specifies the frame (width by height) size in pixels. Set to desired size. Choose from the list in the UI or set a custom value of your choosing up to the maximum output resolution supported by Pearl

Key	Values	Description
slicemode	on empty string ("")	Enables or disables H.264 slicing for RTP. To enable slicing, set to on. To disable slicing, set to empty string ("").
vbitrate	Integer	Gets or changes the video bitrate in kbps.
vbufmode	1 (low delay) 2 (storage)	Specifies the broadcast compression level. For low delay when streaming, specify 1. For best results or recording, set to 2.
vencpreset	0 (Software) 5 (Hardware Accelerated)	Specifies a video encoding preset. For software, set to 0. For hardware acceleration (recommended), set to 5
vkeyframeinterval	integer	Interval time in seconds between key frames in the encoded stream.
vprofile	66 77 100	Specifies the h.264 video profiles. For Baseline profile, select 66. For Main profile, select 77. For High profile, select 100.
qvalue	0…100	Specifies quality for M-JPEG videos.

Channel layout configuration keys

To work with layouts, you need to know the integer identifier of the layout. To find your layout's identifier, select the layout using the Admin panel and look for the identifier in the browser's url.
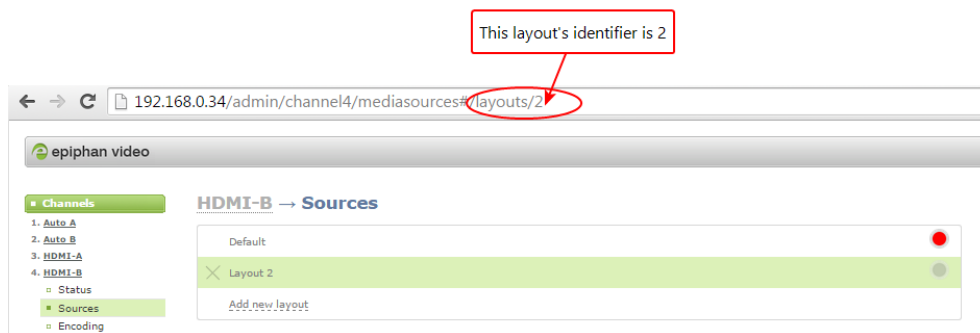
Table 91 *Supported channel layout configuration keys*

Key	Values	Description
active_layout	integer	Specifies which layout is currently active for the specified channel.

Audio configuration keys

The following audio configuration keys are supported. For more information on individual items listed, see Configure audio encoding.

Table 92 *Supported Audio configuration keys*

Key	Values	Description
audio	on empty string ("")	Enables or disables audio for the stream. To enable audio, set to on. To disable audio, set to an empty string ("").
audiobitrate	32 64 96 112 128 160 192	Specifies the audio bitrate for the stream. Not applicable for PCM audio codecs.
audiochannels	1 (mono) 2 (stereo)	Specifies the number of audio channels. For mono, set to 1. For stereo, set to 2.
audiopreset	CODECS: pcm_s161e (PCM) libmp3lame (MP3) libfacc (AAC) RATES: 16000 (AAC only) 22050 44100 48000	Specifies an audio code preset in the format CODEC;RATE. i.e. libfaac;22050

Stream publishing configuration keys

The system supports the following stream publishing settings. For more information on publishing the stream, see What is streaming?.

Table 93 *Supported Stream Publishing configuration keys*

Key	Values	Description
publish_enabled	on off / any other value	Starts or stops streaming to CDN servers (RTSP, RTMP type streaming). See Streaming to a CDN or multicast streaming. To turn streaming on, set to on. To turn streaming off, set to off or to any other value.
publish_type	0 (do not publish) 2 (RTSP Announce) 3 (multicast RTP/UDP) 4 (multicast MPEG-TS over UDP) 5 (multicast MPEG-TS over RTP/UDP) 6 (RTMP push)	Specifies the type of stream publishing, if any.

RTSP Announce configuration keys (Publish type 2)

The following settings are supported when the publish type is set to RTSP Announce. For more information on RTSP and these settings, see Set up an RTSP announce streamWhat is streaming?.

Table 94 *Supported RTSP Announce configuration keys*

Key	Values	Description
rtsp_url	string	Specifies the RTSP server announce URL.
rtsp_transport	tcp udp or empty string ("")	Specifies the RTSP transport, either tcp or udp. Use udp or "" for udp transport Use tcp for tcp transport.
rtsp_username	string	Specifies the username for the RTSP server.
rtsp_password	string	Specifies the password for the RTSP server.

RTP/UDP configuration keys (Publish type 3)

The following settings are supported when the publish type is set to RTP/UDP. For more information on RTP/UDP and these settings, see What is streaming?.

Table 95 *Supported RTP/UDP configuration keys*

Key	Values	Description
unicast_address	string (IP address)	Specifies the unicast/multicast address.
unicast_aport	1000...65535, but not 5557	Specifies the UDP port for RTP/UDP audio streaming. Note port 5557 is used for network discovery and cannot be used for streaming.
unicast_vport	1000...65535, but not 5557	Specifies the UDP port for RTP/UDP video streaming. Note port 5557 is used for network discovery and cannot be used for streaming.

MPEG-TS configuration keys (Publish types 4 and 5)

The following settings are supported when the publish type is set to MPEG-TS and for associated SAP distribution. For more information on MPEG-TS and these settings, see What is streaming?Viewing with Session Announcement Protocol (SAP).

Table 96 *Supported MPEG-TS and SAP configuration keys*

Key	Values	Description
unicast_address	string (IP address)	Specifies the unicast/multicast address.
unicast_mport	1000...65535, but not 5557	Specifies the UDP port for MPEG-TS streaming. Note port 5557 is used for network discovery and cannot be used for streaming.
sap	on empty string ("")	Enables sharing of recorded files via SAP. To enable sharing files over SAP, set to on. To disable sharing files over SAP, set to an empty string ("").
sap_channel_no	integer	Specifies the SAP channel number.
sap_group	string	Specifies the SAP group name.
sap_ip	string	Specify the SAP annoucement IP.

RTMP push configuration keys (Publish type 6 and 7)

The following settings are supported when the publish type is set to RTMP Push. For more information on RTMP and these settings, see Set up an RTMP or RTMPS (push) stream and What is streaming?.

Table 97 *Supported RTMP Push Configuration Keys*

Key	Values	Description
rtmp_url	string	Specifies the RTMP server URL.
rtmp_stream	string	Specifies the RTMP stream name, as configured with the CDN.
rtmp_username	string	Specifies the username for the RTMP server.
rtmp_password	string	Specifies the password for the RTMP server.

Content metadata configuration keys

The following keys are available for configuration of the content's metadata.

Table 98 *Supported Content Metadata Configuration Keys*

Key	Values	Description
author	string	Specifies the name of the author for the stream/recording. Refer to description above on handling white space (spaces) in the string.
comment	string	Specifies a comment for the stream/recording. Refer to description above on handling white space (spaces) in the string.
copyright	string	Specifies the copyright for the streaming/recording. Refer to description above on handling white space (spaces) in the string.
title	string	Specifies the title for the stream/recording. Refer to description above on handling white space (spaces) in the string. (This string can be displayed by certain viewing applications by looking at the stream's metadata information.)

PART 6: Maintenance

Keep your Pearl running smoothly using the latest firmware updates and maintenance features.

Topics include:

- Power down and system restart
- Perform a factory reset
- Firmware upgrade
- Support
- Storage space maintenance

Power down and system restart

You can perform the following tasks:

- Reboot using the Admin panel
- Power off the device using the Admin panel
- Power off the device using the power button

Reboot using the Admin panel

To reboot Pearl using the Admin panel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, click **Maintenance**. The maintenance page opens.

3. Click **Reboot Now** and click **OK** when prompted.

Power off the device using the Admin panel

You can use the Admin panel to power off Pearl. The power button on Pearl is a toggle switch. If you power off the device using the Admin panel, the power switch remains in the on state. To power back on, you must double press the power button.

To power off Pearl using the Admin panel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, select **Maintenance**. The maintenance page opens.

3. Click **Shutdown Now** and click **OK** when prompted.

Power off the device using the power button

You can manually shut down Pearl using the power button.

For rackmount models of Pearl, the power button is located at the front of the system. For the desktop model, it's found on the back.

To power off Pearl manually, double-press (two successive fast presses and releases) the power button to initiate a safe power down.

> If the system is unresponsive, press and hold the power button for 4 seconds to force an immediate power down.

Backup your Pearl setup

Configuration presets are the perfect way to backup your Pearl setup so that you can reapply it later without worrying if someone changes your settings or does a factory reset.

You can create a configuration preset from the Configuration menu when you select **Maintenance**, see Configuration presets.

Perform a factory reset

Administrators can use the Admin panel to perform a factory reset and restore the configuration of Pearl to the manufacturer's original default settings. For a list of affected settings, see The Factory default configuration preset and Factory reset.

> 🛑 **Performing a factory reset erases all your input port settings (video and audio), channels, configuration presets, network settings, all locally saved media files and recordings from Pearl.**

Consider applying a factory default configuration preset if you want to preserve your uploaded media files, configuration presets, and channel recordings, see **Configuration presets**.

To perform a factory reset:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, select **Maintenance**. The maintenance page opens.

