

## Conduit Live

## User Manual

*Complete draft (2008.08.11)*

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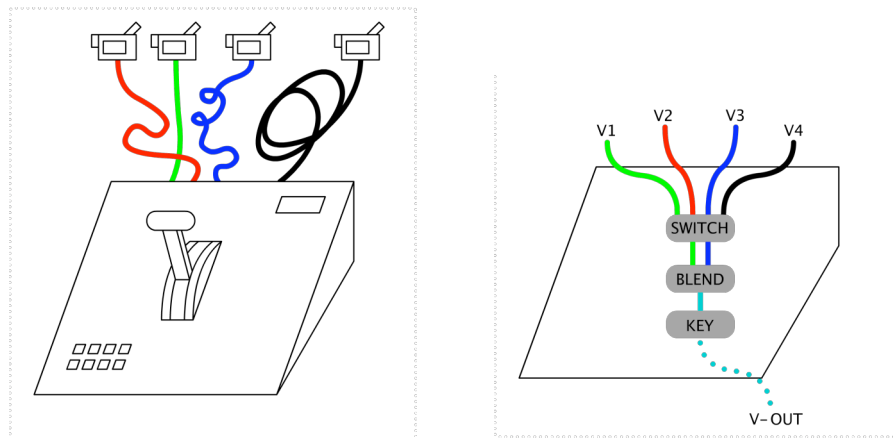
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# Conduit Live explained

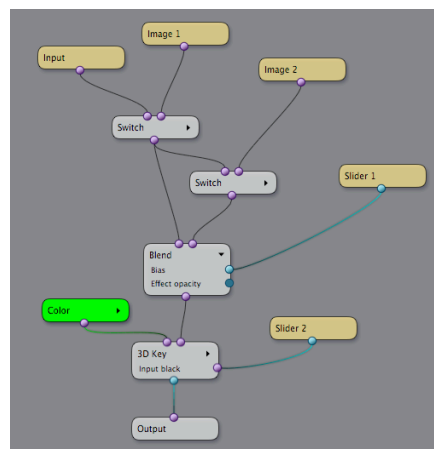
## An analogy

One way to approach Conduit Live is to think of it as an extremely configurable video mixer. A traditional video mixer is a physical device. Inside its plastic shell is a circuit board and other electronics whose purpose is to process and combine the input signals to produce one or more output signals. For a simplified overview of how these components work together, the “guts” of the mixer could be represented with connected boxes for each operation: switching between inputs, blending between video tracks, applying a color key, and so on. The illustration on the right shows this idea:



Conduit Live is a software tool that allows you to create your own video mixers using an interface somewhat similar to the above illustration. Graphical boxes called “nodes” are used to represent the various inputs, outputs and operations. To build your video processing tool, you can drag’n’drop these nodes into Conduit’s composition area and connect node outputs to inputs on other nodes. This gives you a tree-like visual overview of everything that happens to your images as they pass through the “virtual video mixer”.

(By the way, these “virtual mixers” built using Conduit’s nodes are called *conduit trees* in this manual, or simply *conduits*.)



## Invisible rendering

If you have prior experience with video editing and effects software, you're most likely familiar with the concept of rendering: in order to see what your work looks like in motion, the computer first needs to calculate all the images, and this takes time – often a lot of time. Some editing packages offer “realtime” filters but usually in a limited form: as soon as you apply more effects or try to use HD media, the application stops trying to give realtime results and instead you have to wait for render results again.

Conduit is fundamentally different because it's designed to work like a video mixer: everything happens in realtime. The only time you need to render your work is when you want to export it to a movie file.

## Inputs and outputs

In a physical video mixer, the inputs and outputs are actual connectors such as composite or S-Video. Conduit Live is software, so the inputs and outputs are naturally more configurable. In addition to live video streams, you can use QuickTime movies and still images as input sources.

Although this manual started off by comparing Conduit Live to a video mixer, it's not necessary to have any live video devices connected to your computer: Conduit Live is equally useful for applying realtime effects to movies on your hard disk and then exporting out the result.

*(For more information, please see section Working with images.)*

Conduit Live can output onto a full-screen display with no limitations as to the resolution. There is also an “aux output” feature that can be used to simultaneously render a second video stream on a separate video card or display.

