



ChromaSOUND Technical Supplement CS100
7 February 2001

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Forward

This paper is intended to help answer many of the often-asked questions regarding ChromaSOUND, (CSOUND) and how to configure both your hardware and software for the best results.

Although CSOUND is a technically complex product, it doesn't *have to* be difficult to use. The reason we phrase it that way is because it does require a little knowledge of how the Windows Volume Control, (WVC) sound card, and sound card mixer operate. Since the WVC presents a deceptively simple interface, it's easy to be misled into thinking things are set up correctly, when in fact, they aren't.

We've tried to put the important things first, for the benefit of those who "just want to make it work". Feedback and suggestions are welcome.

Setting up the Windows Volume Control

Here are step-by-step instructions on how to set up the WVC for use with CSOUND. Since brands and models of sound cards differ, the specific names of controls may not match exactly with the illustrations. Most of the differences are relatively minor, though.

Step 1 *Launch the WVC*

On the Windows Task Bar, (where the Start button is) launch the WVC by **double-clicking** on the small speaker icon. It's located at the far right, next to the clock display:



Your machine may have other icons in the same general area, that's ok. Also, note that if you "miss" the double-click, a single-slider window will appear, instead of the full WVC window. If that happens, try again.

Note: *If you don't have a taskbar icon like the one shown above, it's either been disabled, or the WVC hasn't been loaded on your computer. In either case, the WVC must be loaded and enabled before you'll be able to proceed with these instructions.*

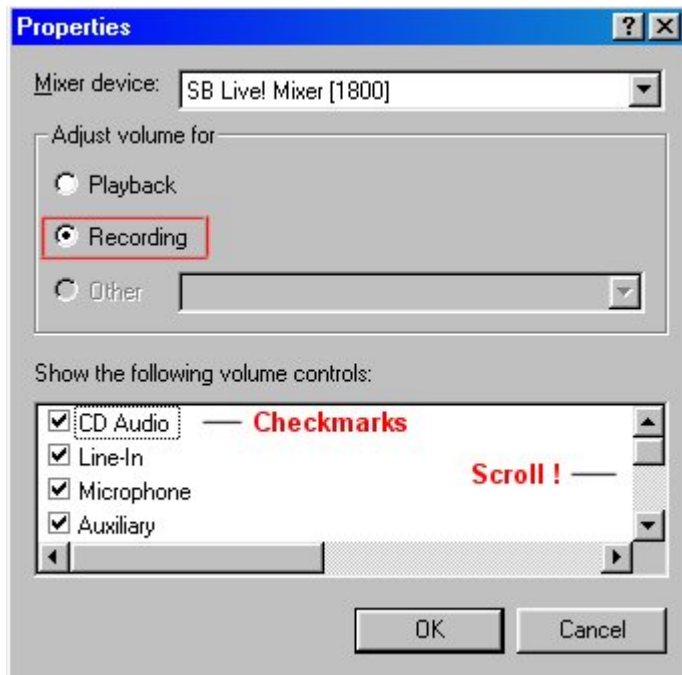
Step 2 *Navigate the menus to the Recording Control*

Select (click) "Properties" from the Options menu :