   Factory reset

   Factory reset   [Reset]

   WARNING: All recordings, branding files, configuration presets, channels and recorders will be removed!

3. Click the **Reset** and click **OK** when prompted.

   The page at 192.168.0.183 says: ✕

   Do you really want to reset the device?
   WARNING: All recordings, branding files, configuration presets, channels and recorders will be removed!

   [OK]   [Cancel]
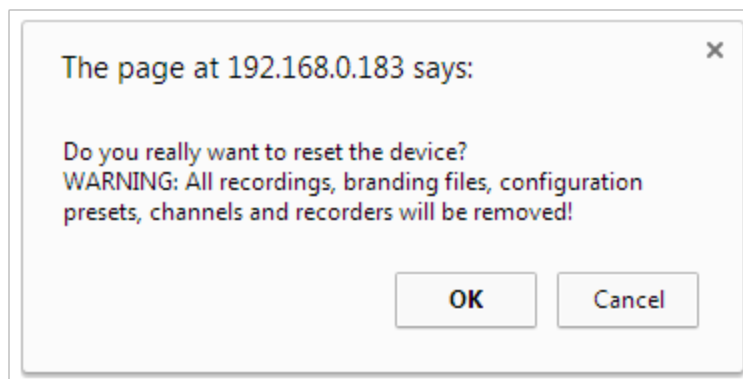
4. The system resets to factory defaults and reboots. Wait for the system to finish rebooting before configuring Pearl.

Firmware upgrade

When you register your product with Epiphan, you can choose to receive email notifications whenever firmware updates are available. To take advantage of exciting new features and important fixes for your Pearl, install new firmware whenever the system indicates that a firmware update is available.

Topics include:

- Check for firmware updates
- Update the firmware
- BIOS update

> ✅ The BIOS update section appears on the **Firmware Update** page only when your Pearl system requires a BIOS update.

Check for firmware updates

Your Pearl automatically checks for firmware updates if the **Enable connection to maintenance server** option is checked on the **Maintenance** page of the Admin panel. You can also manually check for updates If your Pearl has internet access.

> ✅ When **Enable connection to maintenance server** is checked, the built-in firmware update mechanism checks for updates for your specific product and hardware version automatically.

To manually check for new firmware:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, select **Firmware Upgrade**. The firmware upgrade page opens.

3. Click **check for updates** beside the current firmware version. If an update is found, a red box appears in the top left side of the Admin panel with a link to download and install the firmware.

Firmware update
Version **3.10.0h** is available.

Download and install

Update the firmware

If your Pearl has internet access, the easiest way to install a firmware update is to use the download link that's provided when you check for new firmware. If you have a Pearl firmware file that was provided to you by Epiphan Video, you can install the new firmware using the web-based Admin panel.

> 📋 You cannot install new firmware from a locally saved file using the local console on Pearl.

While the firmware is updating, the touch screen displays a firmware update in-progress notice. All streaming and recording functions stop until after the firmware upgrade is complete.

Installing new firmware takes a few minutes, after which the system reboots. Depending on the upgrade, a disk rebuild may be required, causing the restart process to take more time. Please be patient and wait for the system to finish rebooting.

> 🛑 Do not interrupt power to the system during a firmware upgrade.

Before you begin

Schedule a time to when you can update the firmware without negatively impacting viewers or automatic file upload and recording schedules.

It's good practice to make a backup of your current configuration before applying a firmware update so that you can revert to the previous firmware if needed, see Create a configuration preset. You should also clear your web browser's cache after the update is complete.

To perform a firmware update:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. (Optional) Save a copy of the current system configuration. See Configuration presets.

3. From the Configuration menu, select **Firmware Upgrade**. The firmware upgrade page opens.

4. Do one of the following:

    a. Click **check for updates**. If a red box appears in the top left side of the Admin panel, click **Download and install**.

    b. Click **Choose File** and select the firmware upgrade file that's located on your admin computer, then click **Apply**. The system unpacks and verifies the file. If the file is valid, the upgrade begins.

    If the touch screen is enabled, a notice that the firmware update is in progress appears.

> 🛑 Do not interrupt power to the system during the firmware upgrade.

5. When the firmware update is complete, a message lets you know that Pearl is going to reboot. Wait for the system to restart.
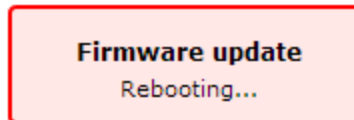
6. After the system reinitializes, go to the settings for your web browser and clear your web browser's cache.

7. Connect to the Admin panel and login as **admin**, see Connect to Admin panel.

8. From the Configuration menu, select **Firmware Upgrade**. The firmware upgrade page opens. Verify that the firmware version is the expected new version.

If in the rare occasion the firmware update fails, the touch screen reports the failure. Please collect system information such as the serial number of Pearl, the previous firmware version (if known), and the new firmware version and contact **info@epiphan.com**

BIOS update

If Pearl requires a BIOS update, a BIOS Upgrade section appears on the Firmware update page in the Admin panel. We recommend performing the BIOS update whenever they become available to ensure optimum performance of your device.

The BIOS Upgrade section appears on the **Firmware Update** page only when your Pearl system requires a BIOS update.

To perform a BIOS update:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. (Optional) Save a copy of the current system configuration. See Configuration presets.

3. From the Configuration menu, select **Firmware Upgrade**. The firmware upgrade page opens.

4. Click **Update BIOS** and click **OK** when prompted. The update should begin.
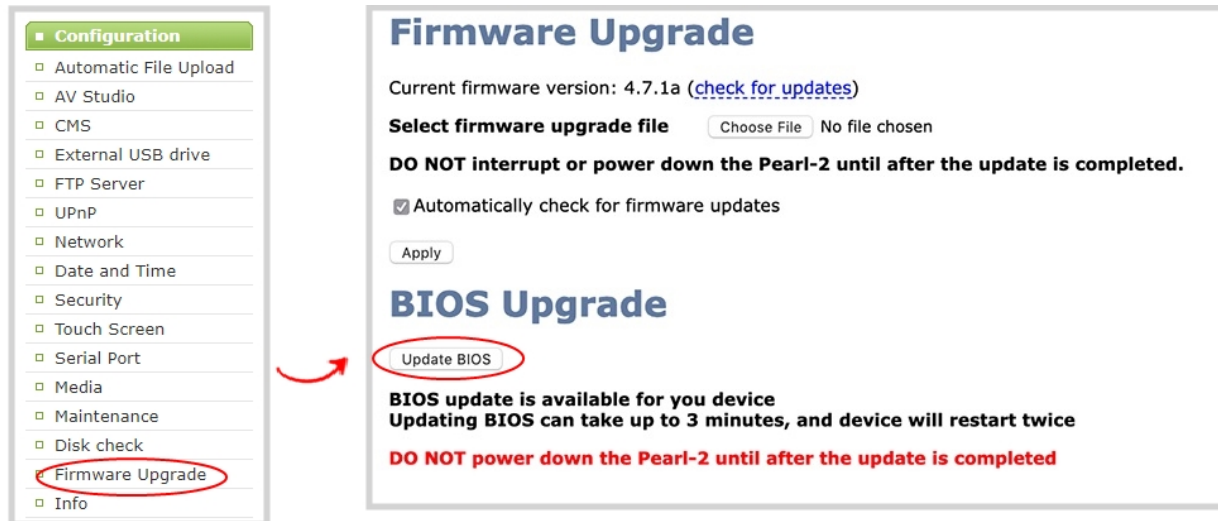
If the touch screen is enabled, a notice that the BIOS update is in progress appears.

> 🛑 Do not interrupt power to the system during the BIOS update.

5. When the BIOS update is complete, a message lets you know that Pearl is going to reboot. Wait for the system to restart.

BIOS UPDATE IS IN PROGRESS!

Don't close this page

```
Reading flash              #################### Done
- ME Data Size checking . ok
Secure Flash enabled, recalculate ROM size with signature... Enable.
- FFS checksums ......... ok
Loading capsule to secure memory buffer #################### Done
Erasing Boot Block         #################### Done
Updating Boot Block        #################### Done
Verifying Boot Block       #################### Done
Erasing Main Block         #################### Done
Updating Main Block        #################### Done
Verifying Main Block       #################### Done
```

THE DEVICE IS REBOOTING...

6. After the system reinitializes, go to the settings for your web browser and clear your web browser's cache

7. Connect to the Admin panel and login as **admin**, see Connect to Admin panel.

8. From the Configuration menu, select **Info** and confirm that the date of the BIOS has updated.

> 📋 You can also confirm that the latest BIOS is installed on Pearl when the section called **BIOS Upgrade** no longer appears on the **Firmware Upgrade** page in the Admin panel.

Support

Your Pearl comes with a one-year complimentary support plan starting one year from the original product shipment date. You can purchase a 2-year extended support plan from Epiphan Video for a total of three years of product support from the original product shipment date:

- **SupportPlan** offers a 2-year support extension
- **SupportPlan+** offers a 2-year support extension plus remote troubleshooting support

Remote troubleshooting support allows the Epiphan support team to remotely access Pearl to help troubleshoot issues and reset lost admin passwords, see Support. No private information is sent to the Epiphan maintenance server during a remote session. For more information about service plans, see www.epiphan.com/supportplan.