*(See section Image outputs.)*

## Recording video

In addition to processing video and outputting onto a full-screen display, Conduit Live is capable of simultaneously recording video. You can capture the incoming raw video signals, the rendered output, or even both at the same time – but please note that recording the rendered video places more strain on your hardware, so you may need to cut down on the image size or compression.

*(See section Recording video to disk.)*

## Conduit Live + Stage Tools

Equipped with Stage Tools, Conduit Live becomes like a lighting console for realtime video effects and playback. Practically everything in Conduit Live can be programmed to create show sequences: slider animations, conduit tree changes, image load/play/pause events, even full-screen output changes. With Stage Tools, a single video operator can easily and reliably run a complex show with multiple video outputs and any mix of live and prerecorded video material.

*Stage Tools is sold separately by Lacquer oy/ltd (the developer of Conduit).*

*Please contact sales@lacquersoftware.com for more information.*

## Working with images

### The source image

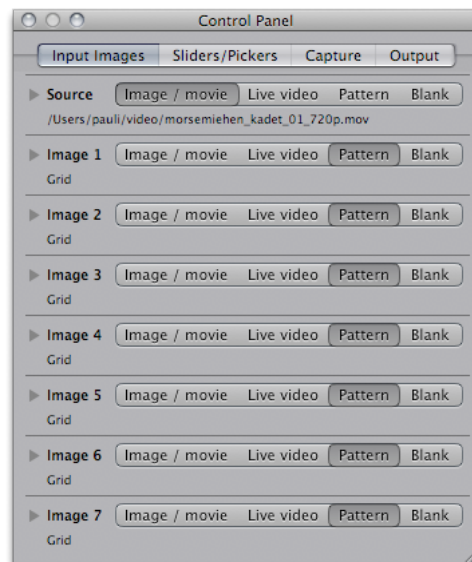
The source image (or “main source”) is an important concept in Conduit Live.

Many other video applications require you to first decide the image format for your project (for example, “DV NTSC 16:9”) before you can do anything. This adds an extra layer of complexity: you must know the exact format used by your media files or video capture device, and make sure to specify precisely matching output settings for your project or sequence.

Conduit Live eliminates this step. When you import a media file or connect to a live video device, suitable output settings are determined automatically. For example, if the source you’re using is a live NTSC stream, the output image resolution will be set to 720\*480 and the frame rate to 29.97 – but you don’t need to know these values. If you later decide to change the source to a video file that has a resolution of 1024\*768, the output will adapt accordingly. (Conduit uses proportional values for operations such as those performed by the 2D Transform node, so in general you don’t need to worry about elements getting misplaced, looking too small, etc. after the output resolution changes.)

The output resolution and frame rate don’t necessarily have to match the source image, it is possible to override them (see section *Video output* for more information).

The source image is set in the Control Panel. It is the first item under the Input Images tab:



The source can be a media file loaded from disk (“Image / movie”), a live video stream from a capture device (“Live video”), a built-in test pattern (“Pattern”), or simply blank.

Depending on the type of the source image, Conduit Live will use one of two different playback modes. The following two chapters describe these modes in detail.

### “Free run” playback mode

Conduit Live has an internal “playback clock” that affects how the program renders its output and treats video media. The clock will behave differently depending on the playback mode.

In “free run” mode, the playback clock will start running when you press Play and will never start over (until you press Stop, anyway). Any video sources will play according to their own internal clock; for example a looping video clip will continue to loop.

Free run mode is appropriate when the length of the output is unknown. Usually that means you’re working with a live video source, or you want to display video clips for an indeterminate time (perhaps in a live situation where clips should loop while the user performs operations using a controller).

Free run mode becomes active when the source image is set to “Live video”, “Pattern” or “Blank”.

### “Timeline” playback mode

The other playback mode in Conduit Live is called “timeline” mode. It’s easy to tell when this mode is active, as there’s a dark grey timeline visible below the image in the Output Viewer:



Timeline mode is activated when the source image is set to “Image / movie” *and* a video clip has been loaded as the source.

The timeline shows the duration of the source video (the duration is also displayed as text to the right of the timeline). The timeline behaves like the one you would find in QuickTime Player: there is a “playhead” cursor that shows the current position within the clip. You can click and drag on the timeline to move the position of the playhead, and the output updates accordingly.

The current playhead position is displayed as timecode to the left of the timeline (the format is “hours:minutes:seconds.frames”). The two buttons with left/right pointing arrows move the playhead by a single frame in either direction.