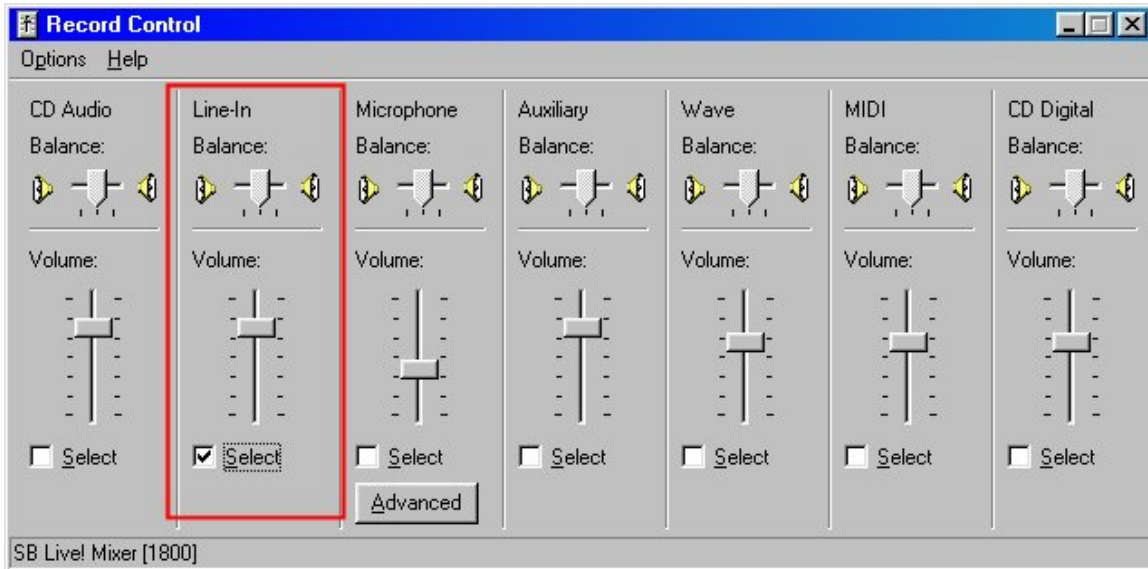
Step 3 *Enable the Controls*

You'll now see a window that looks like the one below. Click the "Recording" option, then look through the list of controls at the bottom. If there are any that don't have checkmarks, put one in. Remember to scroll the list, if it has a scroll bar. When you're finished, click the OK button.



Step 4 **Setting Recording Options**

You'll now see a window titled "Recording Control". This is where you'll set the Recording (input) options for CSOUND. Locate the section that contains the controls for the LINE or MIC inputs, whichever you're using. Starting from the top down, center the "Balance" slider, set the Volume Slider to 50-75%, and make sure there's a checkmark in the "Select" box.

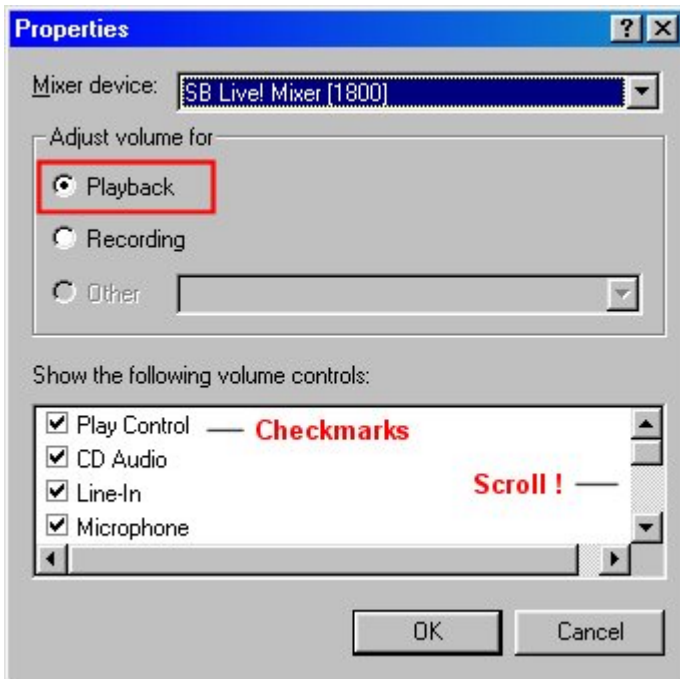


NOTE 1: Most PCI sound cards manufactured by Creative Labs and Ensoniq require using the MIC input rather than the LINE for full-duplex applications. (like CSOUND) This includes the "SB Live!" series we're using for these illustrations. Since most other cards on the market will work with the LINE input, we're using the LINE input in the examples.

NOTE 2: If you're using Windows 2000, (only) the "Select" box above will be labeled "Mute". In this case, make sure that the "Mute" box does NOT have a checkmark in it. Currently, the WVC for all other versions of Windows works as shown above.

Step 5 *Getting back to the Play Control*

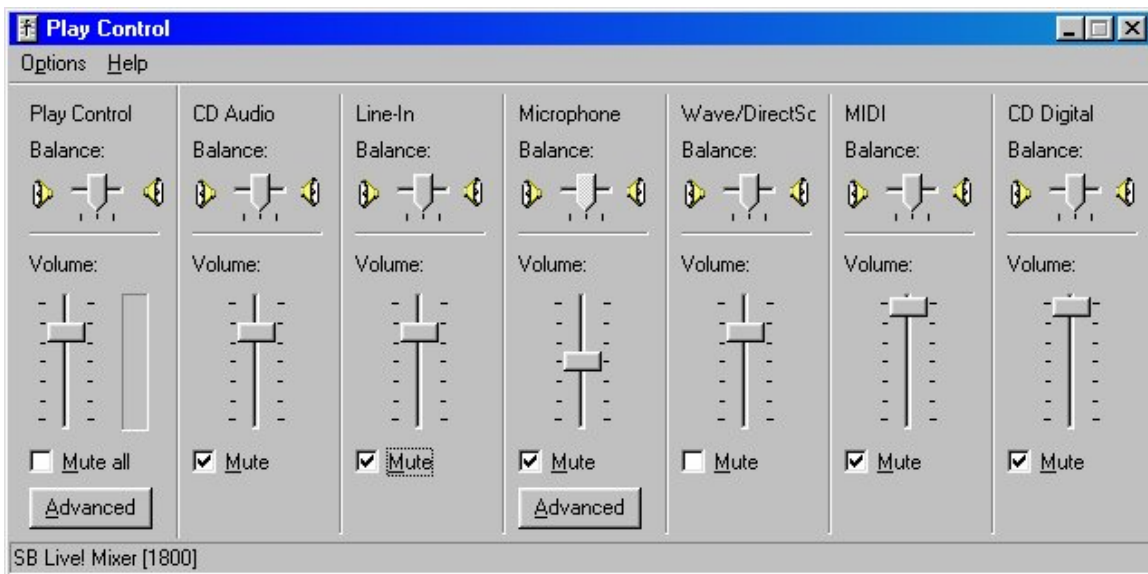
Now that we've set the *Recording* (input) options, we need to go back and set the *Playback* (output) options. Once again, select "Properties" from the Options menu, just like you did in Step 2. This time, though, select the Playback option, and set the checkmarks. Once you've finished, click the OK button.



