



Founded: April 2000

WORKING WITH MUSIC

A 'ZRN GUIDE TO CREATING, EDITING & BROADCASTING AUDIO FILES

VERSION 1.0A FEBRUARY 28, 2006

Draft Edition

(The latest version of this document can be found in the "docs" folder via the *zrn* account.)

Editor:	Andrew Wolan	wacko at emulationzone d0tt org
Authors:	DarkWolf Jennifer Dreadknux Phil Whitehall Andrew Wolan	DarkWolf at emulationzone d0ttorg jennifer at zemiq d0tt com dreadknux at yahoo d0tt co d0tt uk greenyoshi at theodl d0tt com wacko at emulationzone d0tt org

TABLE OF CONTENTS

1 - Introduction	3
About this document	3
Additional Information	3
Credits	3
2 – Direct Recording	4
Overview	4
Get Connected	4
Make a Recording	6
3 - Ripping	9
Overview	9
Configuration	9
ID3 Tagging	12
Ripping	13
4 – Format Conversion.....	14
Overview	14
Converting NSF, GYM, SPC, PSF/PS2	14
Converting MIDI Files.....	16
To Make Your Life Easier (Batch Conversions)	17
5 – Tagging	18
Overview	18
What are MP3 tags?	18
Tagging your Files.....	19
Tagging Batches of Files.....	20
How to Retrieve Title Tags from Filenames	20
Copying ID3v1 Tags to ID3v2 and Vice Versa.....	21
Mass File Renaming Using Tag Information	22
6 - Normalization	24
Overview	24
Tool of the Trade.....	24
When to Apply Normalization	25
7 - Encoding	26
Overview	26
Configuration	26
Encoding	28
Known Bugs	28
8 – Live Broadcasting.....	29
Overview	29
Tool Configuration.....	29
Connecting	37
Source Swapping	37
Disconnecting.....	39
Using the Tool	40
SAM Information	41
9 – FAQ.....	44

1 - Introduction

About this document

Welcome to ‘ZRN’s *Working with Music* documentation. This document contains a wealth of useful information and tidbits for those interested in broadcasting music online. Music enthusiasts will also find this document of value, for it covers subject matters such as ripping, encoding and tag editing.

The information contained here was collected from various individuals with years of experience in these subject matters. So whether you’re a beginner or a seasoned vet, we feel that this document will be of value to everyone.

Additional Information

Throughout this document, references will be made in regards to Icecast, Ices, the SSH shell and the FTP server. Additional information on these subject matters can be found in the *‘ZRN Operations Manual*, a companion document for this manual.

In addition, this manual will make references to the FTP server when discussing specific applications. Most of these applications can be found on the FTP server under the folder “/home/zrn/docs/apps”. Refer to the README file in that directory for a listing of what is available.

Credits

This document was made possible by the contributions of various ‘ZRN staff members, both past and present. The following is a list of contributors on a per-chapter basis.

Chapter	Contributor(s)
2	Darkwolf
3	Dreadknux, Darkwolf and Andrew Wolan
4	Jennifer
5	Jennifer
6	Dreadknux, with initial idea from WTMK
7	Phil Whitehall
8	Andrew Wolan

2 – Direct Recording

Overview

There are many ways to obtain music for a video game. This chapter will discuss how to record music directly from a videogame console onto your computer.

The method presented here is the most complicated means of retrieving music. Attention must be made to ensure that low quality recording equipment is not used; else poor audio quality will be the end result. For that reason, this chapter is only recommended as a last resort if the music in question cannot be obtained by some other means.

Get Connected

First of all, you'll need a fairly good soundcard (older or on-board sound cards tend to record with pops and other errors). Second, you'll need a way to see what you're actually doing, so you'll need a PC TV card or video card with composite video-in. If you don't have either, you can pull a TV really close to your PC, but it will have to be VERY close because of the way the cords are designed. You could also do it "blindly" if the game has a fairly organized sound test.

The last things you will need are some cords and/or couplers. These can be bought at Radio Shack or other electronic/audio stores. The following subsections discuss what is needed based on the connections made available.

Newer Console Systems with A/V cables:

For this you'll need a Y-cable that has two RCA audio male connectors (red & white) on one end, and a 1/8" stereo male (the same type that's used on headphones) on the other. You'll also need two RCA couplers, which will allow you to connect two male ends together.

Take the A/V cable from your system and put two couplers on the RCA audio connectors (red & white). Then connect the Y-cable to the other end of the couplers. Lastly, put the 1/8" end into your soundcard's line-in or microphone input (preferably line-in, only use mic if you don't have a line-in).

Connect your yellow RCA connector from the system's A/V cable to whatever you're using as a video display. Record with your favorite recording software. Make sure to normalize all songs. If the song loops infinitely, make sure you add a fade out.

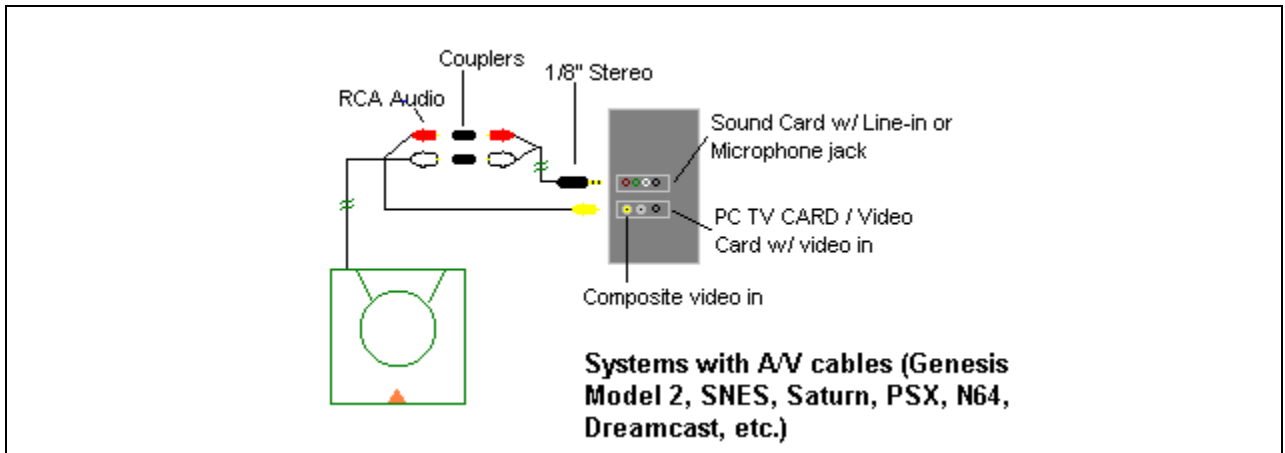


Figure 2.1 – Console System with A/V Cables

Genesis Model 1:

The Genesis Model 1 is a bit different from above. In this case you only need a cable with two 1/8" stereo male ends. Put one end in the headphone jack and the other into your soundcard. Use either the A/V cable (don't use the A/V cable for sound unless you're sure you want to record in mono) or the RF box for your video connection. Make sure to adjust the headphone volume according to your PC's mixer setup.

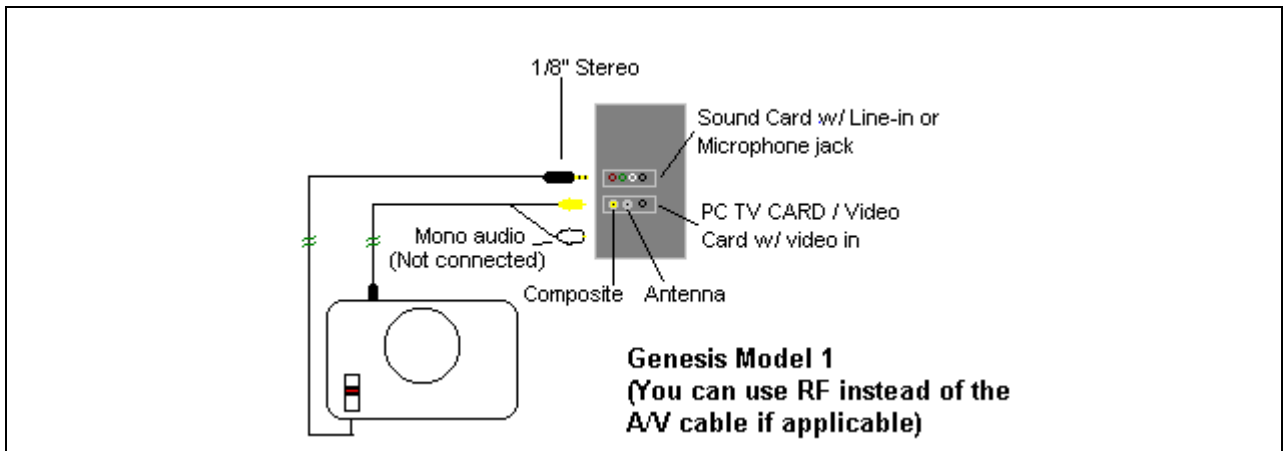


Figure 2.2 – Console System with Minijack

Older Systems that use RF:

You need a PC TV card with antenna connection. Connect the system to the antenna connector with the RF box, there should be an audio output on your PC TV card which should be connected to your soundcard. Some PC TV cards might do this internally, be sure to find out.

You can also do this with a TV/VCR, if you want to do it that way, please e-mail Darkwolf.

In case you're wondering, I have a Pennacle PC TV card that has antenna, composite, S-Video, and an audio out. It only cost \$50.