When in timeline mode, Conduit Live’s playback clock is reset when the playhead reaches the end of the source clip, so any other video clips will also reset to their original position (to ensure they are kept in sync with the main source). This “rewind” operation can introduce a visible delay in playback. This is the main difference compared to free run mode.

### Specifying In/Out points

If you don’t want to play the entire duration of the source clip, you can mark In and Out points on the timeline. When In/Out points have been set, only the portion of the source clip bounded by them will be played.

To set the In point, move to a position on the timeline and press the **I** key on the keyboard. (You can also choose **Mark In** from the Edit menu.)

Similarly, to set the Out point, press the **O** key (or choose **Mark Out** from the Edit menu).

To clear either the In or Out point, go to the Edit menu and choose the appropriate option. Clearing both In and Out points can also be done using the keyboard shortcut **Alt + X**.

### Loading multiple images

In addition to the source image, the Control Panel allows you to load seven additional image sources. As with the main source, these can also be video media files, live video streams, or built-in test patterns.

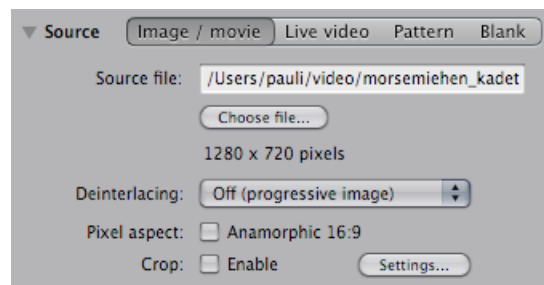
***NOTE:** It’s usually not a good idea to have a video clip loaded as Source and a live stream as one of the other images, because timeline playback mode can introduce visible delays when the source clip loops and the timeline is rewound (see the previous chapter for more information). Typically you’d want to set the live stream as Source.*

Conduit automatically upscales or downscales other images to match the source image’s resolution. (If this is not what you want, use a 2D Transform node to correct the scaling.)

You can also import still images using the Embedded Image node. This allows you to include more than 8 images in the composition. An image imported using the Embedded Image node will be automatically included when you save the effect as a *.conduit* file, which is convenient when moving the effect to a different Conduit system (such as one of the Conduit plugins).

## Image input settings: deinterlace, pixel aspect (16:9), crop

Click on the triangle to the right of the image input's name to reveal the settings view:



This view contains settings that control how Conduit Live treats the image.

**Deinterlacing** is the process of removing interlacing artifacts from a video image. Many video systems (for example traditional NTSC and PAL television, as well as 1080i HD television) use interlacing to increase the temporal resolution of the image: every second scanline in the image is captured half a frame later. These “half frames” are called fields. An interlaced PAL television signal that has a frame rate of 25 actually contains 50 fields per second, which allows for smoother motion – but it only works on displays that can display interlaced content.

Computer displays don't have native support for interlaced content, so in the digital world, interlacing mostly just means trouble. If an interlaced video stream is displayed without any processing, rapid movement within the image will look very poor, as every second scanline will be at a different position. This is known as a “comb” artifact.

To eliminate these artifacts, Conduit Live can perform deinterlacing on the video signal. There are four modes:

- *Off (progressive image)* – appropriate for a stream that is non-interlaced, a.k.a. progressive. No processing is done.
- *Blend (both fields)* – this mode blends the two fields together. This is not a perfect solution, but is often a suitable compromise for live situations, as it does not discard any information.
- *Interpolate (odd = upper field first)* – this mode only preserves the first field and discards the other. Missing scanlines are created by interpolating the first field's scanlines.
- *Interpolate (even = lower field first)* – this mode is the same as the above, except that it preserves the second field.

**Pixel aspect** allows you to specify whether the video image is actually in 16:9 widescreen format, but has been squished to fit a 4:3 frame (this is called “anamorphic” video). When this setting is enabled, Conduit Live will “unsquish” the image back to its original widescreen width.

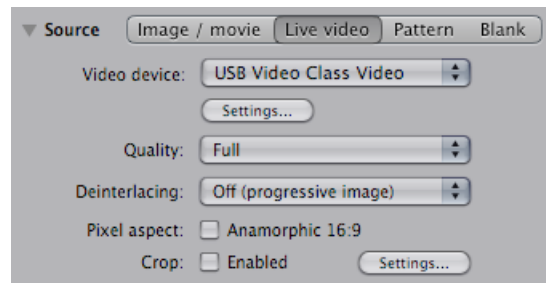
**NOTE:** The pixel aspect ratio setting is only relevant for standard definition (NTSC/PAL) video content.