Step 6 **Setting Playback options**

Now that you're back to the Play Control window, we'll set the Playback options. You can set the options for your CD, the MIDI synthesizer, etc. wherever you would normally leave them. In general, if you're not using a particular device, muting it will reduce the potential for noise, feedback, etc. For CSOUND, though, here are the important controls:

LINE (or MIC)	MUTED (yes, we're sure! ;-)
Play (or Volume)	NOT muted, level set for comfortable listening.
Wave	NOT muted, level set for comfortable listening.



NOTE:

If your WVC shows "Advanced" buttons like those above, you may want to check their settings. Options like equalization, pre-amps, etc. can cause CSOUND to behave in unexpected ways.

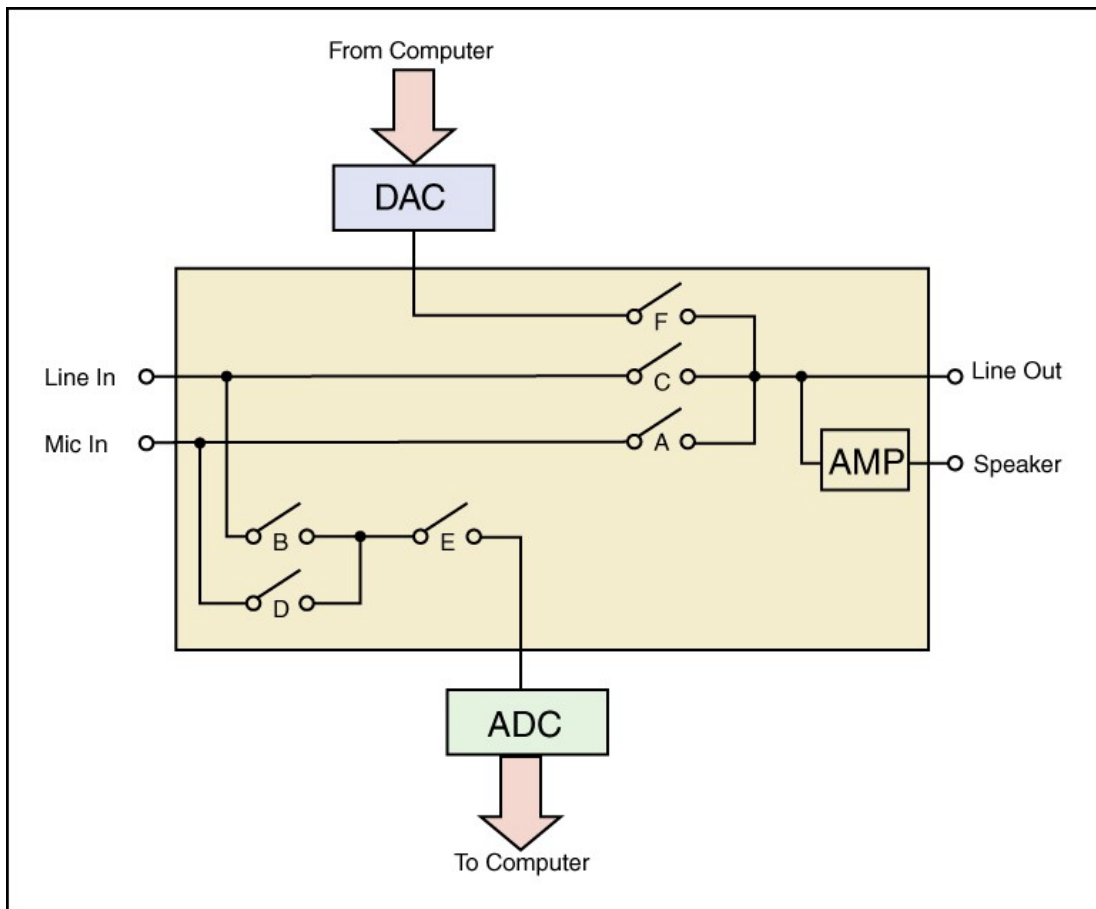
Step 7 **All done!**

If you've made it this far, you should be all set up to use CSOUND. Give it a try!