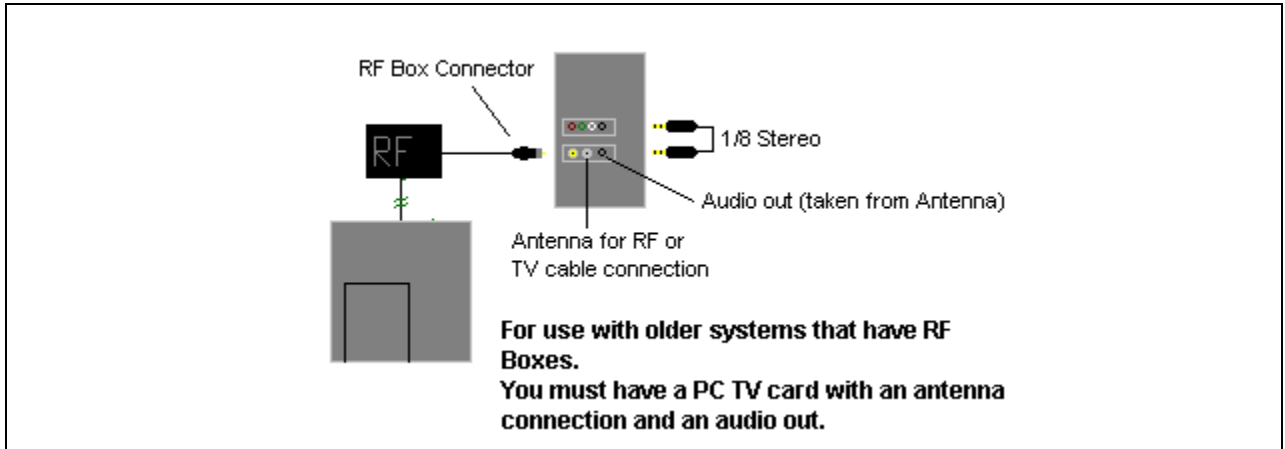


Figure 2.3 – Console System with RF Connector

Make a Recording

In order to make a recording, some recording software will be needed. There are many programs to choose from, both shareware and freeware. Whichever application is used, there are three key points to keep in mind:

- 1) Ensure the program is configured to record from the correct audio source.
- 2) Ensure the volume levels are set correctly
- 3) Always save a recording in a high quality format.

The following section will further discuss these three points. For the purpose of discussion, Audacity will be introduced. Audacity is free sound recorder and editor for Windows, Macintosh and Linux. This program can be found on either the FTP site or online at:

<http://audacity.sourceforge.net/>

1) Check Program Settings

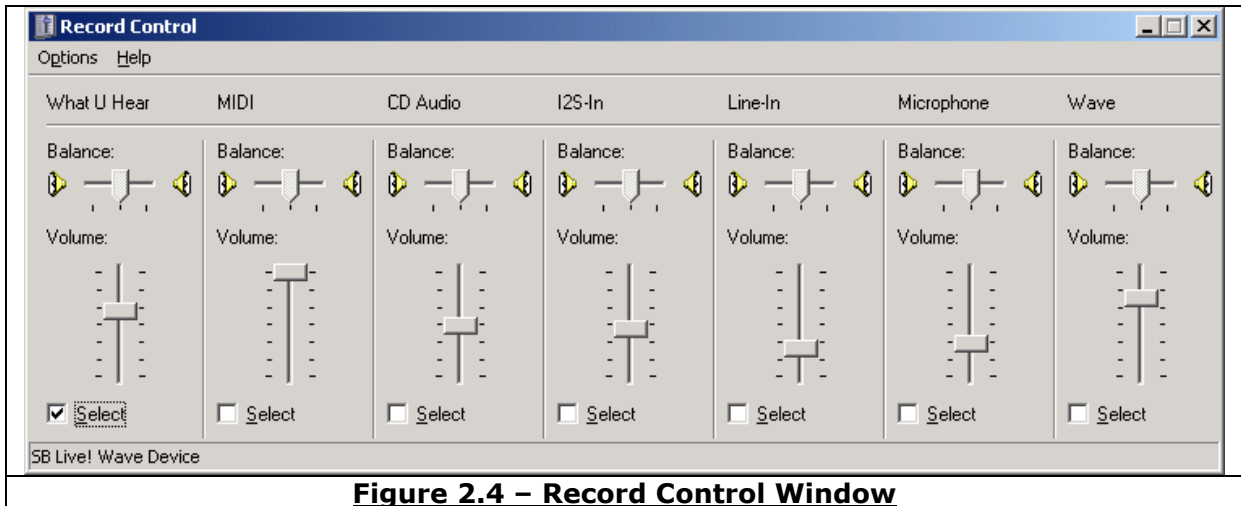
If your recording captured nothing but dead air, or if the recording seems far too quiet, there is a chance that the program is recording from the wrong audio source.

First, check your application to ensure it is recording from the correct audio source. By default, most programs are configured to record from the microphone input. In Audacity, this setting can be changes by accessing the pull-down menu in the upper right hand corner of the application.

If that does not work, you will need to access the Windows mixer. Go to:

Start->Programs->Accessories->Entertainment->Volume Control.

Next, select “Options/Properties”, select the “recording” radio button and hit enter. The “Recording Control” window should now appear, which should look similar to the following figure.



Ensure that the desired audio source which to record from is selected. If not, click on the “select” check box.

2) Correct volume levels

If your recording captured nothing but dead air, or if the recording seems too loud or too quiet, odds are your have a mixer setting misconfiguration.

First, check the record volume settings for your input within your application. It’s possible that it’s set too low or too high. Adjust the volume to a value that is most suitable. In Audacity, these settings can be found to the left of the pulldown menu discussed previously.

Next, check the record volume of the audio source in the Window’s mixer. Access the “Record Control” window and ensure the volume levels look ok. Adjust the volume as needed.

Finally, check the playback volume of the audio source by accessing Window’s mixer “Playback Control” window. To access this window from the “Record Control” window, select “Options/Properties”, then select the “playback” radio button and hit enter. Ensure the audio source is not muted and that the volume levels look ok.

NOTE: For best results, it is recommended that the volume from both the audio source and the input to your source card be set someone in the middle of it’s selectable range. (This includes the “playback” volume for the audio input as well.) Such a setting may reduce clipping while making quiet sounds audible

A popular alternative to this suggestion is to first determine what the loudest part of the song you will be recording is. Next, set the record volume setting so that the sound meter (typically a line of green and red bars,) just barely hits the top of the meter while playing this part of the song. Once set, you are ready to record.

Though more foolproof, this approach is far more time consuming and may only be applicable on a “per song” basis.

3) Always save a recording in a high quality format

Once you are finished making a record and are happy with the results, it is strongly recommended that the recording be saved using the highest quality setting possible. Failure to do so may result in poor quality when encoding the files later on for broadcasting. (Information on how to properly encode a recording into MP3 format is discussed in a later chapter.)

It is recommended that the recording be saved either as:

- A wave file (16-bits, stereo, with a 44Khz sampling rate)
- An MP3 file (128Kbps bitrate or great, stereo, with a 44Khz sampling rate)

(There are other file formats, like FLAC, but there will not be presented.)

In Audacity, it is easy to save in either format. Select either “Export as WAV” or “Export as MP3” under “File”. To change parameters of the output file format, click the down arrow next to the word “audio track” for the audio track that is of interest.

3 - Ripping

Overview

There are many Video Game OST's hanging around, as you may have obviously noticed. Although you can download some soundtracks, it is usually best to try and hunt the actual CD down yourself: [eBay](http://www.ebay.com) is a perfect marketplace for rarities these days. But supposing you have some CD's already, and you'd rather rip the music files from there instead of downloading others, which may be lower-quality versions. This is where this chapter comes in.

There are numerous CD ripping tools available, most of which are free. To help introduce this topic, jetAudio's CD Ripper the tool will be used. From this study, the reader should be able to use their favorite CD Ripper to net the best results possible.

Configuration

To begin, install jetAudio onto your computer. This tool can be found either on the FTP server or online at:

<http://www.jetaudio.com>

Launch the program. Near the top of the application will be six (6) icons. Select the first icon to launch the CD Ripper or press "CNTL-1". A window similar to the following figure will be shown.

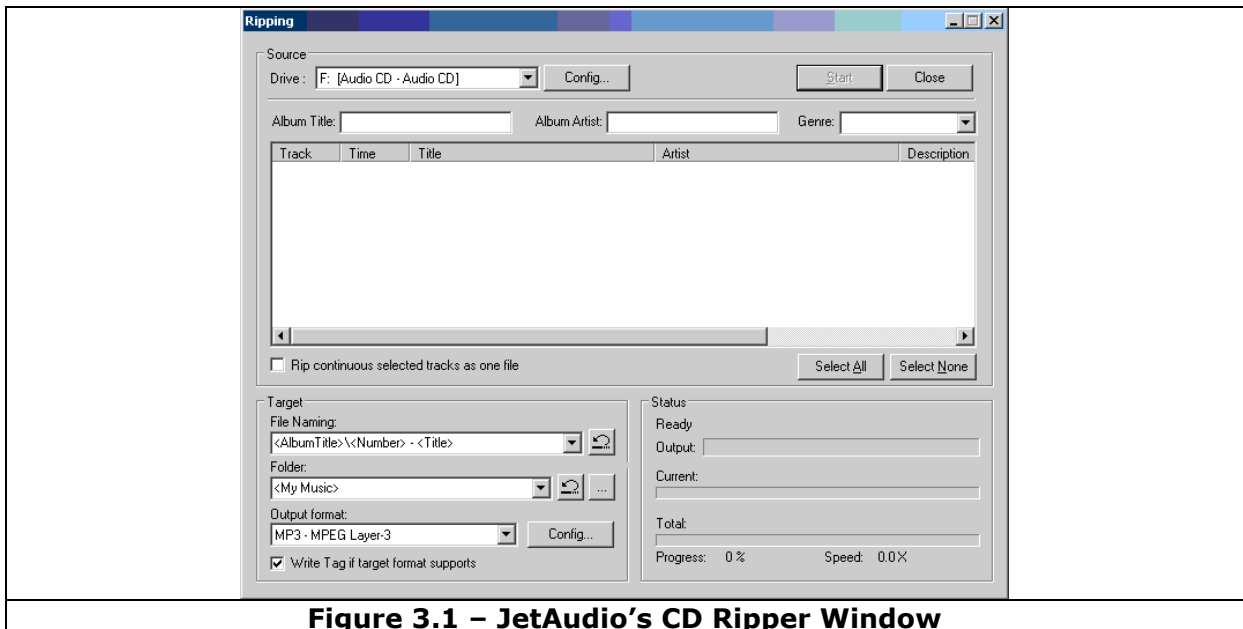


Figure 3.1 – JetAudio's CD Ripper Window

At the top of the screen will be an area entitled “Source”. Using the pull-down menu next to “Drive”, select the drive that corresponds to the drive that will be used to rip music from. If the system only has one drive bay, only one option will be available.

Next, click on the neighboring “Config...” button. A window similar to the following figure is shown. Be sure the “Native NT API” radio button is selected if the tool is running on a NT, 2000 or XP machine. Check off the “Enable Jitter Correction” check box as well. This option will prevent audio gaps to occur on poor performing systems. The term “jitter” corresponds to changes in the time in which it takes a data packet read from the CD to arrive at the application.

