Pan Laws Effect on Exported Audio Levels in Sonar 7

(Updated: 8/04/2007)

0 dB Center, sin/cos taper, constant power

				Export Levels Relative to Original Source				Export Levels Relative to Track Playback Meter			
				w/o track automation		With track automation		w/o track automation		With track automation	
Clip Type	Track Interleave	Panning	Playback	Export Mono	Export Stereo	Export Mono	Export Stereo	Export Mono	Export Stereo	Export Mono	Export Stereo
Mono	Mono	Center	0	0	0	0	0	0	0	0	0
Mono	Mono	L 100%	+3	0	0	0	+3	-3	-3	-3	0
Mono	Stereo	Center	0	+3	0	+3	0	+3	0	+3	0
Mono	Stereo	L 100%	0	+3	0	+3	0	+3	0	+3	0
Stereo	Mono	Center	+3	+3	+3	+3	+3	0	0	0	0
Stereo	Mono	L 100%	+6	+3	+3	+3	+6	-3	-3	-3	0
Stereo	Stereo	Center	0	+3	0	+3	0	+3	0	+3	0
Stereo	Stereo	L 100%	0	+3	0	+3	0	+3	0	+3	0

-3 dB Center, sin/cos taper, constant power

				w/o track automation		With track automation		w/o track automation		With track automation	
Clip Type	Track Interleave	Panning	Playback	Export Mono	Export Stereo	Export Mono	Export Stereo	Export Mono	Export Stereo	Export Mono	Export Stereo
Mono	Mono	Center	-3	-3	-3	-3	-6	0	0	0	-3
Mono	Mono	L 100%	0	-3	-3	-3	-3	-3	-3	-3	-3
Mono	Stereo	Center	0	0	-3	0	-3	0	-3	0	-3
Mono	Stereo	L 100%	0	0	-3	0	-3	0	-3	0	-3
Stereo	Mono	Center	0	+3	+3	+3	0	+3	+3	+3	0
Stereo	Mono	L 100%	+3	+3	+3	+3	+3	0	0	0	0
Stereo	Stereo	Center	0	+3	0	+3	0	+3	0	+3	0
Stereo	Stereo	L 100%	0	+3	0	+3	0	+3	0	+3	0

0 dB Center, square-root taper, constant power

				w/o track automation		With track automation		w/o track automation		With track automation	
Clip Type	Track Interleave	Panning	Playback	Export Mono	Export Stereo	Export Mono	Export Stereo	Export Mono	Export Stereo	Export Mono	Export Stereo
Mono	Mono	Center	0	0	0	0	0	0	0	0	0
Mono	Mono	L 100%	+3	0	0	0	+3	-3	-3	-3	0
Mono	Stereo	Center	0	+3	0	+3	0	+3	0	+3	0
Mono	Stereo	L 100%	0	+3	0	+3	0	+3	0	+3	0
Stereo	Mono	Center	+3	+3	+3	+3	+3	0	0	0	0
Stereo	Mono	L 100%	+6	+3	+3	+3	+6	-3	-3	-3	0
Stereo	Stereo	Center	0	+3	0	+3	0	+3	0	+3	0
Stereo	Stereo	L 100%	0	+3	0	+3	0	+3	0	+3	0

-3 dB Center, square-root taper, constant power

				w/o track automation		With track automation		w/o track automation		With track automation	
Clip Type	Track Interleave	Panning	Playback	Export Mono	Export Stereo	Export Mono	Export Stereo	Export Mono	Export Stereo	Export Mono	Export Stereo
Mono	Mono	Center	-3	-3	-3	-3	-6	0	0	0	-3
Mono	Mono	L 100%	0	-3	-3	-3	-3	-3	-3	-3	-3
Mono	Stereo	Center	0	0	-3	0	-3	0	-3	0	-3
Mono	Stereo	L 100%	0	0	-3	0	-3	0	-3	0	-3
Stereo	Mono	Center	0	+3	+3	+3	0	+3	+3	+3	0
Stereo	Mono	L 100%	+3	+3	+3	+3	+3	0	0	0	0
Stereo	Stereo	Center	0	+3	0	+3	0	+3	0	+3	0
Stereo	Stereo	L 100%	0	+3	0	+3	0	+3	0	+3	0