How does this really work?

In the previous section, we gave instructions on how to set the WVC up for use with CSOUND, but what did we really do? Let's talk a bit about what we're trying to accomplish. In a nutshell, we need to enable the correct input for recording, and disable, or "mute" the direct path between the input and the output. That *direct path* is the Great Deceiver. It allows audio from an input to pass directly to the output, so that you'll hear it on the speakers. The problem is that we need to do some processing in the middle! Let's have a look at a simplified diagram of the audio paths available in a typical sound card mixer.

Figure 1 Simplified sound card mixer diagram



Note we're using the LINE input for this discussion. If you use the MIC input, the principals remain the same.

Our goal in this section is to describe how the audio stream is first input, digitized, and processed before finally being converted back to analog audio for output. Referring back to Figure 1, you'll notice that by closing Switch **C**, the audio stream goes directly from the LINE IN to the outputs. While that's fine for monitoring what's actually on the inputs, our mission is to first capture the audio, process it, and then (finally) deliver it to the outputs. We *don't* want to hear that direct audio! So, in order to do that, first open all the switches, then close switches **B**, **E**, and **F**. Now what have we done?

- By closing switches **B** and **E**, we've enabled the audio to travel from the LINE input to the ADC. (Analog/Digital Converter) This allows CSOUND to access the incoming audio.
- CSOUND processes the audio, using whatever options you've selected.
- By closing switch **F**, we're allowing CSOUND to send the processed audio samples to the DAC, (Digital/Analog Converter) where they're converted back into analog audio for output.

Obviously, this is a simplified description of the process. We've described the major steps, though, which is what we set out to do.

Is my sound card good for use with ChromaSOUND?

PCI vs ISA/built-in

In general, CSOUND will work best with a good quality PCI sound card, although ISA-bus cards and “built-in” chipsets will work *with a reduced dynamic range*. (the range of volume between very soft and very loud sounds) The reason is that ISA-bus devices use one 16-bit, and one 8-bit DMA channel. That means that if you’re recording *and* playing back at the same time, (the definition of full duplex) one of the streams has to be “squished” down to 8 bits. As far as we know, this is always done on the playback (output) side. It makes sense for recording purposes, since doing it that way allows you to record audio 16-bit, and only the *monitor* line is ‘squished’. At the time ISA-bus sound cards were designed, we doubt any manufacturer dreamed that real-time DSP would ever be possible on PC’s, much less run on their cards. The bottom line? If you’re serious about DSP, or other high-performance applications, get a good quality PCI card, from one of the top vendors

Creative Labs and Ensoniq PCI cards

Although we really like these cards, they do require that you use the MIC input, rather than the LINE. The reason is that the mixers don’t allow the direct-path audio from the LINE input to be muted for full-duplex operation. Should that stop you from using these cards? Absolutely not! As long as the built-in 20db preamp is switched off, the MIC input will work just fine. *Also, before you make up your mind either way, please read the following section.*

Latency and DirectSound issues

When we originally released CSOUND, we made reference to a “DirectSound version”. At that time, Microsoft was assuring the developer’s community that a stable DirectX platform and low-latency (delay) DirectSound drivers would soon be available. Unfortunately, that has yet to happen. DirectSound-accelerated *playback* acceleration is now commonly available, (to support the game market) but that’s only half the equation. Not to worry, though! If you have a hardware-accelerated card and a reasonably fast processor, we can still reduce the latency considerably. Developing the methods is just taking a bit longer than we would have liked. In the meantime, though, here’s a specific list of cards that we’re working with:

Creative Labs

PCI-128, (good) PCI-512, (better) “SB Live!” (best)

Turtle Beach

Santa Cruz (preliminary testing only)

Please note that we can’t provide information as to whether or not we can “accelerate” other brands and models. No doubt others will work, but they’ll have to be tested on an individual basis.

Feedback

If there's something you'd like to see added to ChromaSOUND, (or to this document) we'd like to hear from you. If it's (A) practical, and (B) makes sense for the majority of users, we'll usually give it a try.

Best regards,

The Silicon Pixels team

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