When done, hit “OK”.

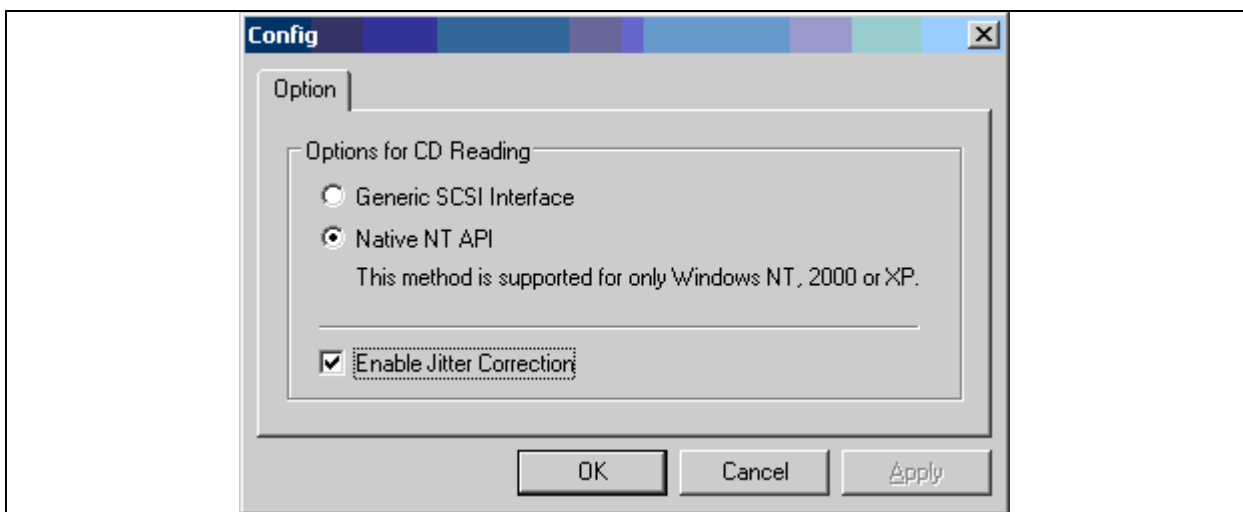


Figure 3.2 – Source Configuration Window

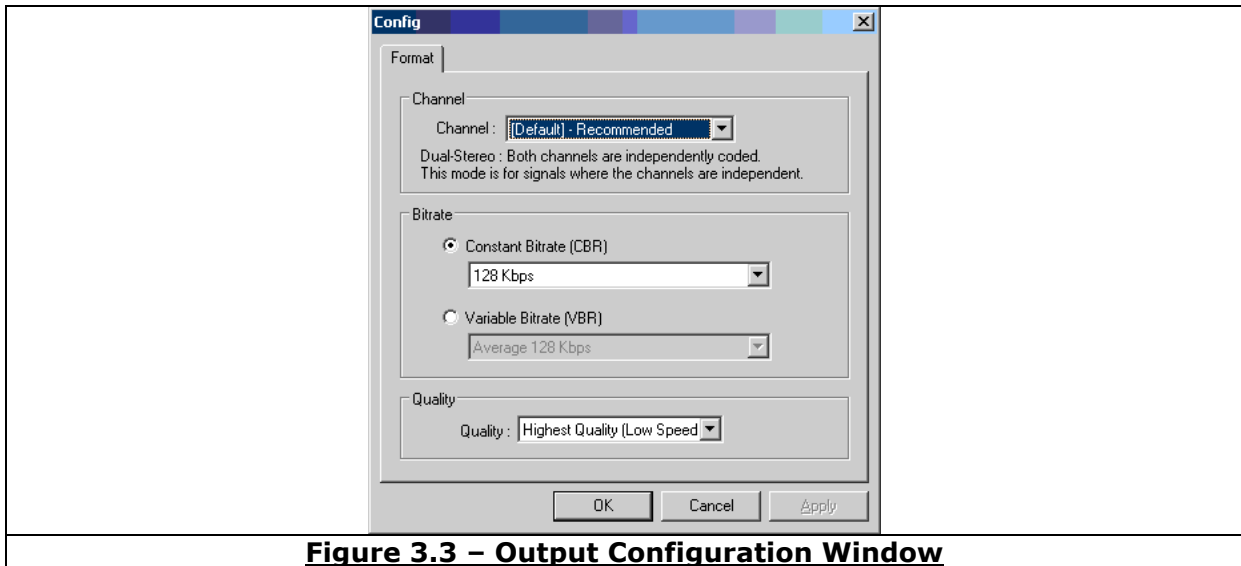
Near the bottom of the “Ripping” window, there is an area entitled “Target”. In the box under “File Naming”, enter

```
<AlbumTitle>\<Number> - <Title>
```

(Notice that the pull down menu is editable.) When ripping a CD, the program will create a folder with the name of “Album Title”, and will name each file with first the track number, followed by a dash and then the song title. While the user is free to use whatever naming format suits their needs, the provided naming format is strongly recommended for files that will eventually be added to ‘ZRN’s music library.

Under “folder”, select the directory where the files are to be saved. Ensure the checkbox next to “Write Tag if target format supports” is checked. This option will store song title, artist name and other related information into the file’s ID3 tag. This option is extremely handy since it’s easier to edit such information before the tracks are ripped to disk.

Under “Output Format”, select “MP3 – MPEG Layer-3” from the pull down menu. Click on the neighboring “Config...” button. A window similar to the following figure will be shown.



For channel, select “Default”. This will use stereo, two channeled sound if it exists. Otherwise, it will revert to “mono” or single channeled sound.

Under bitrate, select the “Constant Birate” radio button. From it’s associative pull down menu, select a bitrate of 128 or 160Kbps or higher. Such a high bitrate is strongly recommended to preserve audio quality when the songs are re-encoded into AM and FM format later on. Failing to use a high bitrate can produce annoying audio artifacts in the final product.

Finally, under “Quality”, select “Highest Quality (Low Speed)”. ALWAYS USE THE HIGHEST QUALITY SETTING, even if it takes a little longer to rip a CD. Selecting a lower quality setting has the potential of introducing “coughs”, “grumps” and other annoying audio artifacts. These artifacts are introduced at lower settings because the encoder will only spend so much time encoding a data packet. In the name of speed, it will return a “best effort” result for the time it had and move on, even if the results are not the best.

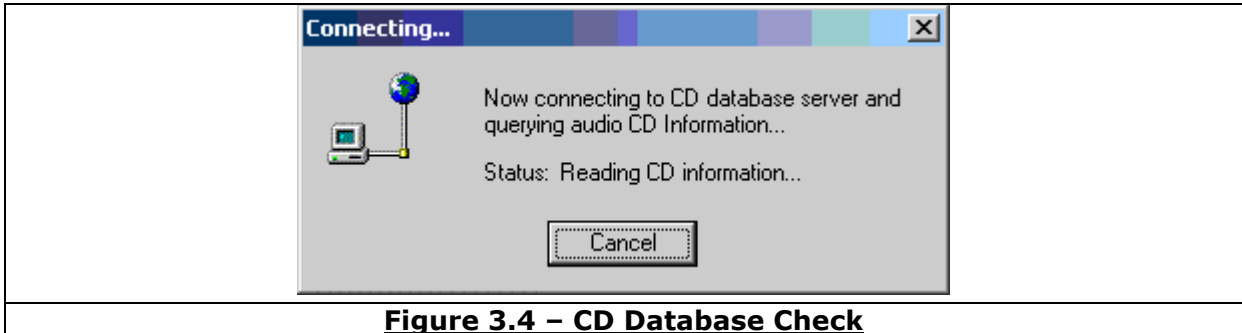
Press the “OK” button to save settings. The tool is now ready to begin ripping.

NOTE: one could directly rip a CD into “AM” and “FM” format. However, such use is **not** recommended because post processing of the output will be more time consuming; song manipulation, such as ID3 tag editing or volume normalization, would have to be two done twice. Furthermore, volume normalization cannot be applied to files in mp3PRO format, which makes such file work impossible to do.

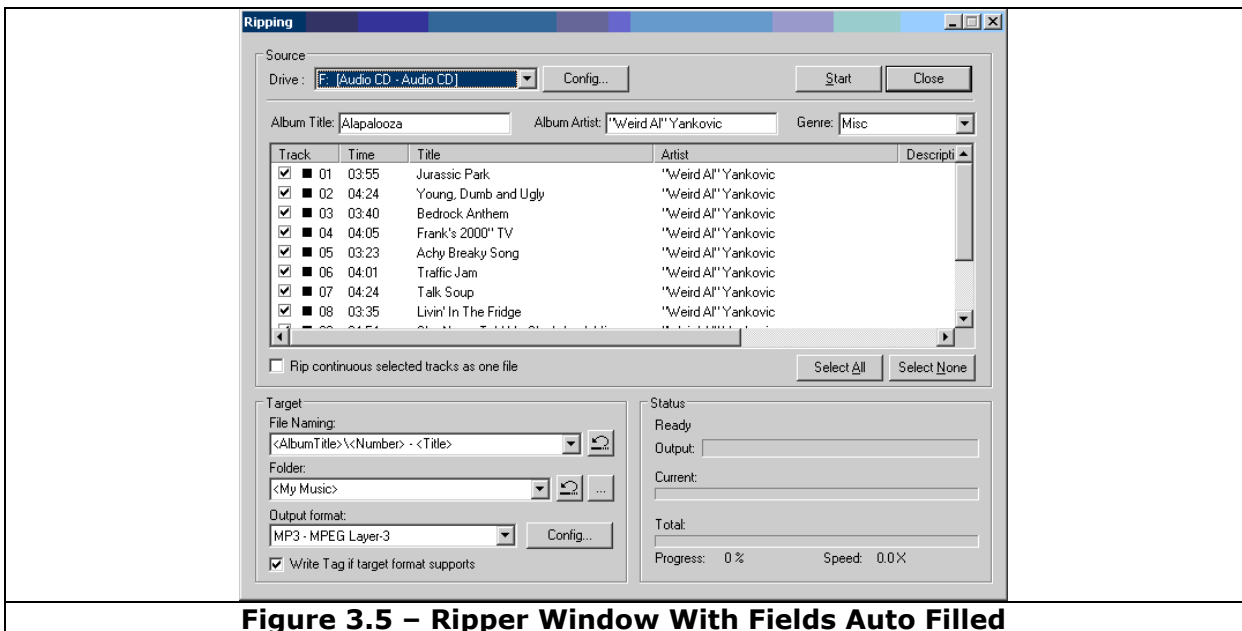
Therefore, it is strongly recommended that files be ripped to a high quality format to disk, so that they can then be edited and worked upon in this format. Once such work is complete, the files are to then be encoded into their correct formats. Such a work flow will ensure a high quality, professional sounding audio product in the end.