-6 dB Center, Linear Taper

				w/o track automation		With track automation		w/o track automation		With track automation	
Clip Type	Track Interleave	Panning	Playback	Export Mono	Export Stereo	Export Mono	Export Stereo	Export Mono	Export Stereo	Export Mono	Export Stereo
Mono	Mono	Center	-6	-6	-6	-6	-12	0	0	0	-6
Mono	Mono	L 100%	0	-6	-6	-6	-6	-6	-6	-6	-6
Mono	Stereo	Center	0	-3	-6	-3	-6	-3	-6	-3	-6
Mono	Stereo	L 100%	0	-3	-6	-3	-6	-3	-6	-3	-6
Stereo	Mono	Center	-3	+3	+3	+3	-3	+6	+6	+6	0
Stereo	Mono	L 100%	+3	+3	+3	+3	+3	0	0	0	0
Stereo	Stereo	Center	0	+3	0	+3	0	+3	0	+3	0
Stereo	Stereo	L 100%	0	+3	0	+3	0	+3	0	+3	0

0 dB Center, Balance Control

				w/o track automation		With track automation		w/o track automation		With track automation	
Clip Type	Track Interleave	Panning	Playback	Export Mono	Export Stereo	Export Mono	Export Stereo	Export Mono	Export Stereo	Export Mono	Export Stereo
Mono	Mono	Center	0	0	0	0	0	0	0	0	0
Mono	Mono	L 100%	0	0	0	0	0	0	0	0	0
Mono	Stereo	Center	0	+3	0	+3	0	+3	0	+3	0
Mono	Stereo	L 100%	0	+3	0	+3	0	+3	0	+3	0
Stereo	Mono	Center	+3	+3	+3	+3	+3	0	0	0	0
Stereo	Mono	L 100%	+3	+3	+3	+3	+3	0	0	0	0
Stereo	Stereo	Center	0	+3	0	+3	0	+3	0	+3	0
Stereo	Stereo	L 100%	0	+3	0	+3	0	+3	0	+3	0

Information

Use the negative of the value in the Export Levels Relative to Track Playback Meter to compensate for level changes due to export. For example, if your settings indicate that export will lower track volume by -3 dB then increase your track fader by +3 dB before exporting in order to maintain identical levels for playback of exported tracks.

Notes

"w/o track automation" exports, the "Raw Tracks - No Automation/FX" preset was used so panning does not affect export levels.

"with track automation" exports, the "Raw Tracks - No Automation/FX" preset was chosen first followed by selecting "track automation" in the mix enable list. Panning will affect export levels.

Discussion and Testing Method Description

This chart describes Sonar meter values relative to the peak values of the clips in the tracks and not Sonar meters compared to exported file levels, although this can be deduced from the data by comparing Playback values to Export values. In almost all cases the playback (ie Sonar's meter) levels are exactly the same as exported file levels or are +/- 3 dB different as a result of any stereo->mono conversion and/or pan law.

If you rely solely on Sonar's meters to determine levels and understand stereo->mono conversion then, in general, you don't have to worry or think about levels. The issues develop when you really want to maintain the original clip levels such as when exporting raw (and possibly edited) tracks for use in other software. However, since Sonar is a mixer it will still send the clips through multiple types of processing even when you disable all the options on the export dialog. The chart describes how clips are affected when exporting them through this minimal and "unbypassable" set of processing.

There are some cases where center-panned tracks have different levels depending on whether track automation is selected or not. They are not panned so track automation should theoretically not affect them. These only seem to occur in the -3 and -6 center pan laws though.

Testing method used to create the tables

1. Create 2 short (~30 second) audio files that are (severely) hard limited to have a near-constant peak of -8 dBFS (for simplicity and easy reproducibility). For the stereo file, both channels should peak at -8 dBFS. These clips are best created in a separate audio editor. Under theoretical conditions both files should show a peak value of -8 dBFS.

2. Create project with 8 tracks. Put the mono clips on the 1st four tracks and the stereo clips on the other 4 tracks. Adjust the interleave and panning on the 8 tracks to correspond to the 8 scenarios.

3. Set the pan law.

4. Play back the project, look at Sonar's meter on each track, and compare them relative to the -8 dBFS theoretical value.

To test the export values

5. Click Edit->Select->None

6. Open Export dialog, create file name, uncheck all "mix enable" options except fast bounce, choose source as "Tracks". Do not alter sample rate from the original sample rate of the clips.

7. Choose file type and check automation as appropriate

8. Export the files

9. Open the 8 individual files in an audio editor and read/record the peak value in the file relative to the theoretical -8 dBFS value.

Repeat starting from step 3 for testing the other pan laws.

Again, the chart values are relative so for example, +3 dB = -5 dBFS and -3 dB = -11 dBFS, etc. With good naming of tracks and export files along with competency with an external audio editor the process can be simplified and streamlined. In fact, every value in the chart could probably be verified in under 60 minutes once the project and clips are setup.