**Crop** allows you to specify an amount of pixels to be removed from the image's borders. This is useful because many video signals contain black or non-image data at the edges. Click on the Settings button to enter values for left/right/top/bottom cropping.

For example, some video cameras always put a black border 8 pixels wide onto the left and right sides of the image. To remove such a border, you would enter "8" for the Left and Right crop values.

### Live video settings

For a live video source, the image settings view contains the same options described in the previous chapter, as well as a device selection popup:



The video devices listed in the popup menu are determined by the drivers installed on your system. There may be devices listed that are not actually active on your system (for example you may see multiple options for "DVCPRO HD" even though you don't have such a device attached – this is because the driver in question always reports itself as active regardless of actual connections).

Some video devices can be further configured through their own settings dialog. You can use the Settings button below the popup to access the configuration dialog. **This step is often required for video capture cards that support many video standards.**

The Settings button is only visible for devices that can be configured.

#### **IMPORTANT NOTE ABOUT HARDWARE COMPATIBILITY**

*The new capture model introduced in Mac OS X 10.5 Leopard supports most old capture drivers, but does not allow access to the configuration dialogs. If you are using the Leopard version of Conduit Live and find that you need to access the configuration dialog for a video device, you should switch to the Tiger version of Conduit Live (10.4 compatible). It uses the old capture architecture and allows access to all driver features.*

*Both the Leopard and Tiger versions of Conduit Live are provided as part of your Conduit Suite purchase. (The Leopard version of Conduit Live was not included in the original release, but was added to the Suite in mid-2008.)*

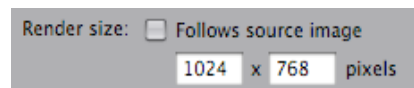
## Using Pattern or Blank as the main source

In some situations you may want to use Conduit Live in “free run” playback mode (see earlier chapters for more information), but you don’t want to use a live video device as the main source. The appropriate solution is to choose either “Pattern” or “Blank” as Source.

However, if you do this, you’ll probably want to manually specify a custom output resolution. As described in the chapter *The source image*, Conduit Live uses the main source to automatically determine an appropriate output size for rendering. If the main source is a built-in pattern, the resolution will be set to whatever is the pattern image’s resolution, which is probably not exactly the resolution you want to render at.

If you specify “Blank” as the source, this side effect will be particularly noticeable: the blank image has a very small resolution, so the output will look extremely blocky.

To correct this problem, open the Output tab in the Control Panel and look for the Render size setting:



Uncheck “Follows source image” and enter a resolution of your choosing into the text fields.

For more information on output settings, see section *Video output* in this manual.

If you’re using a full-screen display for output, you’d usually want to specify the display’s native resolution as the render size. However rendering at a very large resolution will require more processing power and may drop the output frame rate.

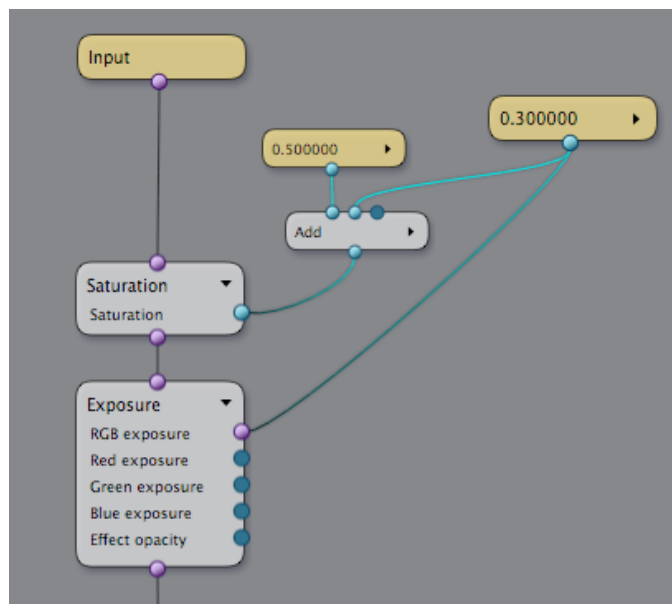
## Sliders, pickers and MIDI control

### Driving parameters

The nodes you use to build a conduit tree each have their own parameters – for example the Saturation node has a “saturation” parameter. Instead of selecting a node with the mouse and modifying the parameter’s value directly, it’s sometimes desirable to control a parameter indirectly, for example so that multiple parameter values could be modified through a single user interaction point.