To contact Epiphan support:

- **Email**: support@epiphan.com
- **Online chat**: www.epiphan.com/support (Monday to Friday between 9am and 5pm Eastern)
- **Call**: 1-877-599-6581 / 613-599-6581

From time to time, Epiphan support may ask you for logs from your system. Follow the instructions to download the log files and allinfo file for support.
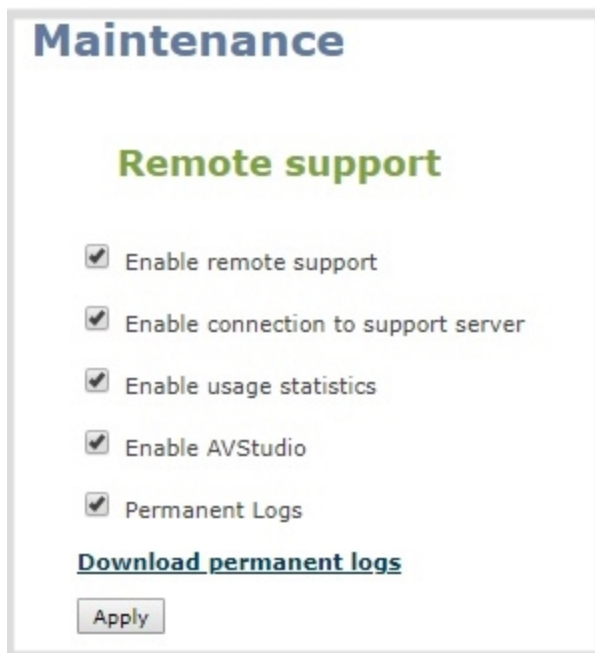
> Remote support is only provided for systems covered by SupportPlan+.

Download logs and allinfo file

If requested by Epiphan support, you can download the logs files and/or "allinfo" data from your system. These files help our support team troubleshoot problems.

To download the logs and allinfo file:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.
2. From the Configuration menu, click **Maintenance**. The maintenance page opens.

3. Check **Permanent Logs** and click **Apply**.

4. Click **Maintenance** again to refresh the maintenance page and click **Download permanent logs**. A zip file containing system downloads.

5. From your browser, run the **allinfo** script. A file is saved to your computer.

> http://<ip address of your system>/admin/allinfo.cgi

6. Share the log files and the allinfo results with Epiphan support.

Configure remote support

Remote support is enabled on Pearl Mini by default and allows the Epiphan support team to remotely access Pearl to help you troubleshoot issues and reset lost admin passwords.

Your network must allow access to the Epiphan maintenance server, which has the domain name epiphany.epiphan.com. Pearl must be able to resolve this domain name to connect to the Epiphan maintenance server for remote support.
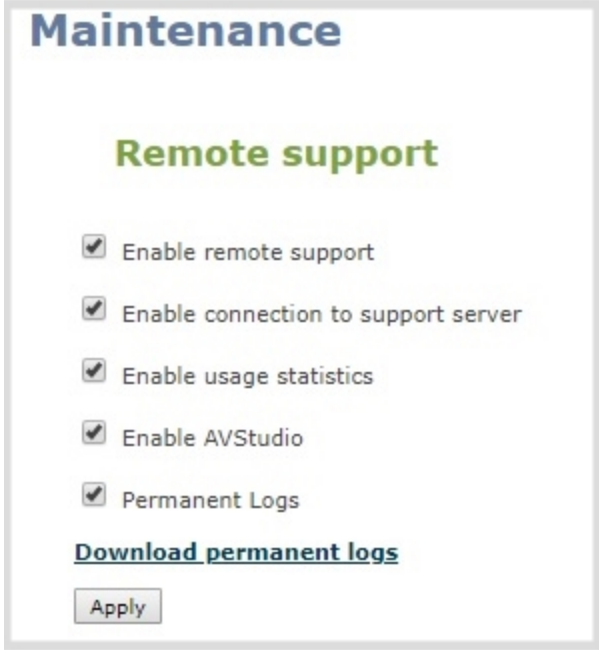
Remote support uses ports 22 and 30. Ensure that these ports are opened to allow remote communication. If your Pearl is on a network that is protected from the Internet by a firewall, consult with your network administrator to configure your network to allow remote Internet access through the firewall for those ports and to add epiphany.epiphan.com to the network's allowed list.

> Remote support is only provided for systems covered by SupportPlan+. For more information about service plans, see **www.epiphan.com/supportplan**.

To configure remote support:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, click **Maintenance**. The maintenance page opens.

3. Check **Enable remote support** to enable incoming connections from Epiphan Systems.

4. Check **Enable connection to maintenance server** to enable outgoing links to the Epiphan maintenance server epiphany.epiphan.com.

5. Click **Apply**.

6. Test that Pearl can access the maintenance server:

   a. From the Configuration menu, click **Network**.

   b. In **Network Diagnostics**, enter **epiphany.epiphan.com** and click **ping**.

   c. The result of the ping should show an IP address for epiphany.epiphan.com. Report any packet losses to Epiphan support.

7. If Pearl can't reach the maintenance server, check the network settings (see Configure DHCP) to ensure DHCP is selected or a DNS server is listed, then try again. Consult with your network administrator if problems persist.

8. If Pearl reaches the maintenance server, ensure your firewall has port 30 open.

9. Confirm with Epiphan support that they are able to access your Pearl for remote troubleshooting.

Disable remote support

Remote support is enabled by default. You can turn remote support off for your Pearl using the Admin panel.

> **STOP** Disabling remote support removes the ability for Epiphan to reset a lost admin password on your Pearl. If you forget the admin password and remote support feature is off, you will need to return the system to Epiphan for reprogramming.

To disable remote support for your Pearl:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, click **Maintenance**. The maintenance page opens.

3. Uncheck **Enable remote support** to disable incoming connections from Epiphan Systems.

4. Uncheck **Enable connection to maintenance server** to disable outgoing links to the Epiphan maintenance server epiphany.epiphan.com.

5. Click **Apply**.

Register your device

When you register your product with Epiphan, you become eligible to download firmware updates when they become available. Take advantage of exciting new features and important fixes for your Pearl. Registering your Pearl is free and only needs to be done once. You have an option to sign up for email notifications whenever a new firmware update is available.

You can register using the Admin panel or Register your device

Have the serial number of your Pearl handy when you register. The serial number appears on a sticker attached to the bottom of the device. You can also see the serial number from the System Status screen using the touch screen on Pearl.

> The banner to register your device appears on the Firmware update page in the Admin panel. If your system is registered or there are no firmware updates are available, you will not see a banner on the Firmware update page.

To register using the Admin panel:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Configuration menu, select **Firmware Upgrade**. The firmware upgrade page opens.

3. Click **Register** in the banner at the top of the page, then enter the information on the registration form.

Register your Pearl to be eligible for firmware updates and keep up-to-date on all the latest features and performance enchacements

Firmware Upgrade

Current firmware version: 4.8.0e (check for updates)

Select firmware upgrade file   Choose File   No file chosen

DO NOT interrupt or power down the Pearl until after the update is completed.

☑ Automatically check for firmware updates

Apply

Storage space maintenance

Pearl has a hard drive for storage of recordings. Occasionally, some maintenance is required.

Topics include:

- Check internal storage space
- Schedule disk check
- Perform disk check

Check internal storage space

You can check how much internal storage space is available on Pearl using Using the Admin panel and from the touch screen.Pearl has a 1 TB HDD and the rackmount models have 512 GB SSDs.

It's good practice to monitor how much free space is available. If the amount of available storage is low, you can always remove some of the recorded files, see Manage recorded files and FTP and automatic file transfers.

> ✅ Disk space can also be checked using Epiphan Live, see **Configure Dashboard panels**.

To check internal storage space:

1. Login to the Admin panel as **admin** or **operator**, see Connect to Admin panel.
2. View the **Internal Storage** section at the bottom of the menu panel. The bar will be mostly green if there is lots of space left, or mostly red if storage space is nearly full.
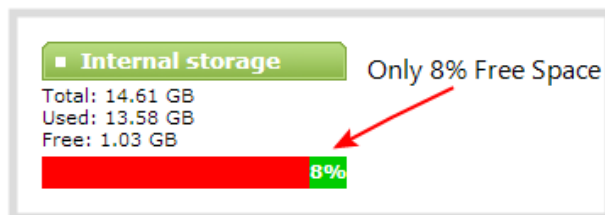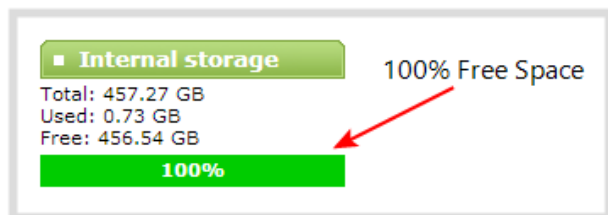
Schedule disk check

A disk maintenance schedule is used to check the system storage drives for errors. Two values are supplied, one to specify the number of system restarts that should occur before disk check, and the second to specify the number of months before performing a disk check. The disk check happens based on whichever event occurs first.

For example, let's say the restart setting is set to 50 and the months setting is set to 6. If six months pass and less than 50 restarts happened, a disk check will occur on the next restart. However if you do 50 restarts in one month, the disk check will happen after the fiftieth restart.