ID3 Tagging

Insert the CD you wish to rip into the computer and close the drive bay. A dialog box similar to that in the following figure will be shown.



What is going on is this: using the number of tracker and the length of each track as a fingerprint, a query is sent to a public CD Database. This database stores information such as artist name, song titles, etc based on the "fingerprint" format described previously. If a match is found, then such information will be displayed in the "Ripper" window, as shown in the following figure.



It is obvious that such a feature is a huge time saver, saving a ton of tedious data entry. However, if you are no so lucky, these fields need to filled in manually. At the very least,

enter the game name under “Album Title” and the name of the level associated with each track.

Ripping

Once the tool is properly configured and the tag fields filled, it is now time to begin ripping. To begin, click on the “Start” button on top of the “Ripping” window. Progress will be shown in the “Status” area in the lower right hand portion of the window. On modern computers, this process should only take a few minutes.

When done, the following window will appear.

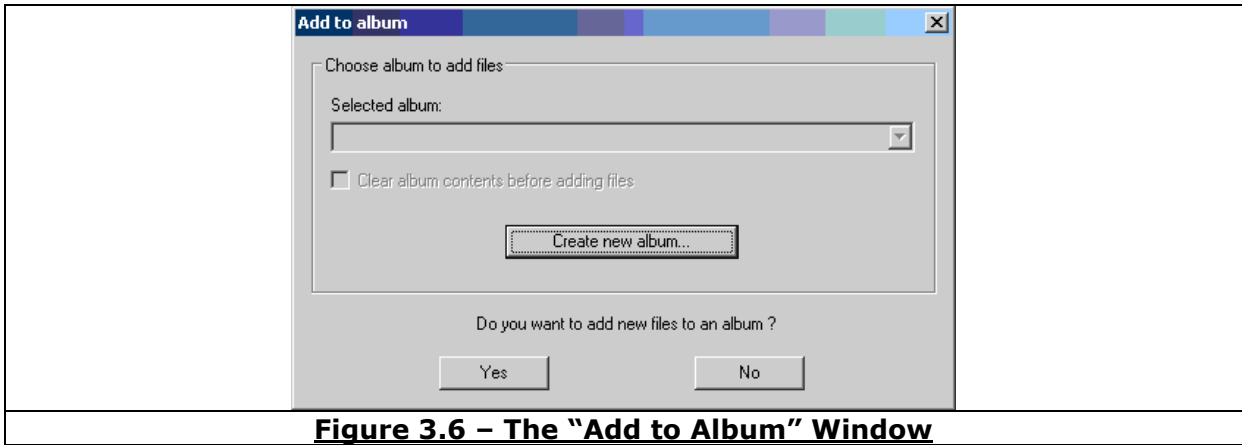


Figure 3.6 – The “Add to Album” Window

This window asks if you want to add the recently extracted songs to an album or playlist. Click on “No” if uninterested or to continue.

And that’s it! To rip another CD, insert a new disk into the computer.

4 – Format Conversion

Overview

Unfortunately, most of the video game tunes found on the Internet are not in MP3 format. Instead, most are found in a file format based on the console system from which they were made for. To play these tunes on an Internet radio station, they will somehow need to be converted over to MP3.

In this chapter, some techniques for converting various audio files to MP3 will be discussed.

Converting NSF, GYM, SPC, PSF/PS2

The best tool for this job is Winamp. You can find many plugins that will allow Winamp to play the most common video game music formats that you will run into.

The most common video game music formats are:

NSF – NES music

GYM – Sega Genesis music

SPC – SNES music

PSF/PSF2 – Playstation 1 music

There are Winamp plugins available for each. Some formats even have multiple plugins available, but these are the best ones to use.

NSF – NEZplug, found at <http://nezplug.sourceforge.net/>

GYM – YMAMP, found at <http://www.zophar.net/utilities/download/ymamp20b.zip>

SPC – SNESamp, found at <http://www.alpha-ii.com/Download/>

PSF/PSF2 – Highly Experimental, found at <http://www.neillcorlett.com/he/>

All of these are considered to be Input plugins. You can play the files now, but you still need to convert them to MP3. For that, you'll need an Output plugin. There are two ways of doing this. Music can either be set to output as a WAV file, which then can be converted to MP3, or you can use a plugin to output directly to MP3. Either way works fine, but WAV files can get very large very quickly. If you want to download the MP3 Output plugin, it's available here: <http://www.winamp.com/plugins/details.php?id=33396>

Install the needed plugins and you'll have all the tools ready that you need. Input plugins are used automatically in most cases, but you'll need to specify your Output plugin. Open up Winamp and press Ctrl-P. This opens the Preferences window. Expand the Plug-ins tree, and click Output. (Refer to Figure 4.1)

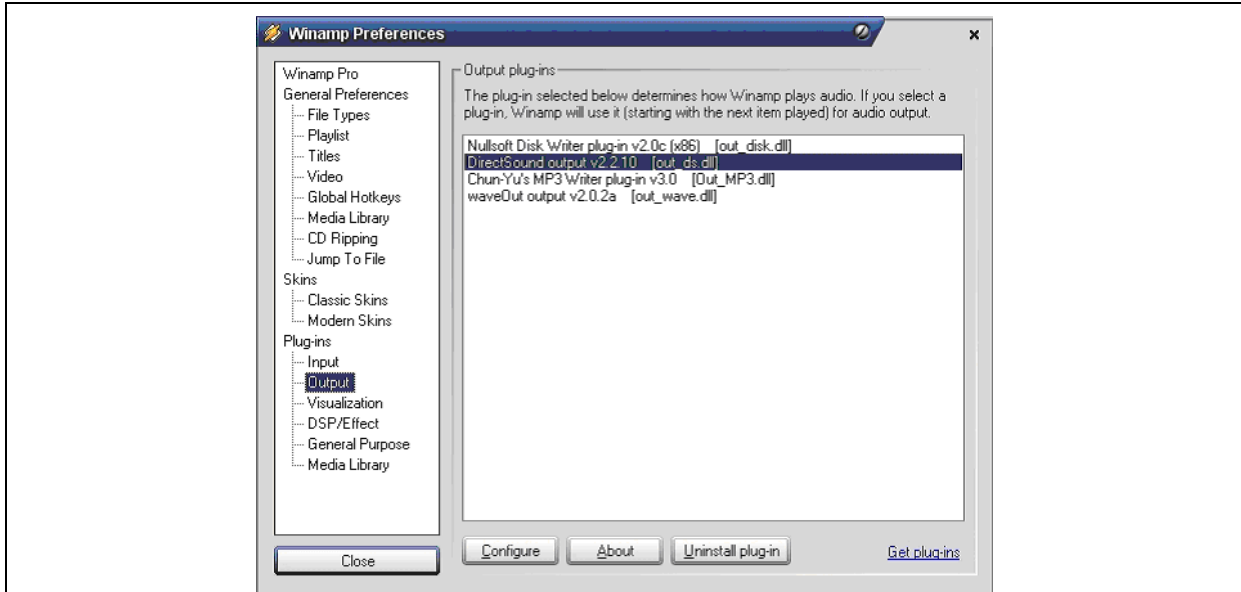


Figure 4.1 – Winamp Output Plugin Selection

From here, you can choose to use either the WAV output (waveOut) or the MP3 output. The default output is DirectSound, which sends the music to your speakers. Once you're finished converting music files, you'll want to make sure you change it back to this. Click on Chun-Yu's MP3 Writer, then press the Configure button.

In the new window, choose the directory where you want the files to be saved. Now you will want to choose the quality settings. Since these files will be reencoded later on, it is best to output your files as high quality MP3s: the higher the quality you start with, the better the final audio product will sound.

Change the MP3 output settings however you want. Be sure to select "high quality" encoding to avoid potential audio artifacts in the final audio project. Close the window to save the changes made.

All you will have to do now is press play on Winamp. As it goes through the playlist, it outputs each file separately and does its best to properly name and tag them. You may still have to go in and clean up the file naming and the tagging though, because it isn't perfect.

This Winamp plugin isn't perfect either. Sometimes when it gets through converting a playlist, it will show a dialog window stating that there was an error outputting to a file. 99% of the time, there really isn't a problem. You may want to listen to the recording of the last song on the playlist though, just to be sure.

Converting MIDI Files

You may also wish to convert MIDI files to play on your station. Usually to do this you need to convert the MIDI to a WAV file, and then convert it to an MP3. This is because MIDIs are not digital audio like MP3s, and have to be recorded in order to turn it into digital media. This process can be both time consuming, and hard drive consuming. However, there is a tool out there that makes it much simpler: Apple's iTunes player. You can download it for free here: <http://www.apple.com/itunes/download/>

Once you have the player installed, open it up. Your default screen should be your music library. You can add songs to this library to play them, or in this case, convert them. To add a file to your library, press Ctrl-O. Find the file or files you wish to add. Now you should have some files listed in your library.

The default conversion format in iTunes is ACC. To change this, open the Preferences by pressing Ctrl-, (comma). Click on the Importing tab and change the Import Using dropdown box to MP3 and set the desired kbps. I would recommend recording a high quality version, and then converting it to the lo-fi and hi-fi station formats.