Conduit’s parameter inputs are designed to make this possible. These inputs are visually on the right-hand side of the node, and work the same way as the inputs at the top of the node. When you connect another node’s output to a parameter input, the parameter becomes “driven” by a node. (When a parameter is driven, you can’t modify its value directly in the Conduit user interface – the value is entirely controlled by the connected node.)

The most basic way of using this functionality is to drive many parameters with a single value. In the following example, a Number node with the value 0.3 is driving both the saturation and exposure of the image:

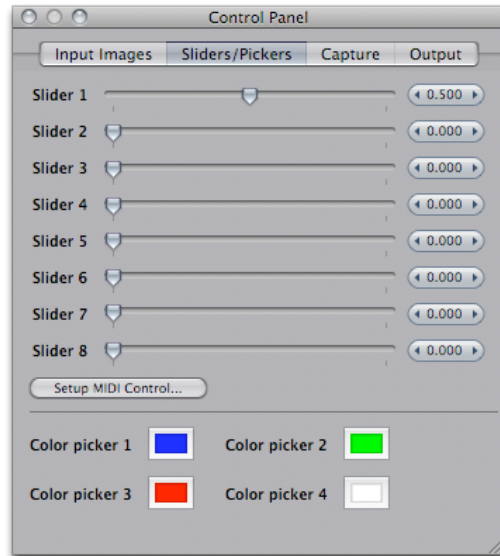


### Sliders

Driving parameters would not be particularly useful if it were limited to using values from other nodes within same conduit effect. The Slider node provides an easy way to access values from outside the conduit.

Sliders are part of the conduit’s external interface, that is, the sliders are accessible outside the conduit node view. In the plug-in versions of Conduit, the slider interface is located in Conduit’s parameter area within the host application (for example in Final Cut Pro, the slider values can be modified in the Conduit filter’s properties view).

In Conduit Live, the sliders are located under the Sliders/Pickers tab in the Control Panel:



Modifying a slider is reflected in the output of a matching Slider node within the conduit tree.

### Color pickers

The Color Picker node works the same way as the Slider node, except that its output value is a color rather than a number.

In Conduit Live, color pickers are located just below sliders in the Control Panel.

### Controlling sliders with external devices

Conduit Live supports the MIDI standard for connecting with external devices. MIDI is widely used on musical devices: the data sent by a MIDI device can be in the form of musical notes (e.g. the keys of a piano keyboard) or controller data (e.g. a slider such as “sound volume”). The sliders in Conduit Live can be controlled by MIDI data in addition to the graphical user interface in the Control Panel. Thus a MIDI controller can be a very convenient interface for controlling Conduit in live performance situations.

The MIDI connection is bidirectional, so the physical sliders on the MIDI device will move in response to changes made in Conduit Live’s on-screen interface. (This functionality requires motorized sliders.)

Setting up MIDI control in Conduit Live is very easy if you have a Behringer BCF2000 (or any other MIDI controller that outputs on the same channels): you don’t need to do anything except ensure the controller is powered. It is detected and automatically configured by Conduit Live upon startup. You can tell that the BCF2000 is properly detected if its sliders jump to Conduit’s default positions: the first slider halfway up, the others fully down.

For other controllers, Conduit Live has a MIDI Setup dialog accessible from the Sliders/Pickers tab of the Control Panel. Using MIDI Setup, you can “teach” a connection for each slider with an easy process: click on the Learn button, move the

physical control on the MIDI device through its full range (i.e. if it's a slider, move it all the way up and down), and then click Learn again. If the MIDI device is properly connected to the computer, Conduit Live should now know about it.

### **Controlling pickers with MIDI notes**

It's also possible to use MIDI notes to drive the color pickers in Conduit Live. This makes the color pickers work like on/off toggle buttons: the first note will switch the picker to color A, and another note will switch the picker to color B. (By default, colors A and B are black and white, but this is configurable in the MIDI Setup dialog.)

By default, Conduit Live configures the pickers to match the MIDI notes sent by the four toggle buttons in the bottom-right corner of the Behringer BCF2000 controller.