> Disk check occurs during start up and can cause a lengthy delay in starting up the system.

To set the disk check schedule:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. Select the **Disk Check** link in the Configuration menu; the disk maintenance page opens.

3. Set the **number of restarts to occur before the next check**. Set to 0 if you don't want to force a disk check after a specific number of restarts.

4. Set the **number of months to pass before the next check**. Set to 0 if you don't want to force a disk check after a specific number of months.

5. Click **Save**.

Perform disk check

A disk maintenance schedule is used to periodically check the system storage drives for errors. If you prefer, you can run the disk check manually at a time that is convenient for you.

Running the disk check manually resets the timers for the scheduled disk check (i.e. next check won't happen automatically until either the number of restarts or months passes).

> If the system is recording when you start a disk check, it will stop recording and resume after the check is complete. Frames presented during the disk check are not part of any recording.

To start a manual disk check:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. Select the **Disk Check** link in the Configuration menu; the disk maintenance page opens.

3. Click the **Check Now** button; a new page opens showing you the progress of the disk check.

> **STOP** Do not interrupt power to the system during the disk check.
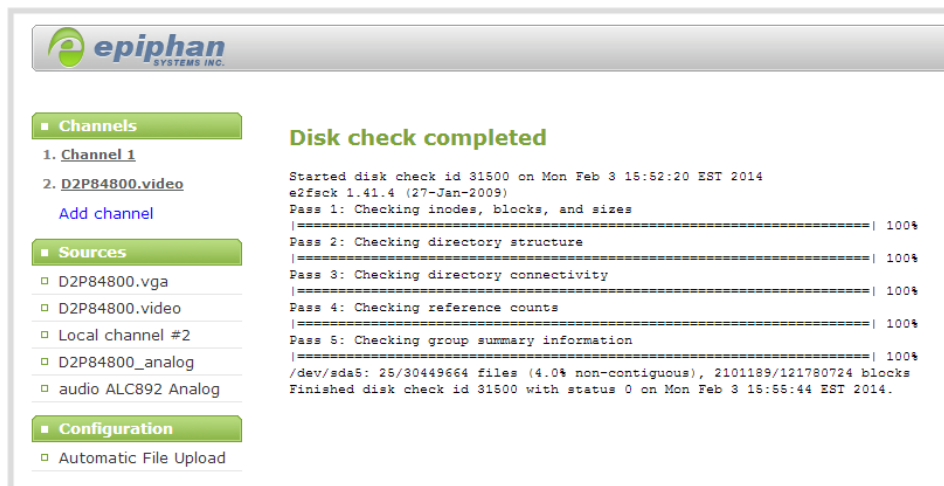
4. When the disk check is complete, the main page returns and a summary is shown.

Troubleshooting

In addition to fine tuning channel settings such as frame rate, resolution and bitrate to ensure optimal use of resources while streaming a quality video, there may be circumstance when you must fine tune the video input source.

> It's good practice to backup your configuration settings so that you can revert back to a good configuration if the changes you made are not desirable, see **Configuration presets**.

Topics include:

- Troubleshooting Quick Reference
- Remove black bars (matte) from the video
- Use a specific EDID for the video input port
- Unstretch the output video
- Remove the combing effect on images
- Video isn't centered
- Video looks squished
- Video too bright, too dark or washed out

Troubleshooting Quick Reference

Use the follow quick reference table for help if you are experiencing problems or unexpected behavior from your Pearl.

Table 99 *Troubleshooting Quick Reference*

Problem	Action(s) to Resolve
Not sure if the connected video inputs are being captured.	Check each source's input from the source preview in the Admin panel. OR Check the touchscreen interface to view confidence monitoring for each channel, see About the touch screen. OR Check the Dashboard interface in Epiphan Live, see Monitor video and audio input sources.
No sound is coming from an audio source.	Verify that you are using the correct audio input by following the steps in Configure encoding. OR Check the audio meter from the Dashboard view in Epiphan Live, see Monitor video and audio input sources. OR Check the touchscreen interface for audio monitoring or use the 3.5 mm audio jack on the front of Pearl to verify audio, see About the touch screen.
Captured SDI audio contains audible "clicking" sound or other audio distortions upon playback.	Ensure audio sample rate is set to 48 kHz. Lower sample rates (i.e. 32 kHz and 44 kHz) can sometimes cause audio distortion.
When previewing a channel using the Live broadcast link or the preview link in the Admin panel, some web browsers do not play audio.	The Flash (FLV) plugin must be installed for your web browser to play back audio that's encoded as PCM. Web browsers that use Flash players to preview video do not support audio that's encoded using 48 kHz MP3 or 48 kHz PCM.
Time stamps between Pearl and an RTSP	Reconnect your RTSP source to reset desynchronized time

Problem	Action(s) to Resolve
source are not synchronized.	stamps. Verify that you are using a local NTP server on your Pearl as a time synchronization server for your RTSP source, see Configure a time server.
Too much noise is present in the audio output.	Check the input level of the audio source to make sure it's the correct level. Modify the input **gain** if necessary, see Adjust audio gain and delay.
Video playback is fine, but when I play the clip in Adobe Premiere Pro the audio and video are out of sync.	Adobe Premiere Pro has a known issue handling video that is recorded using a variable frame rate. Convert the clip to a constant frame rate using a third-party software, such as Handbrake, before editing in Adobe Premiere Pro.
Adobe Premiere Pro won't load my .mp4 recording from Pearl.	Check if the selected recording format in Pearl is MP4-Fragmented. Adobe Premiere Pro does not currently support fragmented .mp4 files. Before editing in Adobe Premiere Pro, convert the clip to progressive .mp4 format. Run the file through ffmpeg or a third-party software such as Handbrake to preserve both audio and video output.
I can't preview my channels using the Epiphan Live Dashboard on Chrome even after I updated the security certificate for my website	Some versions of Chrome and Microsoft Edge don't display channel previews from the Dashboard if you're on an HTTPs network and your website has an insecure or invalid security certificate, even after you update the security certificate. Use a different web browser such as Firefox or update the version of your web browser, then add the security certificate for the website to the exceptions list.
Image quality is poor or insufficient.	The following tips can help improve image quality: 1. Ensure the source resolution is used as the output or recorded resolution. Up-scaling and down-scaling can affect picture quality. 2. Increase the **Bitrate** value and/or decrease the **Limit frame rate** value in the Encoding menu. See Configure encoding.
Frames per second are lower than expected.	The following tips can help improve frames per second (fps): 1. Increase **the Limit frame rate** value and/or decrease the **Bitrate** value in the Encoding menu. See Configure encoding.

Problem	Action(s) to Resolve
	2. Reduce the number of actions happening simultaneously on the system (i.e. if streaming, recording, and copying files, consider waiting to copy files until after streaming and recording are complete).
	3. Enter a low negative value (i.e. -5) in the Frame Grabber's Vertical Shift field.
	4. Reduce the number of channels encoding data.
	5. Ensure the hardware-accelerated H.264 encoding preset is chosen for all channels.
Stream won't play in my media player or browser.	Verify that the Stream Type matches with the media player used and that you have the correct url or SDP file for the player. See Share a live broadcast stream (HTTP, HTTPS or RTSP) and Streaming to a media player or smart TV.

If you still cannot see the stream, try disabling your local computer firewall.

If the issue is still not resolved, contact Epiphan Support at support@epiphan.com. |
| The stream interrupts or the image breaks up. | The following tips can help diagnose image problems:

1. Ensure the source resolution is used as the output or recorded resolution. Up-scaling and down-scaling can affect picture quality. See Configure encoding.

2. Increase the **Bitrate** value and/or decrease the **Limit frame rate** value in the Encoding menu. See Configure encoding.

3. Check network settings including filters, routers and application settings. Packet loss can result in stream failure. |
| The video streamed to my set-top box is dropping frames. | If you're streaming to set-top boxes that have 10/100 Mbps interfaces on the same Gigabit Ethernet and you notice frames are dropping, you can limit the bandwidth of the stream using traffic shaping to adapt for lower bandwidth set-top boxes and prevent frame drops, see Set up traffic shaping. |
| Recording won't start. | If recording will not start, check the Disk Status Information to |

Problem	Action(s) to Resolve
	see if the system is out of disk space. See Check internal storage space and Manage recorded files.
AFU to my CIFS server doesn't work.	Pearl supports Automatic File Transfer (AFU) to CIFS servers (also known as SMB or samba) with samba version 1.
Firmware upgrade fails.	Reboot the system and try again. If the problem persists, contact Epiphan support at support@epiphan.com.
Certain Media players won't play encoded videos but others will.	Depending on the media player used, there could be different issues. If you encounter a playback issue, try using a different media player. Some issues we know of include: 1. On Windows 10, the Movies & TV app sometimes fails to playback MP4-fragmented files with MP3 audio: try changing your MP4 audio encoding to AAC. 2. VLC doesn't play MP4-fragmented files normally. 3. Streams and recordings at very low frame rates (e.g. 1 fps) are not playable in VLC media player, use Windows Media Player and Quicktime Player instead.
Certain Media players won't play MOV videos.	Some media players won't play MOV videos that are recorded with MP3 audio encoding, including: 1. VLC 2.2.4 (Microsoft Windows) if MP3 audio encoding is at 48 kbps. 2. Movies & TV 10.16122.1029 on Windows 10. 3. Windows Media Player 12. Choose a different audio encoding when recording MOV files or use a different media player to playback the recording.
There's no audio when I playback an MP4 file in QuickTime 10.	Apple doesn't support MP3 audio. If your MP4 file is created with MP3 audio, you will not hear the audio during playback in QuickTime 10. Choose a different audio encoding when recording MP4 files or use a different media player to playback the recording.
I can't hear the audio in VLC or the video won't play.	VLC version 3.0.3 won't play audio for MP4 fragmented files. In VLC's Input/Codecs settings page, you can try increasing the file caching parameter.