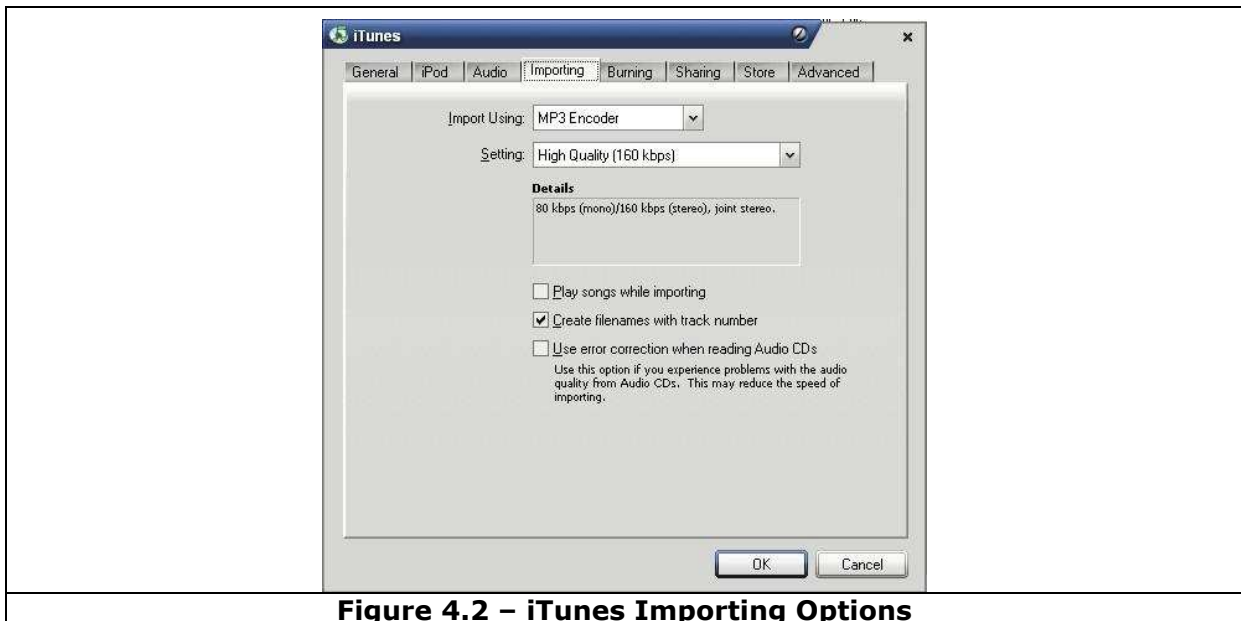


Figure 4.2 – iTunes Importing Options

If you want, you can also go to the Advanced tab and change the iTunes Music Location. That's where your converted files will be saved. When you're finished, click OK. Click and highlight the MIDI files you want to convert. Then click on the Advanced menu, and Convert to MP3.

Make sure you add the MP3 tag information, because MIDIs don't hold any song info. That's all there is to it!

To Make Your Life Easier (Batch Conversions)

Remember that you do not have to convert music files one at a time! If you are using Winamp as your MP3 output tool, line up several songs like a playlist, however many you like, and just press Play. Make sure you do not have song repeating on, or it will constantly cycle through your playlist.

When converting MIDIs with the iTunes player, you will do the same thing. Add multiple MIDI files to your library, just like making a playlist. Then highlight all the ones you want to convert, go to the Advanced menu and click Convert to MP3. It will convert all the MIDIs you have selected.

Converting in batches will save you a lot of time and effort. You can just set it up to convert, and then go to work or go to bed. Also remember that each file format you're converting has its own quirks, some quirkier than others, so you'll want to make sure you check the tag information on all your files before you encode them!

5 – Tagging

Overview

Tagging your files has the potential to be the most tedious and frustrating part of getting your mp3s ready for broadcasting. If you don't have good tag information, though, your listeners won't know the name of the song that is playing. Not all format converters do a good job at grabbing the correct information. Fortunately, there are some really good tools out there to help speed up the process. One of the best tools is ID3-TagIt, which is available at www.id3-tagit.de.

What are MP3 tags?

MP3 tags can contain all sorts of information, from the title of the song all the way to the year it came out. There are also two MP3 tags: ID3v1 and ID3v2. ID3v1 contains less information, and has only limited room for characters. In other words, it is possible to have a song title that is too long to fit in the Title box of an ID3v1 tag. In an ID3v2 tag, however, you've got a longer character limit, as well as extra information you can attach to the MP3. While ID3v2 are the most flexible, ID3v1 are the most compatible.

Here's an ID3v1 tag viewed in ID3-TagIt.

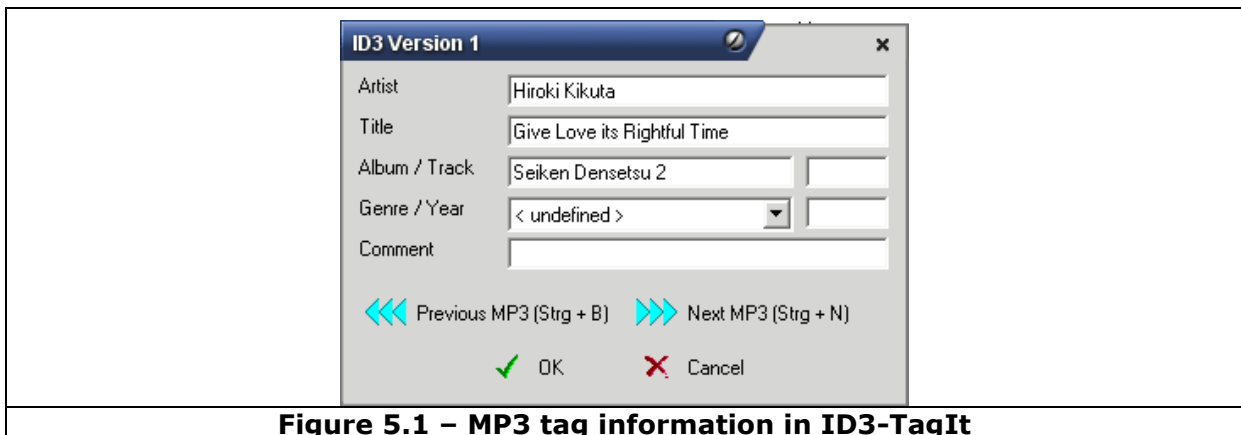


Figure 5.1 – MP3 tag information in ID3-TagIt

In this case, none of the needed information is too long to fit the character limit on the boxes.

Now let's look at an ID3v2 tag viewed in ID3-TagIt.

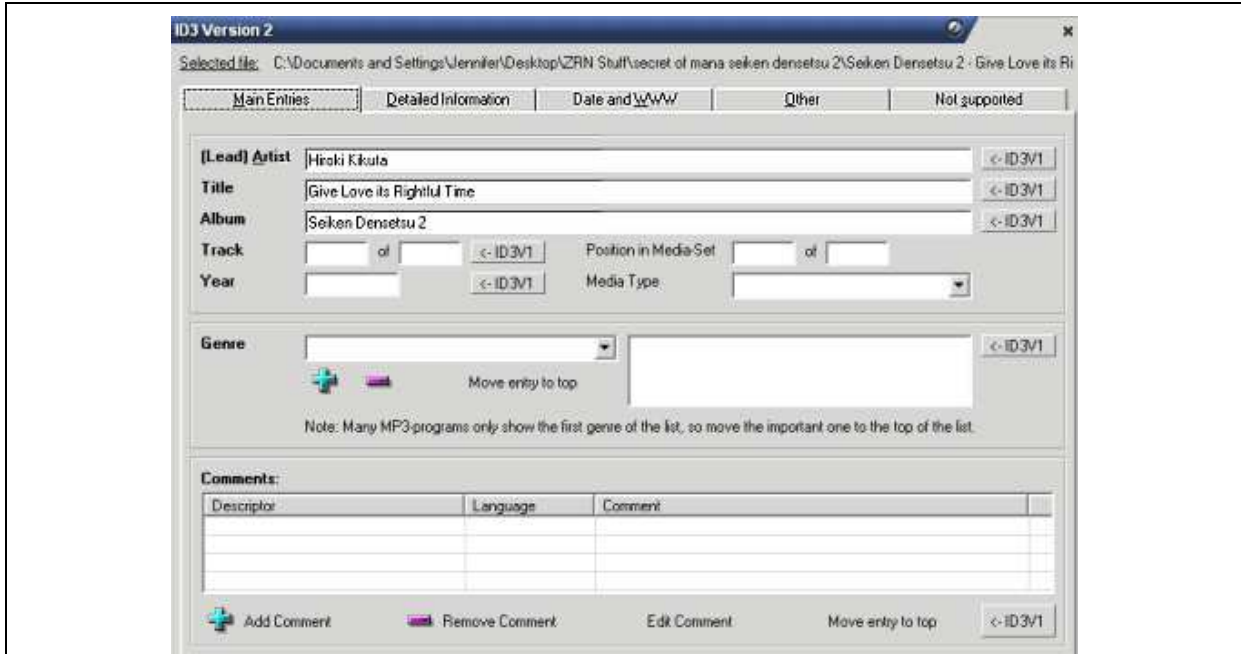


Figure 5.2 - ID3v2 tag information in ID3-TagIt

Even though it's hard to read the text, it's obvious that there is a lot more available in ID3v2 tags. Currently the 'ZRN streamer only needs ID3v1 tags, but it's best to fill in both the ID3v1 and ID3v2 tags. It'll save you time later if ID3v2 tags become required.

Tagging your Files

The three most important bits of information are Title, Artist, and Album. The 'ZRN streamer displays the Title and Album, but it's possible in the future that Artist could be streamed as well.

Title – This should contain the title of the song

Artist – This should contain the artist or composer of the song

Album – This should contain either the name of the album or the game the music is from

If you're lucky, the files you convert will already be appropriately tagged. That doesn't usually happen though. That's where handy tools like ID3-TagIt come in handy. You can edit ID3 tags one by one, or in batches. Batch edits are great for filling in empty Artist and Album information.

Let's say you've just converted 30 songs from Final Fantasy V, but all 30 files have no tag information whatsoever. You're going to need to add all of the necessary information, but you don't have to do it all by hand.

Tagging Batches of Files

I will explain how to tag batches of files, but the same principles apply to just tagging 1 or 2 files.

Open ID3-TagIt. In the left panel window, browse to the directory where you are keeping your music files. They will all appear as a list in the right panel window. Select all the files that have tags you wish to edit. Either press Ctrl-M or use the Functions menu to go to the Multi-ID3v1 tag editor. Enter the name of the album/game in the Album box and the composer (if known) in the Artist box. In this case, the game is Final Fantasy V and the composer is Nobuo Uematsu.

