

AUDIO BASICS

DIGITAL AUDIO

Digital audio recording works by **sampling** (i.e. recording) an electronic audio signal at regular time intervals. An analog-to-digital (A/D) converter measures and stores each sample as a numerical value that represents the audio amplitude at that particular moment. **Converting** the amplitude of each sample to a binary number is called **quantization**. The number of bits used for quantization is referred to as **bit depth**. **Sample rate** and **bit depth** are two of the most important factors when determining the quality of a digital audio system.

BIT DEPTH

Unlike analog signals, which have an infinite range of volume levels, digital audio samples use binary numbers (**bits**) to represent the value of each audio sample along a digital range. The accuracy of each sample is determined by its bit depth. Having a higher bit depths mean your audio signal is more accurately represented when it is sampled. Most digital audio systems use a minimum of 16 bits per sample, which can represent 65,536 possible levels of audio. 24-bit samples can represent over 16 million possible levels.

AUDIO LEVELS

0db analog = -12db digital. To avoid digital audio distortion, which cannot be fixed, keep your audio levels at or under 0db digital, while recording as well as during editing.

TO HEAR YOUR AUDIO IN FCP

Choose **View > Audio Playback > Built-in Output**

AUDIO WAVEFORM DISPLAYS

Audio Waveforms are displayed in the **Audio Tracks** in the **Viewer**. They can be turned on in the **Timeline** as well: choose **Sequence > Settings**, click the **Timeline Options** tab, then select **Show Audio Waveforms**. Your audio signal will be displayed in the Audio track in the Timeline.

AUDIO TAB CONTROLS

Level slider: This slider adjusts the **amplitude**, or volume, of the currently selected audio clip between +12 and $-\infty$ dB. As you drag the slider, the number in the dB field and the level overlay line are both updated. If you have not placed **level keyframes** [SEE BELOW for info on LEVEL KEYFRAMES] in the current clip, adjusting the Level slider affects the level of the entire clip. If you add level keyframes, using this slider will do either of the following:

- Adjust the level of a keyframe at the current position of the playhead.
- Add a new keyframe to the level overlay and adjust it to the new level.

A change in level between any two keyframes appears as a sloping line on the level overlay line in the Audio tab of the Viewer. Changes to the level overlay in the Viewer are mirrored by the level overlay on that clip in the Timeline.

LEVEL KEYFRAMES

- **Level Keyframes:** clicking the **keyframe button to the right of the Level slider** places a keyframe at the **current playhead location** on the level overlay. You can use keyframes to adjust the audio levels within your clip over time.

FINAL CUT PRO Quick Reference Sheet

- **Level keyframe navigation buttons** allow you to move the playhead forward or backward from one keyframe on the level overlay to the next.
- **Level layover line** – this is the black line running through your waveform indicating db levels. Grab the line in **cursor mode** to change up or down, or add keyframes to modify within a clip.
- **Pan slider** – The pan slider allows you to indicate where, in the spectrum from left channel to right channel audio, you want to place your sound, or how you want to move your sound around. This slider works in two ways, depending on what kind of audio you've opened in the **Viewer**. **If the clip items in the audio tab are a stereo pair:** This slider simultaneously adjusts the left and right stereo placement of both tracks. The **default setting of –1** sends the left track to the left channel output and the right track to the right channel output. A setting of 0 outputs the left and right tracks equally to both speakers, essentially creating a mono mix. A setting of +1 swaps the channels, outputting the left track to the right output channel and the right track to the left output channel. **If the clip items in the audio tab are mono tracks** the pan slider lets you pan the audio track in the current audio tab between the left and right output channels.
- **Pan Keyframe button** - The **keyframe button** to the **right of the Pan slider** places a keyframe at the current playhead location on the pan overlay. You can add keyframes to change pan settings over time.
- **Pan overlay line** – This is the **Red line above waveform** in your clip. Drag this line up or down to change the pan for this clip. If you add key frames to the pan overlay, you can create changes in pan over time. This takes practice and patience.
- **Reset button** - This button **deletes all marked keyframes** on both the level overlay and the pan overlay of the currently selected audio track, and resets the level and pan values to their original captured states (0 dB for the audio level, and –1 for the pan level).
- **Drag hand** – Allows you to drag the current audio clip to the Canvas, the Timeline, or the Browser.

LINKED SELECTION BUTTON

This button is in the upper right hand corner of **Timeline**. **Click** to turn link between Video Tracks and Audio Tracks on or off. **Turn off to open the Audio Tracks in the Viewer** independently of the Video track.