Problem	Action(s) to Resolve
	VLC version 3.0.6 (windows) won't play MP4 fragmented video files. This is a VLC issue.
There's noticeable latency on the video output port.	Disabling the audio on the video output port improves latency for the port, see Disable or enable audio and output port volume.
System is not starting up correctly.	Ensure there are no USB sticks inserted into the USB ports during power up. They may be conflicting with the internal hard drive, causing unexpected behavior.
I can't register my Pearl with Kaltura using the same device name that I just deregistered.	If you deregister Pearl from Kaltura and then too quickly register again using the same name, you may receive the following error message "Unable to register device: System name [D Pearl test] already exists". To avoid this, ensure the deregistered Pearl entry in the list of encoder devices disappears before registering again using the same device name.
My login attempt to create an ad hoc event from Pearl was denied.	Kaltura or Panopto has denied you access to create unscheduled ad hoc recordings and webcasts using Pearl. Contact your CMS administrator to either activate your CMS account or enable the necessary access rights.
Web camera is not working correctly.	There are several possible causes of poor performance on web cameras: ● The camera itself might be malfunctioning. Try hooking it into a computer to see if the problem remains. ● If the picture quality is below standard, try adjusting the settings using the instructions for how to Configure a video input source ● Check that your web camera is on our list of supported models. If it is not, try using a supported camera, and if the problem persists, contact our support team.

Remove black bars (matte) from the video

Channels with only one layout and only one source by default use the aspect ratio of input signals when the output is streamed. If an input video signal doesn't match the encoded frame aspect ratio, bars are added to

the sides or top and bottom of the encoded stream when the output is streamed and recorded.

If you see bars on your output but would rather have the image fill the whole screen, you have to options:

1. Change the output frame size to match the aspect ratio of the input, see Match output frame size with aspect ratio of input signal.

2. Stretch the image to fit the output frame size aspect ratio, see Stretch the image.

The color of the bars (matte) is defined by the Background color that is selected using the custom layout editor for the channel, see Custom layout configuration.

> For example:
>
> - Input signal resolution is 720×480 (a 3:2 aspect ratio)
>
> - encoded resolution is 640×480 (a 4:3 aspect ratio that is narrower than the input resolution)
>
> Borders are added to the top and bottom of the image to preserve the wider ratio of the input.

> For example:
>
> - Input signal resolution is 720×480 (a 3:2 aspect ratio)
>
> - encoded resolution is 1280×800 (a 16:10 aspect ratio that is wider than the input resolution)
>
> Borders are added to the left and right of the image to preserve the narrower ratio of the input.

Match output frame size with aspect ratio of input signal

The frame size is matched only for layouts that have only one source. Note that if you have layouts with different frame sizes, switching them while live streaming will cause an interruption and restart of the stream. The same thing happens if you change the resolution of your source while streaming.

To change the output frame size on channels to match the aspect ratio of the video source:

1. Connect to the Admin panel and login as **admin**, see Connect to Admin panel.

2. To determine the input port name of the video source that's used in the channel, select the channel from the Channels menu and click **Layouts**. The custom layouts page opens.

3. Once you have determined the name of the video input source , select the input port for that video source under Inputs menu.

4. Make note of the input signal resolution.

5. From the Channel's menu, click **Encoding** for the channel. The Encoding page opens.

6. You can either check **Use current signal resolution as frame size** or you can choose the frame size resolution from the list.

a. If the source resolution appears in the list, you can choose any resolution that's listed on the same line (i.e. with the same aspect ratio).

b. If the source resolution doesn't appear in the list, calculate the source resolution and enter it in the **Frame size** fields.

> **TIP**: Temporarily check **Use current signal resolution as frame size** to see the frame size listed in the Frame size fields, then uncheck that check box and manually enter the value in the **Frame size** fields.

7. Click **Apply**.

Stretch the image

You can remove the matte (black bars) by stretching the image to fit your output frame size using the custom layout editor.

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Channels menu, select the channel and click **Layouts**. The custom layout editor page opens.

3. In the layouts list, select the row for the layout you want.

4. In the items list below the layout editing area, select the video source. The video source settings appear.

5. Uncheck **Keep aspect ratio when scaling**.

6. In the layout editing area, click and drag to stretch the video source to fill the frame.

7. Click **Save**.

Use a specific EDID for the video input port

Extended display identification data (EDID) is data provided by a video display device, like a monitor. The EDID describes the display's capabilities to a video source, such as the graphics card in a PC or other video output device.

In Pearl, the video source uses the EDID information to determine what resolutions, color depth, and other settings the monitor supports.

> EDID is mostly ignored by VGA sources, but it is crucial for DVI sources.

The video input ports on Pearl have a factory set EDID. When you connect a video source such as a laptop or camera to Pearl, the video source sees Pearl as if it were a monitor. The EDID that's assigned to the input port is read by the video source to determine what video signal it needs to send to Pearl.

Usually, the video input ports on Pearl correctly emulate a monitor for the connected video source. However, there are times when you may need to upload a custom EDID, like when your source uses a custom set of display properties.

When you upload a custom EDID to an input port on Pearl, you can force the port to supply a specific resolution, color depth, etc to the connected video source.

Upload a new EDID

In most cases, the factory installed default EDID works fine for sources connected to the HDMI ports on Pearl. However, there may be times when a connected video source uses resolutions that you do not want to use. In that case, you can manually upload an EDID and force Pearl to use a specific set of attributes for a specific HDMI input port. All video sources you connect to that HDMI input port will use the EDID you've manually assigned to the port.
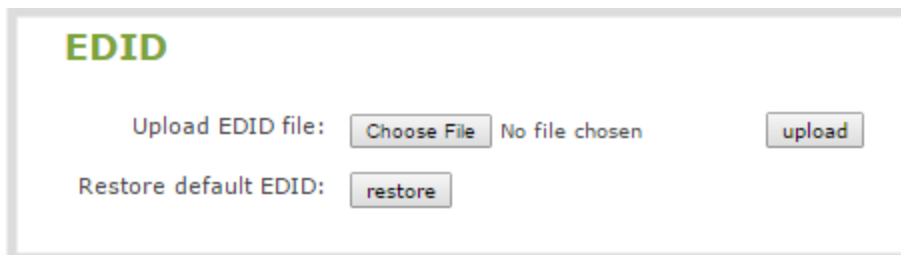
EDID changes remain in effect for the HDMI input port until you replace the EDID with another one or specifically choose to restore the factory EDID for that specific HDMI input port. A system-level factory reset does not remove a manually assigned EDID from the HDMI port.
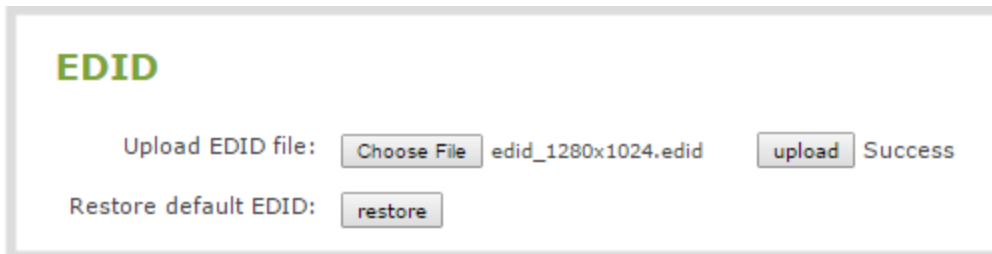
> This feature is not available using the local console on Pearl.

To download a new EDID file:

1. Go to the Epiphan support web page and select the support page for Pearl.

2. Scroll to the **EDID** section and select an EDID from the list. The file is saved to your downloads folder on your hard drive.

3. Connect to the Admin panel and log in as **admin**. See Connect to Admin panel

4. From the Inputs menu, select the input port for which you want to upload the EDID.

5. On the configuration page for that source, scroll to the **EDID upload** section and click **Choose FIle**.

EDID

Upload EDID file: [Choose File] No file chosen   [upload]
Restore default EDID: [restore]

6. Browse to the location where the custom EDID file was saved and select it, then click **open**.

7. Click **upload**. When the upload is complete, the page updates to reflect success or failure.

EDID

Upload EDID file: [Choose File] edid_1280x1024.edid   [upload] Success
Restore default EDID: [restore]
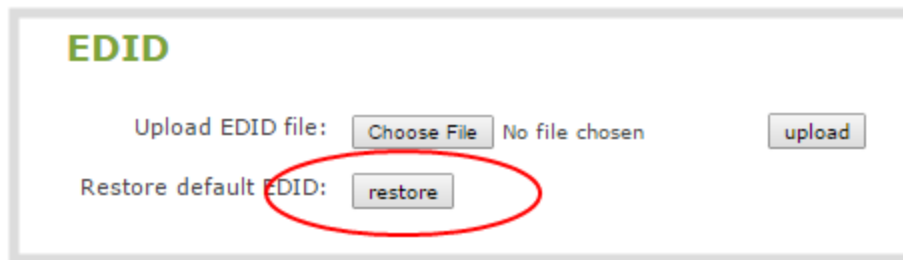
Restore factory default EDID

When you no longer want a custom EDID assigned to an input port, you can restore the input port to use the factory default EDID. Currently there is no way to tell if your input port is using a custom EDID. If you are unsure, restoring to factory default is the best approach.