## Recording video to disk

### Modes of capture

Conduit Live supports two different modes of video capture. They are superficially similar – both write a video stream onto your hard disk – but very different in implementation and thus the strain that they place on the computer’s processing capacity. To make effective use of Conduit Live’s recording functionality, you need to be familiar with this difference.

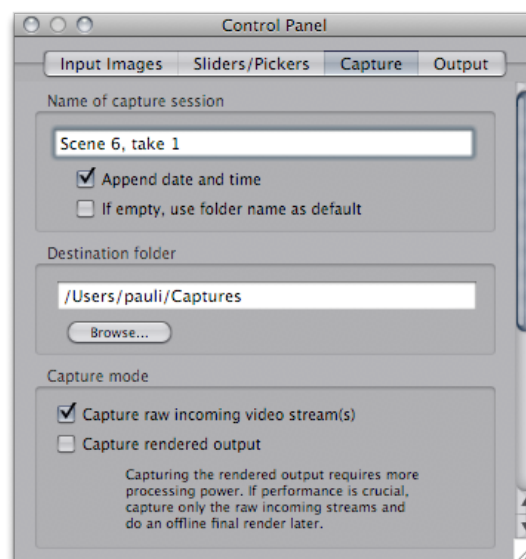
The first mode is called *raw capture*. In this mode, Conduit Live merely records the original video stream from the capture device (or devices, if you have multiple device connections active at the same time). The video data is preserved intact; Conduit Live doesn’t need to do any processing on it, so the recording can be handled completely independently of rendering. This means raw capture is a fairly lightweight operation for the computer – if your hard disk is fast enough, you’re good to go.

The other mode is *rendered capture*, in which Conduit Live records the actual output that is rendered on display. Using this mode, you could for example key out a bluescreen background and directly record the finished key onto disk. On the other hand, this kind of capture requires much more processing power. (For more information on how to optimize rendered capture, see chapter further ahead.)

### The capture session

In addition to video streams, Conduit Live also records its own state. This includes the current conduit tree as well as changes made to sliders, etc. All this recorded data together is called a *capture session*.

Before you can start recording, you need to fill out some basic details about the capture session. This is done under the Capture tab in the Control Panel:



The capture session must have a name and a destination folder. In the above screenshot, the name of the session is “Scene 6, take 1” and the destination folder is “/Users/pauli/Captures”. When recording starts, Conduit Live creates a new folder to hold all the data related to the capture session. This newly created folder is named according to the capture session and placed in the destination folder.

When **Append date and time** is enabled, Conduit Live will add the current date and time to the name of the capture session folder. This can make it easier to distinguish between similarly named capture sessions.

The option **If empty, use folder name as default** directs Conduit Live to use the destination folder’s name as the name of the capture session if you haven’t supplied a name. This option can be useful if you’re in a hurry to get recording and don’t want to spend time typing a name for the capture session.

### Specifying the capture format for raw streams

There are two format options for raw streams. Almost always you’ll want to use the default option: recording the original data as a QuickTime movie. This preserves the video stream exactly in its original format. (Conduit Live doesn’t do recompression for raw streams, so you can’t specify a different QuickTime compression method.)

The other option is to record the video as an uncompressed DPX image sequence. This option is only useful in professional environments that have standardized on the DPX image format. (The data format used in the produced DPX files is Y’CbCr 4:2:2.)

### Specifying the capture format for rendered capture

Conduit Live supports the QuickTime movie format for recording the rendered output. Before recording can start, you must specify the compression type. This is an important decision because the video compression method (“codec”) has a significant impact on image quality, capture performance and disk space consumption.

Choosing a compression type usually comes down to trying to find a balance between these three factors. (Sometimes there may be other limitations as well, for example if you plan to use the recorded video files in an editing application that might only support specific compression types.) There are so many different compression methods that it’s impossible to cover them all in this manual, but the following are some common ones:

**Photo-JPEG** is a video codec directly based on the extremely widespread JPEG image format. Photo-JPEG has a number of advantages: it is widely supported, is not controlled by a single corporation, is lightweight (doesn’t take a lot of processor time to decode), and doesn’t use interframe compression so frames can be decoded individually. On the other hand it doesn’t offer very good compression compared to newer codecs and image quality suffers visibly when the quality setting is lowered, so Photo-JPEG is typically only useful at high quality settings (75%+). At high quality it is a very reasonable alternative to uncompressed video in situations where disk space is more important than pixel-precise quality.