LOOPING PLAYBACK

Looping Playback is used to **adjust Filters and Levels**. Looping playback allows you to play only the selected audio clip and listen to your filters as you play. **Open clip in Viewer** and **set In and Out** points in the keyframe graph area (right side of Viewer window). **Move the Playhead** to the clip's In point. Choose **View > Loop Playback**. Choose **Mark > Play > In to Out**. **Press Spacebar** to play the loop as you adjust your audio filters.

WORKING WITH AUDIO IN THE TIMELINE

Adjust **Track Height Control** to make the audio track larger so you can see audio waveforms more easily in the Timeline.

Turn on clip overlay controls to adjust levels in the Timeline using Markers and the Pen Tool.

Before editing audio tracks, it is useful to **create a stereo pair** from any mono tracks. **Select** your audio tracks, then from the menus at the top of the window, select **Modify > Stereo Pair**, or simply key in **Option-L** on keyboard. When working in **Stereo Pair** option, all changes made to one track appear on the adjacent track, so you only have to make one adjustment for two audio tracks. If you keep your tracks as mono tracks, you will have to make the same adjustments separately to each track. You can always turn your tracks back into mono tracks by turning off the Stereo Pair function.

AUDIO FILTERS

Filter parameters can be viewed and adjusted in the **Filters** tab of the **Viewer**. **Apply an audio filter** to an audio clip, then **click the Filters tab**. You can also double-click a filter in the Effects tab to view its parameters in the Viewer, but you won't be able to hear any changes you make because the filter is not yet applied to a clip. [SEE 'APPLYING A FILTER TO AN AUDIO CLIP' BELOW]

The most useful Final Cut Pro audio filters can be separated into five broad categories:

- **Equalization (EQ):** An audio equalizer allows you to increase or decrease the strength of an audio signal within selected frequency ranges, or bands, from high, mid to lowrange audio. High range audio includes hissing sounds, mid-range includes voices, and low range includes bass sounds.
- **Gain and normalization:** Audio normalization amplifies an audio clip based on its peak (or loudest) value. By default this value is 0dB, the highest level possible before clipping (digital distortion) occurs. When the Gain parameter value is positive, the clip audio is amplified. When the Gain parameter value is negative, the clip's audio is weakened. A Gain value of 0 has no effect on your clip's audio.
- **Dynamics (compression and expansion):** An audio compressor reduces dynamic range by weakening parts of a signal above a certain threshold. The audio limiter, by reducing the level of the loudest sounds in your clip, allows you to raise the overall level without distortion.
- **Noise reduction:** Final Cut Pro has three noise reduction filters for use in specific situations:
 1. **Hum Remover-** lets you get rid of "cycle hum" that may have been introduced into your audio recording by power lines crossing your cables or by a shorted ground wire in your setup.
 2. **Vocal DeEsser:** allows you to attenuate the "ess" sounds produced by a speaker whose "ess" sounds are very pronounced.
 3. **Vocal DePopper:** lets you attenuate harsh "P" sounds that result from puffs of breath bursting into the microphone.
- **Echo and reverbation:** two of the most frequently used filters change the effects of a particular acoustic space.

APPLYING A FILTER TO AN AUDIO CLIP

Select a clip or clips in the Timeline. Choose >**Audio Filters**, then **choose a filter from the submenu**. The filter is applied to all selected clips. If you selected video clips, the filter is applied to any audio items linked to those clips. Or, **drag an audio filter** from the Effects tab of the Browser **to a clip** in a sequence in the Timeline.

IMPORTING AN AUDIO FILE FROM A CD

Insert the CD into the computer's drive. If iTunes opens automatically, close it.

Double click on the **CD icon** to open it and view audio tracks.

Select the desired **track** and **drag it** into your **Bin** in the Browser.

Or select **File > Import > Files >** and choose desired **track**.

CONVERTING MP3 to AIFF in iTUNES

Final Cut Pro does not work well with MP3 encoded audio files. You must convert them to AIFF files, even though you can import and play MP3 files that are in your FCP Browser bins.

Delete the MP3 files from FCP, convert them to AIFF files [instructions below], and bring them back into your Browser bins to work with in FCP.

FINAL CUT PRO Quick Reference Sheet

Open iTunes.

Choose **iTunes > Preferences**

Click **General** at the top of the Preferences window

Click **Import Settings**

From the **Import Using** menu, choose **AIFF Encoder**

Click **OK**.

If the file you are converting is already in your iTunes library, **select** the song, then choose **Advanced > Create AIFF version**.

If the file is not in your iTunes library, hold the **Option** key down while choosing **Advanced > Convert to AIFF** and then locate the file for the song you want to convert on your hard disk. When the conversion is finished, the new file appears in the **iTunes library** under Music. **Drag the file to your desktop** and select **File > Import**, or simply **drag file to your Browser**.