To restore the default EDID:.

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

2. From the Inputs menu, select the source you want to restore. The source configuration page opens.

3. Scroll to the **EDID** section and click **restore**.
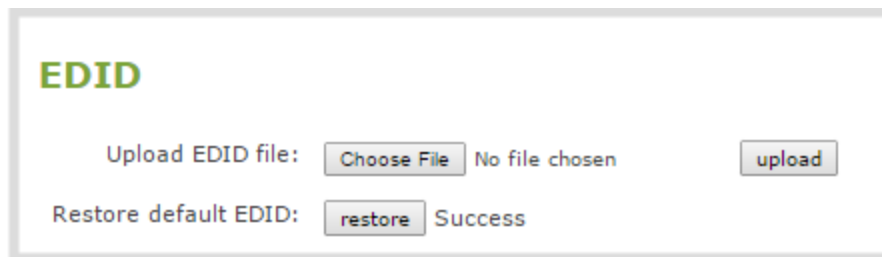
4. When the default EDID is applied, the page updates to reflect success or failure.

Unstretch the output video

Pearl preserves the aspect ratio of your input video signal by default when you add the source to a layout using the custom layout editor. If you've changed the default setting, the image is stretched to match the output frame size.

To prevent the image from looking stretched, you can use the custom layout editor to preserve the video source's aspect ratio.

> 📋 Unstretching the image causes a matte (black bars) to appear on the sides or top and bottom of the output. To remove these see **Remove black bars (matte) from the video**.

To preserve the video source's aspect ratio:

1. Connect to the Admin panel and login as **admin**. See Connect to Admin panel.

2. From the Channels menu, select a channel and click **Layouts**. The custom layout editor page opens.

3. In the layouts list, select the row for the layout you want.

4. In the items list below the layout editing area, select the video source. The video source settings appear.

5. Check **Keep aspect ratio when scaling** and click **Save**.

Video isn't centered

With VGA sources, the image can display too high or low, or too far to the left or the right.

To shift the video horizontally or vertically:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

3. From the Inputs menu, select a VGA video source. The configuration page for the VGA source opens.

4. Do one of the following to shift the video.

   a. To shift the video horizontally to the right, enter a positive integer in **Horizontal shift**.

   b. To shift the image to the left, enter a negative integer in **Horizontal shift**.

   c. To shift the video vertically upwards, enter a positive integer in **Vertical shift**.

   d. To shift the image downwards, enter a negative integer in **Vertical shift**.

5. Click **Apply**.
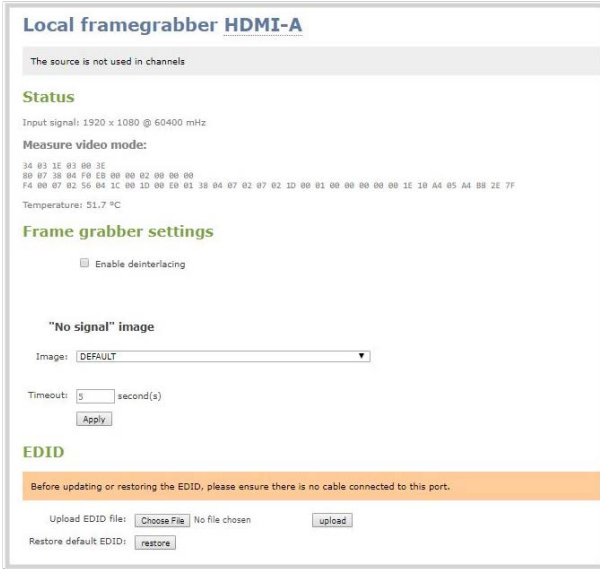
Remove the combing effect on images

When frames are interlaced, artifacts from one frame may appear on the next frame. This happens when a fast motion video is interlaced.

Since each frame is captured from a different point in time, the action captured in one frame is carried over to the next frame. The result is a blurred image and horizontal lines running across the video.

To convert an interlaced source signal to a non-interlaced signal.

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

3. From the Inputs menu, click the source name. The configuration page for the source opens.

4. Check **Enable deinterlace** and click **Apply**.

Video looks squished

With VGA sources, the image can sometimes look squeezed horizontally on the screen. This happens when there's a mismatch between the aspect ratio that Pearl detects and the aspect ratio that is sent from the VGA source.

To compare the two, you must know the aspect ratio that the VGA source is sending.

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

3. From the Configuration menu, click **Info**. The Info page opens with a list of all configured channels.

Channels

#	Channel name	Status	Video source	Audio source	Stream	Bitrate	Actual bitrate	Frame size	FPS / Actual FPS	Port	
1	Auto A	ok	SDI-A	SDI-A Audio	H.264+aac	5000 kbps	578 kbps	1920x1080	30 / 29.9	8000	View
2	Auto B	ok	SDI-B	SDI-B Audio	H.264+aac	5000 kbps	421 kbps	1920x1080	30 / 30.0	8001	View

4. Compare the aspect ratio from the source with the aspect ratio from the Pearl info window.

5. If there is a mismatch, go to the Encoding page for the channel and change the frame size to match the frame size of the VGA source, see Configure encoding.

6. If the video still looks like it's squeezed horizontally on the screen, do the following:

   a. From the Inputs menu, select the VGA source. The source's configuration page opens.

   ■ Inputs
   - □ HDMI-A
   - □ HDMI-B
   - □ SDI-A
   - □ SDI-B
   - □ VGA-A
   - □ VGA-B
   - □ USB-A
   - □ USB-B
   - □ Analog-A Audio
   - □ Analog-B Audio
   - □ HDMI-A Audio
   - □ HDMI-B Audio
   - □ SDI-A Audio
   - □ SDI-B Audio

   Add RTSP input

   b. In the Aspect ratio field, select **Wide mode** if the source is wider than what is being displayed in the output preview, then click **Apply**.

> 📋 You can refresh the page to check how the VGA source looks in the preview.

Video too bright, too dark or washed out

If the video from the VGA source is too light, too dark, or washed out, use the offset and gain controls to adjust image quality.

Increasing the gain amplifies weak signals but also increases noise, so balance the offset and gain values to get the best quality image.

Adjust these settings by the smallest values possible. If you make a large change to one setting, compensate by making a large change to the other.

> 🛑 Setting both the offset and gain to high values can result in poor video quality.

To adjust the offset and gain for a VGA source:

1. Login to the Admin panel as **admin**, see Connect to Admin panel.

3. From the Inputs menu, select a VGA source. The configuration page for the source opens.

4. To brighten the image, enter a value from 0 (brightest) to 255 (darkest) in **Gain**.

5. To add contrast, enter a value from 0 (brightest) to 63 (darkest) in **Offset**.

6. Click **Apply**.

Limitations and known issues

This section includes known issues or limitations that affect functionality or usability and ways that you can work around these limitations.

Important notes about upgrading from firmware older than 3.16.0

1. In release 3.16.0, configuration presets replaced the concept of backup files. These new files use a new format to accommodate portability between systems. As a result, backup files from previous versions (prior to 3.16.0) cannot be loaded on systems running firmware 3.16.0 or newer. Further, if upgrading from a release older than 3.16.0, all existing configuration presets are deleted during the firmware upgrade. Be sure to keep notes for any configuration presets you wish to recreate.

2. As of release 3.16.0, streaming can be enabled and disabled independently from streaming credential configuration. If upgrading from a release older than 3.16.0, streaming defaults to enabled (started) until set to disabled.

Affecting firmware upgrades from before 4.0.0

- In firmware 4.0.0 and beyond, the MPEG-4 encoding option is not offered. As a result, all MPEG-4 channels are automatically converted to H.264. However, sometimes this does not occur automatically, and those channels are not able to encode.
  Workaround: Before updating your firmware, ensure that none of your channels use MPEG-4. If they do, convert them manually to H.264 before uploading firmware 4.0.0.

Affecting firmware upgrades to 4.8.1 (or later) with traffic shaping

If traffic shaping is already configured using the Pearl API, observe the following before upgrading to 4.8.1 (or later):

- Traffic shaping that's configured using the API will continue to work after you upgrade the firmware. You can clear traffic shaping for one or more channels using the API at any time.

- If you reconfigure traffic shaping for a channel using the Admin panel after upgrading the firmware, the API can no longer be used to configure traffic shaping for that channel. You must use the Admin panel going forward. The other channels are not affected.