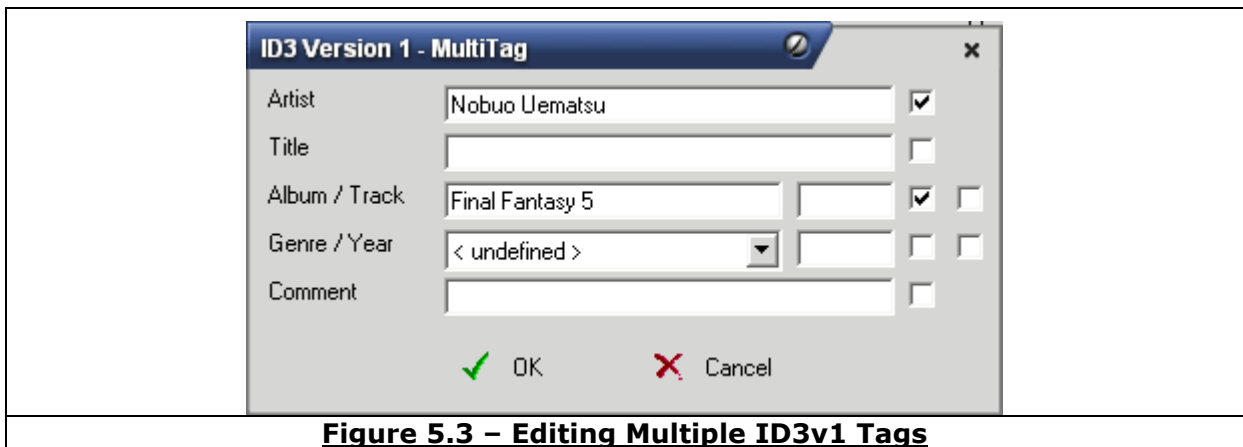


Figure 5.3 – Editing Multiple ID3v1 Tags

Notice it says “MultiTag” in the title bar. Also notice the checkmarks next to the boxes I filled in. This means that when I click OK, that information will be written to the ID3v1 tags on ALL of the songs I selected. Once you’ve clicked OK, that little window will disappear, and you’ll notice information appear in your file listing. We’re still missing one other vital piece of information – the Title.

How to Retrieve Title Tags from Filenames

The easiest way to retrieve title information is from the file name itself. During conversions, the files get saved with some general convention, but things don’t always go as planned. Here are a two problems you may face:

- Your filenames have underscores “_” in them
- You have no title info in your file names

If either of those cases is true, you’ll have to handle some information one song at a time. You can choose to go through and manually rename all your files using spaces in place of underscores, or adding the necessary title info.

- Song1.mp3 would become Final Fantasy 5 – Opening Theme.mp3

- Final_Fantasy_5_-_Opening_Theme.mp3 would become Final Fantasy 5 – Opening Theme.mp3

Unfortunately, there isn't really any way around this. Chances are if your filenames look like either of those, so does any info in your tag, and you'll have to change it all yourself. If necessary, go and change all the filenames until you're happy with how they look. Now you can pull the Title information from the filename, and it can be done in a batch!

Press Ctrl-F or go to the Functions menu and click "Filename to TAG Ver 1."

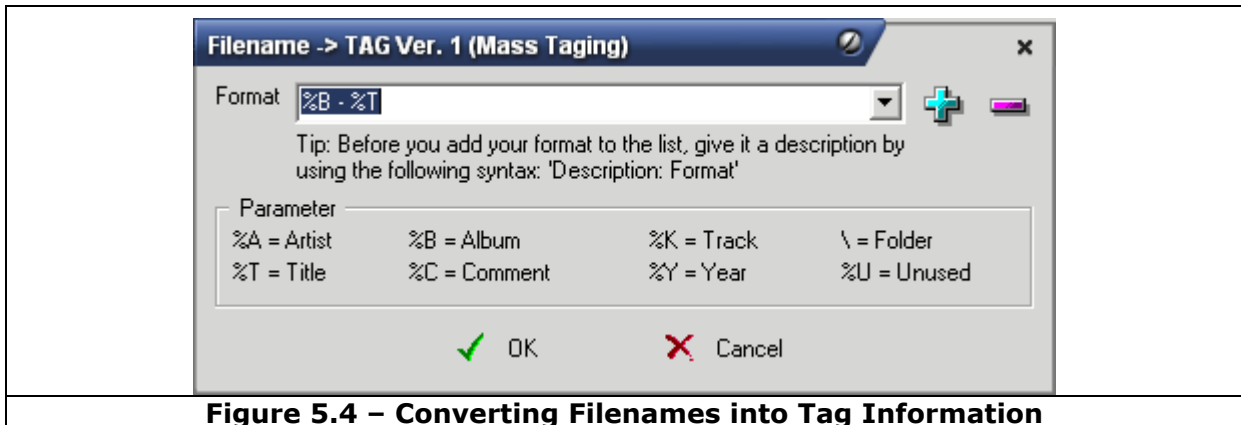


Figure 5.4 – Converting Filenames into Tag Information

The window that opens will look something like Figure 4. In the Format box you should put the way your filenames are arranged. I usually use Album/Game – Title so the format for mine would be %B - %T. This allows the program to parse your filenames to find the information it's looking for. When you have that entered, you can click OK, and song title information should start displaying on your file list.

Copying ID3v1 Tags to ID3v2 and Vice Versa

The very last thing you have to do is turn all this ID3v1 info into ID3v2 info. To do it in one batch, select all the files you want, and then press F4. This will bring up a Transfer/Convert ID3-Tags window. Select "Transfer ID3V1 to ID3V2" and press OK. You've now completed tagging your batch of music files!

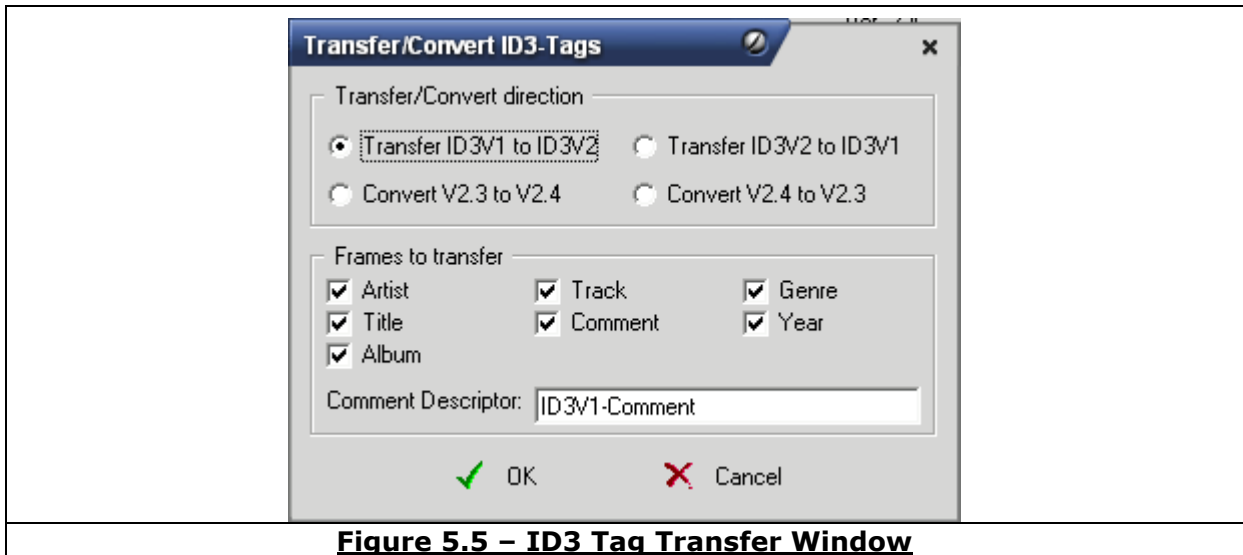


Figure 5.5 – ID3 Tag Transfer Window

The steps for adding ID3v1 info can be reversed. Just do the same basic steps, add your ID3v2 info, and then open up the Transfer/Convert ID3-Tag window again, and just choose “Transfer ID3V2 to ID3V1” instead.

Mass File Renaming Using Tag Information

ID3-TagIt comes with the option to take and rename files using the tag information. Remember, the best format is Album/Game – Song Title.mp3 but no matter what format you choose, you’ll have to make sure you have the needed information in your tags. If you have messy filenames and no Title information, you’ll have to manually enter the title of each song in the tag editor.

Once you’ve finished that, you’re ready for renaming. For this, you would go to the Format menu and press “TAG Ver. 1 to Filename.” Enter the format you want your filenames to be, and the program will take the tag info and rename your files in a batch.

Refer to the following figure.

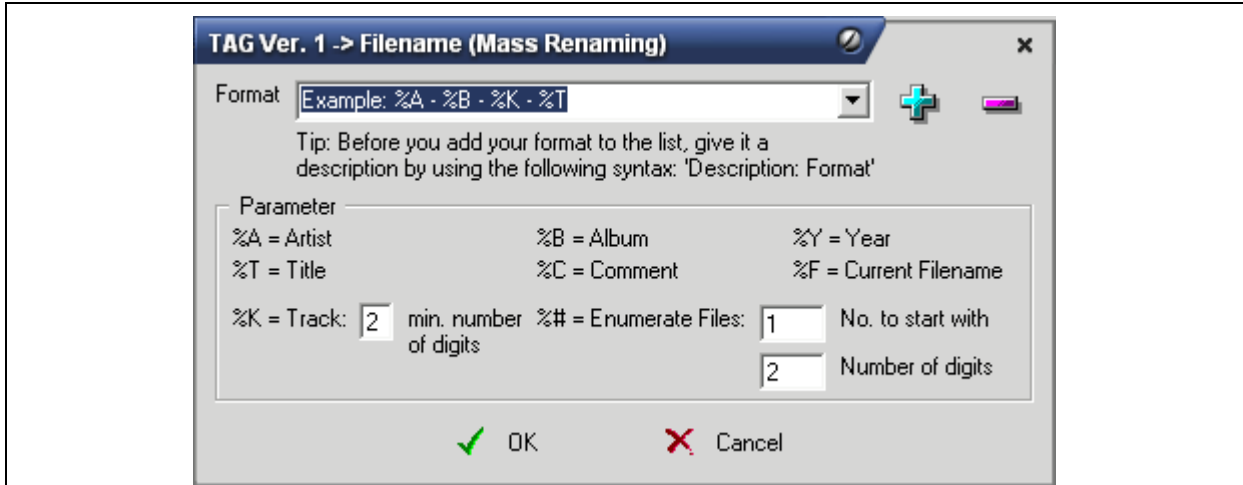


Figure 5.6 – Massively renaming files

6 - Normalization

Overview

There is nothing more annoying than listening to a song on the radio only to have it followed by a song that is either too loud or too quiet. Imagine listening to a nice, naturally quiet NiGHTS track only to have it transition to a very loud ChuChu Rocket sample. The end result is a frustrated listener who must constantly adjust the volume at their console, sometimes at a per song basis.