**Animation** is a video codec that is commonly used for lossless compression of RGB images such as computer generated animation. This codec uses a form of compression that works for images that have large areas of solid colors, but doesn't compress video footage well. Thus captured video generally requires a lot of disk space: roughly 1 GB for one minute of SD video. The Animation codec can also record an alpha channel for transparency information. When used with Conduit Live's rendered capture, this can be used to record a blue / green screen key as a separate alpha channel for further compositing in another application.

**Uncompressed 8-bit 4:2:2**, as the name suggests, does not use any compression. Video frames are recorded in Y'CbCr 4:2:2 format at a precision of 8 bits per channel. For most video sources, this is the maximum quality level.

**DV/DVCPRO** is the SD format recorded by most tape-based digital camcorders including MiniDV, DVCam and DVCPRO cameras. This compression method is actually very similar to Photo-JPEG but operates at a fixed bitrate, so there is no quality setting that you could change. DV/DVCPRO video is sometimes called "DV25" because the bitrate is 25 Mbit/s – this translates to a disk space requirement of about 188 MB / minute.

**DVCPRO 50 / DVCPRO HD** are higher quality formats based on the DV codec. The former is also called "DV50", as it simply doubles the bitrate for higher quality. DVCPRO HD (also known as DVCPRO 100) again doubles the bitrate but also increases the image resolution, so it is a HD format. The image resolution of DVCPRO HD is 1440\*1080, which is meant to be upscaled to 1920\*1080 for HD displays. Recording in DVCPRO HD takes four times as much disk space as DV: about 750 MB / minute.

### Optimizing rendered capture

Capturing the rendered output requires both a lot of processing power and hard disk bandwidth. If the system can't keep up, Conduit Live will abort recording and display an error message. If this happens, there are a few things you can try to ease the burden on the computer:

- Reduce output resolution. Rendering at a smaller resolution reduces the amount of data that needs to be processed and written to disk. Try different values for the *Render size* setting in Output, in the Control Panel.
- Change the compression type. Some compression methods are very processor-intensive and can't be used in a live recording situation. (See the previous chapter for more information on some commonly used compression types.)
- Disable Aux Output, if you are using this feature of Conduit Live to render another image stream on a separate monitor.

### Recording audio separately

Some video devices such as camcorders can record both audio and video, and thus they provide a data stream that contains both video and audio in sync. (This is called a muxed stream in video jargon.)

But sometimes you may need to record audio separately from the video. To this end, Conduit Live allows you to specify a separate audio recording device. The recorded audio is placed in a separate file within the capture session folder.

In this mode Conduit Live effectively has separate device connections to the video and audio devices, so there's no guarantee that they will be in sync. (For example, the video capture driver might buffer a couple of frames before starting its output while the audio driver starts instantly.)

Therefore you should treat this like any other recording situation where the audio and video are going to be captured by separate devices (for example a film camera and a DAT recorder). The traditional solution has been to use a clapperboard during the shoot, and later sync the video and audio tracks in post-production. Professional editing applications like FCP and Avid offer tools for syncing separate audio and video without too much pain.

### Contents of a capture session folder

Each capture session is stored in a folder. When viewed in the Finder, its contents might look something like this:

```
My capture session.conduitseq  
  Built-in microphone.wav  
  ConduitCaptureLog.xml  
  Main.conduit  
  My capture session -- Canon HV20.mov  
  My capture session -- Built-in iSight.mov  
  RenderedOutput.mov
```

Separate files are created for each video source as well as any separately recorded audio sources (in this case, Built-in microphone).

**ConduitCaptureLog.xml** contains a recording of everything that happened in the application during recording. This could be used to reproduce a live situation in an off-line application such as Final Cut Pro.