- If you plan to use the Admin panel to configure traffic shaping for easy access and ease of use, you can clear traffic shaping for all channels using the API before you upgrade the firmware or after the upgrade. Keep in mind that you can no longer use the API to clear or configure traffic shaping for any channels that were configured using the Admin panel.

Recommendation: After enabling traffic shaping using the Admin panel, test a multicast stream using the auto traffic shaping settings. If your low bandwidth network device is displaying poor video quality, then manually set the limit bandwidth bitrate according to the bandwidth of your particular network device. See Set up traffic shaping.

Affecting encoding

- **Limitation**: When Pearl is overloaded, video frames or audio samples can be dropped causing variable frame rate and audio cracks.
  Workaround: Pearl is a powerful system capable of many simultaneous tasks, but like any other computing device, it has finite resources. If this problem is observed, check the CPU load from your system's Info page. To reduce system load, do any of the following: disconnect unused video displays from Pearl's video output ports, delete unused channels and unused layouts, or reduce the complexity of layouts by scaling at the source instead of having the system scale, or reduce the number of sources in layouts, or reduce the frame size or frame rate for channels displayed on the video output ports. Note that actions performed in the Admin panel and Epiphan Live can increase overhead (such as adding channels/sources to Epiphan Live's Dashboard preview panels), as can switching layouts via Pearl's touch screen.

- For VGA sources only, some wide-mode resolutions are not correctly identified and result in a slightly squished image (e.g. for a 1360x768 source, the detected resolution may be 1024x768).
  Workaround: This issue is related to the video source. Test your source to see if it exhibits the issue. If possible, avoid using wide-mode for VGA sources that exhibit this issue.

- Encoding video at 60 fps with either 16 kHz or 22 kHz AAC audio can result in some dropped video frames.
  Workaround: Select another video frame rate, a different audio sampling rate, or choose MP3 audio.

- The automatically calculated frame size for HD VGA sources is occasionally incorrect.
  Workaround: This problem is caused due to cable degradation or poor cable connection. Re-seat or exchange your VGA cable. If the problem is still not resolved, visit the Epiphan Pearl support page for a custom EDID to resolve the issue.

- **Limitation**: Encoding digital video signals (such as HDMI™) for recording or DisplayPort output occasionally causes very small color distortions on thin, black visual elements displayed against white backgrounds (i.e. black text font on a white page).

- Configuring very low frame rates such as 1 fps encoding with a high bitrate setting (e.g. 7000 kbps) results in poor video quality.
  Workaround: Allow Pearl to automatically select the best bitrate setting. For 1 fps, this results in a bitrate of about 1180 kbps.

- Occasionally, a solid black image appears when connecting an AV.io HD capture card to a USB port on Pearl.
  Workaround: Reconnecting the capture card resolves the issue and captures the video normally.

- Some audio distortion is heard on video output port using PCM 22 kHz encoding or very low frame rate (1-5 fps).
  Workaround: For best results, use AAC 48 kHz or PCM 48 kHz audio encoding and encode the channel at higher than 5 frames per second.

- The Analog-B source sometimes crosses its audio with other active audio sources.
  Workaround: Try rearranging audio sources and see if the problem persists. Alternatively, a soft reboot of the system resolves the issue.

- The GoPro camera model HERO7 and some Evertz video distribution systems can suddenly stop working with Pearl.
  Workaround: Reset the EDID for the Pearl input. You can also use a device such as an HDMI splitter to isolate and filter the video signal before the signal is sent to Pearl.

Affecting streaming and recording

- Interlaced SDI capture is sometimes shifted downwards, resulting in a small green line at the top of the video.
  Workaround: This issue varies with different sources. If it is affecting your capture, the best solution is to crop out the green line in your layout.

- The ability to perform an **FTP Delete** cannot be disabled, even after using the **Disable FTP Delete** command in the FTP session.
  Workaround: Ensure that access to control of the FTP session is restricted to those aware of decisions about deleting the stream.

- Extracting tracks from a .MP4 recording when there isn't enough storage space for the extracted files causes the extracted files to become corrupted. Workaround: Check how much internal storage space is available on Pearl/Pearl-2 and delete any unnecessary recordings to free up more space.

- Occasionally, tracks won't extract from a 64 GB .AVI multi-track recording using the Admin UI.
  Workaround: Perform the extraction again.

- Some audible clicks are present during playback of AAC formatted recordings at 48, 44, and 22 kHz when using Microsoft Edge versions 41-42.
  Workaround: Use a different web browser to playback the recordings.

- When configuring the primary channel and audio sources for a Pearl remote recorder in Panopto, choosing a Pearl channel that has no audio as the primary video source without choosing a primary audio source from another channel can cause the remote recorder's preview to not display properly in Panopto.
  Workaround: Choose a primary audio source from one of the other channels.

Affecting the Admin panel

- Passwords and IP restrictions set for viewers don't restrict access when using certain common platforms or when set on a per-channel basis if your stream uses HTTP Live Streaming (HLS) because HLS is processed directly by the apache server.
  Workaround: This only applies if you're using a password for the stream. The only common platforms where this is a know issue are VLC and iPhone6, iOS 10.0.1, and using another platform prevents the issue. If you're streaming over HLS, do not set viewer passwords and IP restrictions per-channel. Use global viewer passwords and IP allow/deny lists instead.

- It is possible to name two or more channels with the same value. Use of automatic file transfer and UPnP is unpredictable if this occurs.
  Workaround: Ensure each channel has a unique name.

- The automatic file upload (AFU) file queue shows a maximum of 15 files. The Newer 15 and Top of the list buttons do not work. All files are transfered even though they are not listed.
  Workaround: Wait for the queue to have fewer files in the list. Use global viewer passwords and IP allow/deny lists instead.

- The **Empty Queue** button does not delete an AFU file transfer that's in progress.
  Workaround: There is no workaround at this time.

- Cropping a video source to 16:9 using the layout editor may not scale correctly and can appear as a thin line in the layout editor. This happens when the device or web browser you're using with the admin interface has a

different approach to composing layout. Recording and streaming are not affected.
Workaround: Due to color space limitations (YUV with 2x2 subsampling), the cropped region's dimensions must be set to even values.

- Using Microsoft Edge to connect to Pearl using the mDNS name of Pearl does not work.
  Workaround: Use a different web browser such as Chrome, Firefox, or Internet Explorer since Microsoft Edge doesn't support mDNS.

- The special preview mode that lets you preview all channels at once using a web browser isn't functioning.
  Workaround: Preview individual channels using different tabs in your web browser.

- If you've created more than five channels on Pearl, it's possible to select more than the maximum number of five channels supported by Kaltura for scheduled VOD and manual (ad hoc) events. Only the first five channels will list for an event in MediaSpace.
  Workaround: From the **Content management system configuration** page in the Admin panel, choose only up to a maximum of 5 channels and ensure that no other channels are selected.

Affecting Epiphan Live

- Very fast, repeated switching between layouts using the Switcher interface can sometimes cause the monitoring panels and the preview in the Admin Panel to display an blank screen until the video image finishes loading.
  Workaround: Avoid repeated fast switching between layouts.

- The green and red borders around the "Preview" and "Live" areas in the Channel section are offset from the video by a few pixels.
  Workaround: The offset is cosmetic and does not affect your Live stream, so no workaround is required.

- When monitoring the display output for a prolonged period of time, the audio on the display output starts to stutter. This does not affect streaming or recording.

- When a DisplayPort output assigned to a Dashboard preview panel has its source changed, the preview panel does not automatically update to reflect the change.
  Workaround: Refresh the Epiphan Live Dashboard in your web browser to update any changes in your preview panels.

- Audio ports that have no audio source connected display an error status message on the Dashboard instead of remaining blank.
  Workaround: There is no actual error and no action is required. Ignore error status messages for audio ports that don't have an audio source connected.

- When setting up the video output ports on Pearl, the video input source's frame rate as set for the channel is used by default for the video at the output. The **Frame rate** field in the video output port settings does not change the frame rate of the video at the output port or change the frame rate of the connected display device. **Workaround**: Ignore the Frame rate field in the video output port settings.

Affecting USB devices

- Audio from an HDMI video source that's coming in on one of the USB ports will occasionally drop some bytes of the audio signal.
  Workaround: Use audio from another source in your layouts.

Affecting other areas

- Pearl fails to restart after improper shutdown (power cable removed or rapid power cycle). LED and touch screen blink.
  Workaround: Restart Pearl by removing the power cable for 20 seconds, then reattaching the cable and powering the system back on.

- AFU to Amazon Web Services S3 Simple Cloud Storage transfer sometimes does not recover after the network connection is cut. The expected behavior is that the file transfer would restart, but there is sometimes a time desync that results in a failed transfer.
  Workaround: If the network connection is severed during a AFU transfer, the process must be restarted from the beginning, and the transfer must proceed without interruptions to the network.

- Pearl doesn't synchronize time from a local Windows NTP server.

- When LDAP authentication is enabled, logging in to Pearl using LDAP can sometimes stop working.
  Workaround: Sign in to the Pearl Admin panel using the administrator account and disable LDAP authentication. Sign out and then sign back in to the Admin panel using the administrator account and re-enable LDAP authentication.

- In multi-view recordings, different Kaltura players (such as the KMC and MediaSpace) can playback audio differently, where the KMC plays audio from the channel selected as the "main entry".