This effect is nothing new and is due to the fact that our music comes from various sources, which tend to have their own “standard” at which volume to record their music at. These standards tend to vary by album, by year, or even on a per song basis

Tool of the Trade

For the convenience of the listener, and for a better end product, all songs must be adjusted or “normalized” to a maximum preset volume. Doing this ensures that one track doesn’t sound too quiet or loud compared to the next.

Ideally, one would want a tool that can perform such normalization on MP3 in a lossless manor. This would mean that the music file could be adjusted without the need of reencoding, preserving quality. Fortunately, there are many such tools available. The tool that is recommended and thus introduced here is *MP3Gain*. This tool can be found off of the ftp site or online at:

<http://mp3gain.sourceforge.net/download.php>

With MP3Gain, one can change the natural volume of any music track so that they all flow with each other. And it’s real simple to use. When you open the program, the window should look like that shown in the following figure:

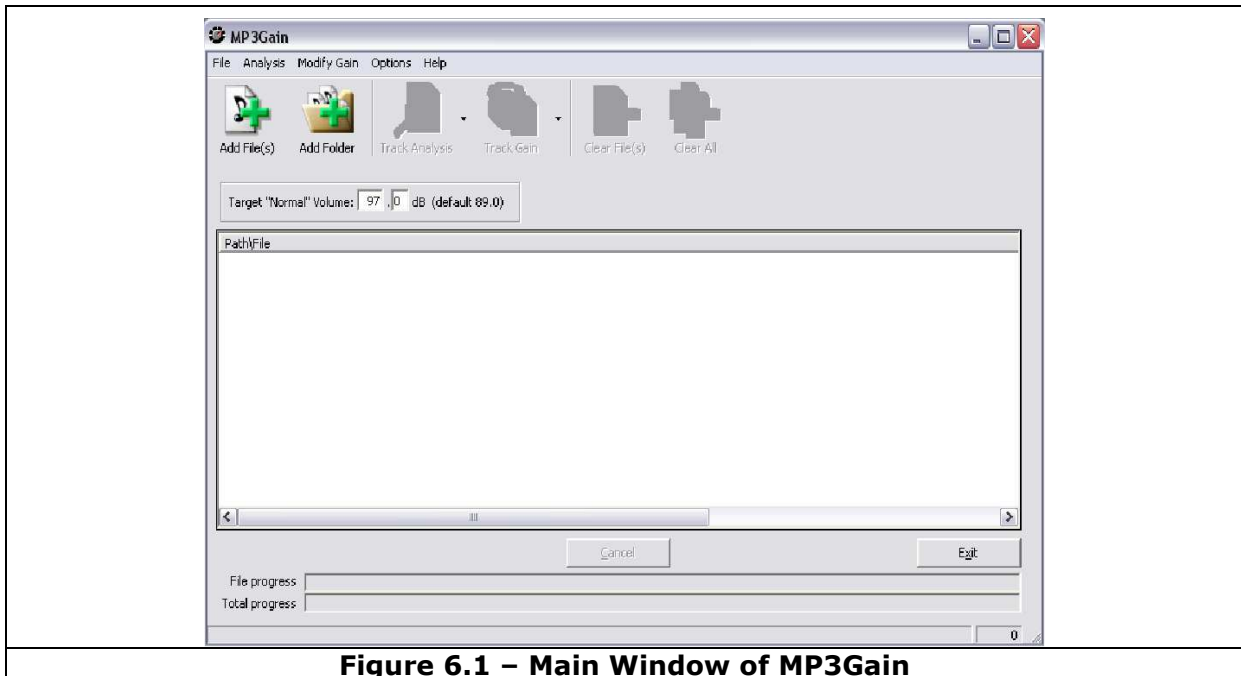


Figure 6.1 – Main Window of MP3Gain

By default, the field where it says “*Target ‘Normal’ Volume:*” should be set to **89.0dB**. This value also corresponds to the *ZRN Audio Normalation Standard* of 89dB, which is something all ‘ZRN stations must abide by.

In order to add files and folders of music, simply click the “*Add File(s)*”/”*Add Folder*” as applicable, and select your file or folder. They will appear in the white area in the center. If you wish to check all the files to see what Volume they’ve been set with, then click the “*Track Analysis*” button to scan them. To set the tracks in the area to the Volume set in the field (read: 89.0dB) then click on “*Track Gain*”. The program will go through each file about twice, once to analysis and another time to change any volume that requires it. Simply wait for it to finish its job and you’re free to upload your files into the *unsorted uploads* directory on ‘ZRN.

When to Apply Normalization

It is strongly recommended that normalization be applied to your music files *before* they are encoded into AM or FM format. There are two reasons for this:

- 1) If normalization was done last, each song would have to be processed twice, (for AM and FM,) wasting time.
- 2) Due to its internal structure, MP3Pro files are not compatible with this tool, which means FM files cannot be normalized after they are created.

To save time, it is best to normalize the high quality copies of any songs you ripped, generated or obtained online with this tool prior to encoding them into broadcast format.

7 - Encoding

Overview

With a library of music on hand, and with each song properly tagged and normalized, it is now time to encode these files for online streaming. Due to online bandwidth limitation, these files need to be condensed so they can be easily and efficiently streamed to each listener in real time. This condensing implies that the files will be re-encoded into a lower, more streaming friendly bitrate.

As with the other media tools, there are many encoders to choose from on the Internet, some free, some at a cost. The tool that will be presented here is jetAudio because it not only supports MP3's, but it also supports the MP3PRO audio format. (The MP3PRO format is used by the FM stations of 'ZRN.) format is which is what

Configuration

If you haven't done so already, install jetAudio. This program can be found either on the FTP server or online at:

<http://www.jetAudio.com>

For MP3PRO support, be sure to install the mp3PRO plug-in.

Launch the program. Near the top of the application will be six (6) icons. Select the second icon to launch the Converter (Encoder) or press "CNTL-2". A window similar to the following figure will be shown.

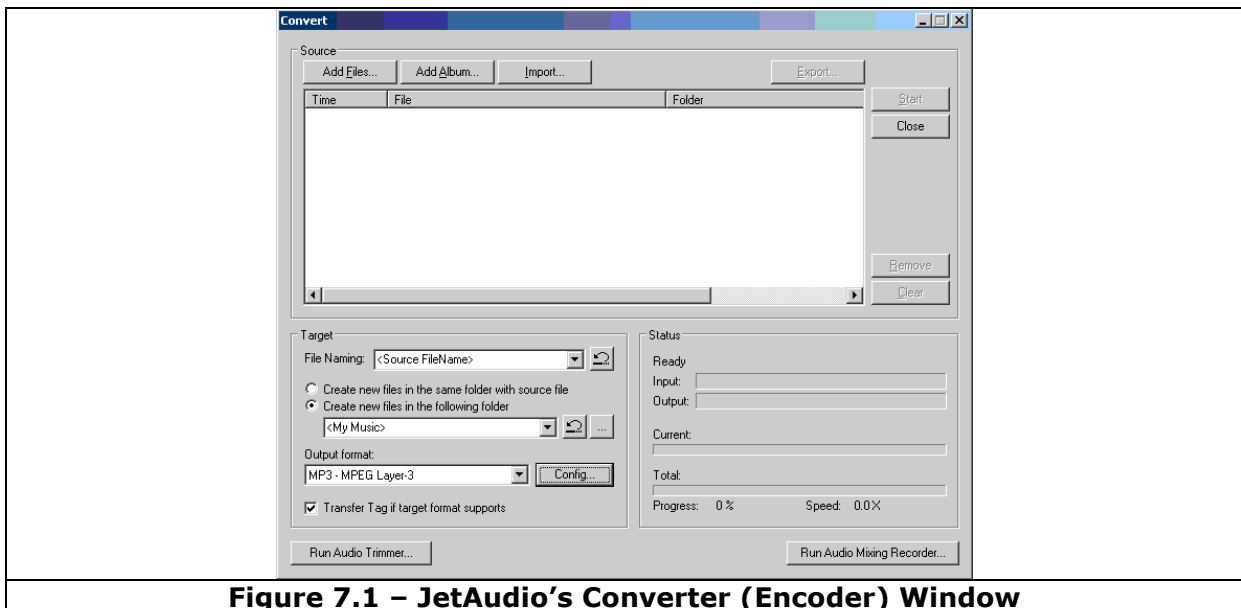


Figure 7.1 – JetAudio's Converter (Encoder) Window

Near the bottom of the window will be an area named “Target”. It is strongly recommended that the pulldown next to “File Naming” be left to the default setting, which is “<Source FileName>”.

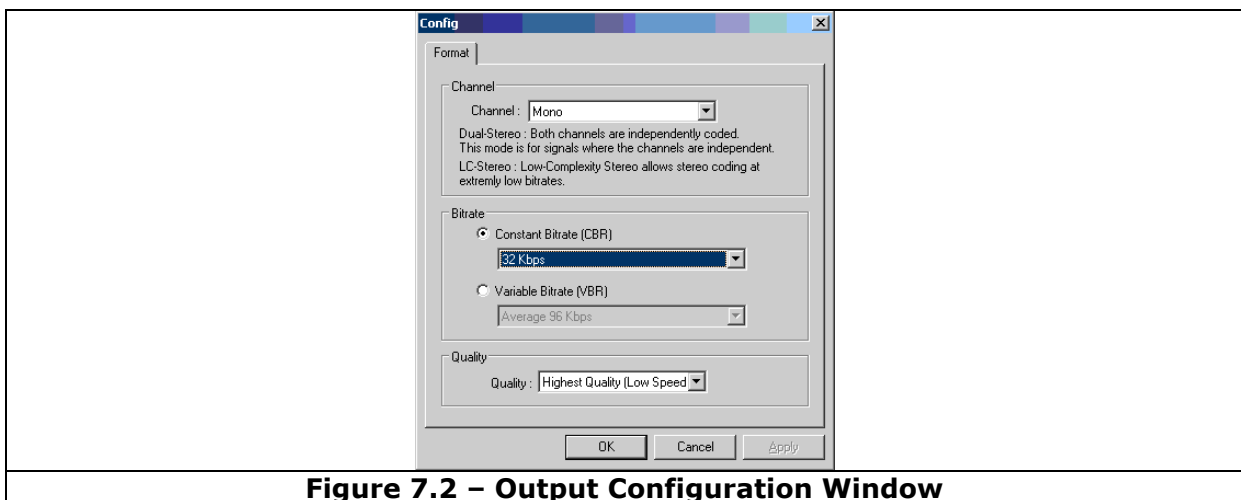
Below that pull down will be two radio buttons. Select the second radio button named “Create new files in the following folder”. Be sure to specify the folder where the convert music files are to be saved in the box below.