**Main.conduit** is the conduit tree that was active when recording started.

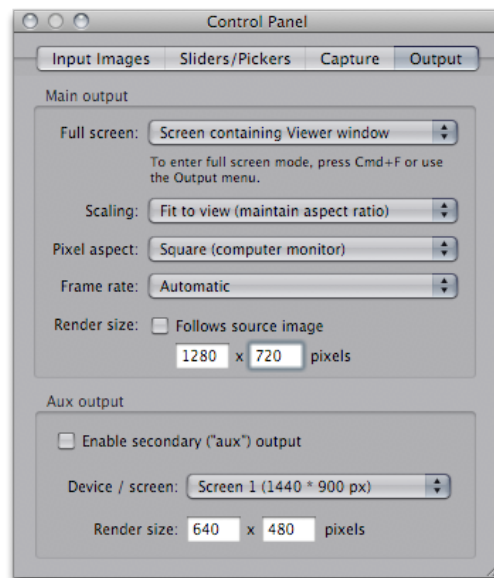
**RenderedOutput.mov** is the recorded rendered output.

## Video outputs

### Changing main output settings

As described in the section *Working with images*, Conduit Live automatically matches video output settings to the main source. While this is appropriate for most situations, you can easily specify different settings for output when needed – for example, to render at a lower resolution if the computer can't do capture fast enough at full size.

Output settings are located under the Output tab in the Control Panel:



Use the **Full screen** pop-up list to select the display to be used for full-screen output.

### Scaling and output pixel aspect

**Scaling** determines how Conduit Live fits the rendered image onto the output viewer (or full-screen display). The default setting, **Fit to view**, stretches the image to fit in the viewer without distorting the contents of the image. The setting **Off (1:1 pixels)** turns off scaling completely and just centers the image within the viewer. The third option **Stretch** stretches the image to fill the viewer without regard to the aspect ratio of the image.

These scaling options can also be accessed as buttons in the Output window.

**Pixel aspect** is only of interest if you are using full-screen output onto a display device that is not a computer monitor. The pixel resolution of an SD video display typically doesn't match the actual aspect ratio (for example the NTSC resolution of 720\*480 may be stretched out to fill a 4:3 or a 16:9 screen). To ensure that Conduit Live can properly scale content for this kind of display, you should choose either the **4:3** or **16:9** setting. (Conduit Live automatically decides between NTSC and PAL based on the render resolution.) This setting only has an effect when the Fit to view scaling mode is enabled.

## Output frame rate

**Frame rate** determines how often Conduit Live renders its output. The default setting, **Automatic**, uses the frame rate of the main source as a basis for the output rate. This is appropriate if all your video sources have the same frame rate.

If you have multiple video sources with different frame rates, or you want to do live video manipulation with the minimum latency, use the **Every frame** setting. In this mode Conduit Live renders at the maximum frame rate allowed by the output device (in practice, the display's refresh rate – usually 60 Hz).

The other modes, **Even / Odd / Every third / Every fourth**, can be used to artificially limit Conduit Live's rendering rate if a specific output rate is required.

## Render size

The **Render size** settings affect the resolution at which Conduit Live renders output images.

When **Follows source image** is checked, the render resolution always matches the main source. (See section *Working with images* for more information.)

To enter a custom resolution, first uncheck **Follows source image**.

## Aux output

Aux output is a feature that allows you to display two different images on two different displays. When the **Enable aux output** setting is activated, a new **AuxOut** node is created in the Conduit Editor (if there isn't one already). It works just like the regular **Output** node: the connected node's output is rendered onto the display that you specified for aux output.

As with the main output, the **Render size** option can be used to specify the image resolution. Rendering on a separate video card requires more processing power, so you may want to specify a lower resolution than the main output.

For example, you might have 1920\*1080 HD image that is rendered at full resolution for the main output, and you want to render another alternate preview simultaneously on a smaller display. As the smaller display doesn't need the full resolution, you could specify something like 640\*360 as the render size for aux output in this case.

## Outputting to a video display through a capture card

Some video capture cards offer a "video desktop" feature that makes the card's video output (usually SDI or component) available as a display in the Mac operating system. This is usually the easiest way to get a non-computer video signal from Conduit Live. (An alternative is to use a converter box, for example DVI-to-SDI.)

If you plan to do this, you need to be aware of a limitation related to video cards. Specifically, Conduit Live generally uses the graphics acceleration features available on the primary video card (GPU) for rendering. The video desktop is a feature of the capture board, which doesn't provide graphics acceleration. This limitation can be circumvented by using the Aux output feature in Conduit Live.

When Aux output is enabled, Conduit Live still renders on the fast primary GPU and merely copies images to the other video card for display. This allows Conduit Live to be compatible with “video desktop” and other devices that look like video cards to the operating system but are not accelerated. Thus it’s generally best to use Aux output (rather than the main output’s full-screen mode) for these purposes.