- The CMS Events page refreshes every six hours. In releases earlier than 4.10, if the Events page is not manually refreshed or no new/changed events are processed within a seven day period, Pearl ignores sessions that are not listed on the Events page for recurring Panopto events that have more sessions then the Events page can display at any one time.

- If the SD card is removed while a recorded event is uploading to Panopto, uploading is interrupted and the file does not upload; however, the event in Panopto appears as upload complete. If the SD card is immediately re-inserted, Pearl Mini must be rebooted before Pearl Mini will detect it.
  Workaround: Wait a minimum of 5 minutes before re-inserting the SD card and rebooting Pearl Mini if the SD card is ejected while files are uploading to Panopto.

- If you modify a particular recurring lecture capture plus live webcasting event (e.g. a VOD + Live Stream event in a recurring series), Kaltura excludes that event from the recurring series and the webcast doesn't stream. That's because the RMTP URLs for the modified event looses it's mandatory tokens. However, the recurring Kaltura event does record as scheduled and other events in the series are not affected.
  Workarounds: To regenerate the RTMP tokens for a live event, go to MediaSpace, find the modified live event entry and uncheck the Live event checkbox - and save. Then re-check it and save the event again. Alternatively, you can go to the Kaltura Management Console (KMC), find the modified live event entry and then, in the Live stream tab, click **Re-generate Stream Token**.

Previous releases and features

This section lists features and updates introduced in previous product releases.

Release 4.10

- Local Admin panel access using a USB keyboard, mouse, and monitor connected directly to Pearl plus a built-in virtual keyboard, multiple keyboard language layouts, and support for touch screen monitors
- Assigning Pearl a unique device name, description, and location
- Using a Kaltura application token to register Pearl as a remote recorder
- Selecting a video output source using the touch screen

Release 4.9.1

- Kaltura ad hoc event details and configurable event schedule refresh interval
- Panopto support for ad hoc event authentication from Pearl's touch screen using credentials for external identity providers
- Panopto ad hoc event folder selection from the Pearl's touch screen
- Automatic user logout when an ad hoc event ends
- International character support in channel names, layout names, video and audio input names, text overlays, and recorded file names. For a list, see International character support
- Epiphan Discovery Utility support deprecation

Releases 4.9.0 and 4.9.0h

- Full Panopto integration
- Kaltura ad hoc event creation using the touch screen
- Toggle Temperature/CPU load on the touch screen
- Automatic EDID verification of connected sources upon start up
- USB tethering removed
- Confirmation before AFU queue file deletion
- Kaltura users who are only defined in MediaSpace are allowed to start unsheduled ad hoc events using both the touch screen and the Admin panel (4.9.0h)

Release 4.8.1

- Traffic shaping to improve video output quality when streaming over a Gibabit Ethernet network to 10/100 Mbps set-top boxes (see Limitations and known issues if using the API for traffic shaping)

- Improved video smoothness of the HDMI outputs

- We improved the smoothness and quality of interlaced video from SDI inputs

Release 4.8.0

- Hardware acceleration

- Live switching improvement

- Audio inputs as playback audio sources for HDMI outputs

- Product registration changes

- Pairing to AV Studio changes

- Original Livestream and Wowza Cloud streaming presets removed

Release 4.7.1

- AFU to SFTP server stability improvement

Release 4.7.0

- Integration with Kaltura CMS

- International character support in text overlays

- Chroma key color selection update

- RTMPS certificate update

- EAP-TLS user name field update

Release 4.6.0

- 802.1x network security compliance

- RTMPS AV encryption

- HTTPS

- Discovery utility port disabled

Release 4.5.1

- Constant volume for layouts with multiple audio sources

- Stereo and mono analog audio selection

- Mute audio

- Remote login

- Channel as a source

- Mirror the video output

- Some important UI terminology changes

Release 4.4.1

- AV synchronization improvements of RTSP streams and loopbacks.

- Fixed the Wowza custom streaming option.

- Improved the recognition of AV.io SDI capture cards when they are first plugged in.

- Fixed a hot plug issue affecting the detection of interlaced 1080i signals from certain camera models (for example, Sony HDR-CX180, HDRCX190, and Panasonic HC-VX980M).

Release 4.4.0

- Constant frame rate

- Audio VU meter

- Epiphan Live preview on HTTPS networks

- AFU to an SCP server remote directory creation

Release 4.3.0

- Chroma keying

- Text overlay and custom layout editor enhancements

- Clone channels and custom layouts

- Clone recorders and recorder metadata

- AFU enhancements

- Start and stop individual streams using Epiphan Live

Release 4.2.0

- USB 3.0 support for web cameras and AV.io UVC video capture cards

- Fully integrated multi-publishing

- Enhanced video cropping

- Audio delay control

- Epiphan Live recordings management

Release 3.17.0

- IP camera support

- Epiphan Live

- Dynamic Text

- One Touch Control

- Expanded touch screen functionality

Release 3.16.1

- Updated VU meter ballistics

- Audio attenuator support

- Capture volume control changed to input gain

Release 3.16.0

- Two new hardware models: Pearl Rackmount and Pearl Rackmount Twin

- Video output ports

- Streaming control

- Portable configuration presets

- Progressive MP4 and improved Adobe Premiere Pro support

- Power button change (double-press to shut down instead of single-press)

Release 3.15.3 features

- Configuration improvements

- Enhanced user control

Release 3.15.2 features

- Layout items can now be reordered

- Finer layout item position control

- Video switching via RS-232 and HTTP APIs

Release 3.15.1 features

Firmware release 3.15.1 was a big release with a lot of new features for Pearl, making it your perfect, go-to favorite when recording or streaming live video events.

- Front-mounted audio jack for Pearl

- Live video switching

- Audio monitoring on Pearl

- Video source cropping

- Use a picture as a video source

- Transparent PNG overlays

- Stream background, logo and text overlay improvements

- New multi-source layout designer

Release 3.14.4 features

- Live Streaming via Wowza Cloud

Release 3.14.3 features

- Configuration presets

- Network configuration via the touch screen

- Stereo audio encoding

- Support for 256 kbps and 320 kbps audio sampling

- LDAP support

- SCP and SFTP file transfer

Release 3.14.1 features

- Capture 4 HD sources simultaneously

- 48 kHz audio support

- Simplified H.264 video encoding presets

- Configurable EDID

- MP4 support

Release 3.14.0 features

- Touch screen display

- HDMI input

- Automatic channels

- Hardware acceleration for H.264 encoding

- Stream access control improvements

Software license

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April 22, 2019

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The equipment that you bought has required the extraction and use of natural resources for its production. It may contain hazardous substances that could impact health and the environment. In order to avoid the dissemination of those substances in our environment and to diminish the pressure on the natural resources, we encourage you to use the appropriate take-back systems. Those systems will reuse or recycle most of the materials of your end life equipment in a sound way. The crossed-out wheeled bin symbol invites you to use those systems. If you need more information about collection, reuse and recycling systems, please contact your local or regional waste administration. You can also contact us for more information on the environmental performance of our products.

Important Safety Warnings

Model numbers covered by this document: ESP1440, ESP1441, ESP1442, ESP1474, and ESP1556

This product is designed for IT power distribution systems with phase-to-phase voltage 230V.

WARNING: This product has no user-serviceable parts and the battery used in this device is not replaceable. Do not attempt to disassemble. Return the device for service.

CAUTION, RISK OF ELECTRIC SHOCK: This device may have multiple AC power cords installed. All power sources shall be disconnected before servicing to avoid shock hazard.

ATTENTION: Cet appareil ne contient aucun composant pouvant être entretenu ou réparé par l'utilisateur. En cas de panne, retourner l'appareil pour réparation.

ATTENTION, RISQUE DE CHOC ÉLECTRIQUE: Cet appareil peut être équipé de multiples cordons d'alimentation en courant alternatif. Pour placer cet appareil hors tension, débrancher tous les cordons d'alimentation sans exception.

FCC Compliance Statement

47 CFR Section 2.1077 Compliance Information

Unique identifier: Pearl

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference

2. This device must accept any interference received, including interference that may cause undesired operation.

Responsible party (US contact):

Epiphan Video
116 University Avenue, Suite 100
Palo Alto, CA
94301, USA

www.Epiphan.com

FCC CAUTION

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

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Innovation, Science and Economic Development Canada:

This device complies with ICES-003 of the ISED rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and

(2) this device must accept any interference received, including interference that may cause undesired operation.

Cet appareil est conforme à la norme ISED NBM-003 pour les appareils radio agréés. Son fonctionnement est sujet aux deux conditions suivantes:

(1) Le dispositif ne doit pas produire de brouillage préjudiciable, et

(2) ce dispositif doit accepter tout brouillage reçu, y compris un brouillage susceptible de provoquer un fonctionnement indésirable.

CE Compliance Statement

Marking by the symbol $C\,\varepsilon$ indicates compliance of this device with the applicable directives of the European Community and meets or exceeds the following technical standards.

Directive 2014/30/EU - Electromagnetic Compatibility

Directive 2014/35/EU - Low Voltage Directive

Directive 2011/65/EU - RoHS, restriction of the use of certain hazardous substances in electrical and electronic equipment

Warning: Operation of this equipment is not intended for a residential environment and could cause radio interference.

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