Next, ensure that the checkbox next to “Transfer Tag is target format supports” is checked. Failure to do so will tell the tool to not copy any ID3 tag information over to the new file. The ID will have to be reentered by hand as a result, which will be a waste of time. (This box has no effect if encoding a wave file.)

The last setting that needs to be set is the output format. The output format is dependent on whether or not the output is to be in the AM or FM format.

Under “Output Format” will be a pull down menu. If the files are to be encoded into the AM format, select “MP3 – MPEG Layer-3”, otherwise, for FM select “mp3PRO – MPEG Layer 3”.

Click on the neighboring “Config...” button. A window similar to the following figure will be shown.



All ‘ZRN stations broadcast in mono, so for the pull down next to “Channel”, section “Mono.” Under bitrate, select the “Constant Birate” radio button. From its associative pull down menu, select either 16Kbps if encoding into the AM format or 32Kbps for FM.

Finally, under “Quality”, select “Highest Quality (Low Speed)”. ALWAYS USE THE HIGHEST QUALITY ENCODING SETTING! Failure to do so will create audio artifacts, leading to annoying coughs and grumps in the final product. These artifacts are introduced at lower settings because the encoder will only spend so much time encoding

a data packet. In the name of speed, it will return a “best effort” result for the time it had and move on, even if the results are not the best.

Press the “OK” button to save settings. The tool is now ready to begin encoding.

Encoding

Now you can start adding all the files you want by clicking ‘Add Files’ or by dragging and dropping them from a Window’s “File Explorer” window. A list of files to be encoded will be shown.

Once you are ready to go, just click the ‘Start’ button. Now, just play the waiting game...

All the successfully encoded mp3’s will have a green tick beside the filename in the ‘Convert’ window. If some files or none of the files got converted, check the settings for “output format”. It is possible that “Mono” was not selected for “channel”.

Known Bugs

For whatever reason, if a wave file is converted into a MP3 or mp3PRO file, a “pop” will be added to the end of the track. The reason for this is unknown and there is no known cure.

It is recommended that wave files be converted to a high quality MP3 using some other encoder, such as RazorLame. From these, process the file using as normal and then use jetAudio to perform the final conversion.

8 – Live Broadcasting

Overview

Up to this point, the streamer has been assumed to be a program that plays a playlist of music on the server. An alternative to automated programming is to DJ or host a *Live Broadcast* from your PC. Such programs are the most exciting thing a station operator can do with an Internet radio station, especially while interacting with your audience via an online chat room.

There are many advantages to DJing a live broadcasting. Not only can the DJ craft and edit a playlist in real time, but he or she can mix and match any audio source, whether it be a CD, a microphone, a tape, a wave file, or a music file, and stream it to the broadcaster. A live broadcast can even be used to conduct a live talk show, which can include colleges using an Internet audio chat client.

There are many broadcast tools available; some free, others at a cost. To help introduce the technological fundamentals of running a live show, the tool *jetCast* will be introduced. From this study, the reader should be able to configure their favorite broadcast tool to perform a live show. Finally, some information regarding *SAM*, 'ZRN preferred broadcast tool, will be introduced.

Tool Configuration

Before a broadcast can be made, the tool needs to be configured correctly. To begin, install jetCast. The tool can be found either on the FTP server, or at this address:

<http://www.jetAudio.com>

If jetAudio has already been installed, the tool should be available in the start menu. If you haven't done so already, be sure to install the mp3Pro plug in as well. Once installed, launch the program and click on the "Preferences" button below the "JetCast" logo in the upper left hand corner.

Audio Stream Format

The first setting that needs to be set is the audio stream type or "format". Go to "General->Format" and click on the radio button next to "Use MP3 as streaming format".

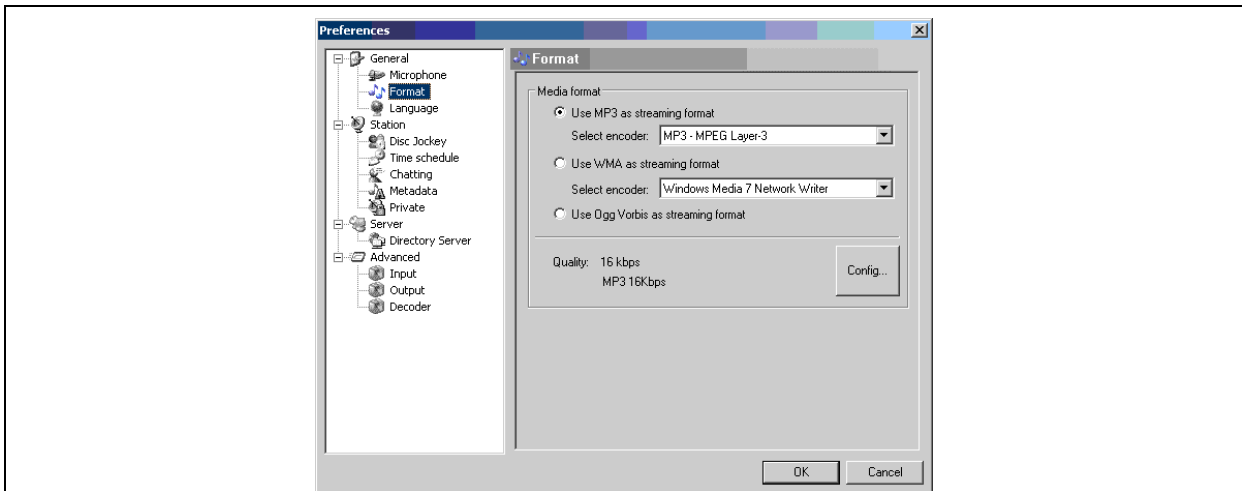


Figure 8.1 – General->Format Display

Next to it will be a pull down menu. The format to select is depended on the media type for the station. Below is a chart for ‘ZRN’s radio stations:

Type	Select the following from pull down
AM	MP3 - MPEG Layer 3
FM	mp3PRO - MPEG Layer-3

Next, click on the large “Config...” button below.

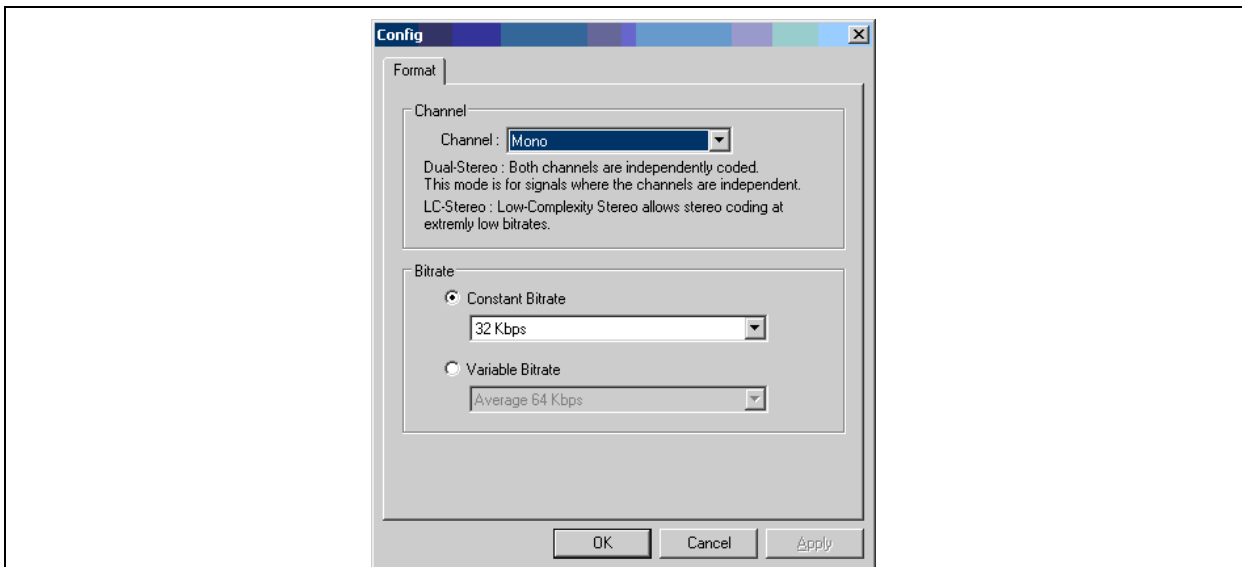


Figure 8.2 – Format Configuration Window

‘ZRN’s Audio standard specify that only single channel or “mono” audio is to be used. Therefore, under channel select “mono”. Under bitrate, select the radio button next to “Constant Bitrate”. Below it will be a pull down menu. The bitrate to select is depended on the media type for the station. Below is a chart for ‘ZRN’s radio stations:

Type	Bitrate
AM	16 Kbps
FM	32 Kbps

Press the “ok” button to complete setup.

The observant reader may be questioning, “Why about the sampling frequency?” The tool sets this setting automatically, so there is no reason to worry about it. (For those that are interested, the tool just happens to use 11Khz and 44Khz for the AM and FM formats, respectively. The makers of jetAudio must have come to the same sampling rate conclusions that Andy made some time ago.)

Server Configuration

The next area of interest is the server settings. The way the tool will be configured is this: the audio stream will be generated locally on the user’s computer. This audio stream will then be forwarded to user’s Icecast station on ‘ZRN. If a listener wants to tune in, he or she merely needs to connect to the Icecast server in question. It is important to note that listener will NOT be connecting

Under the preferences window, go to “Server”. A window similar to the next figure should be shown.

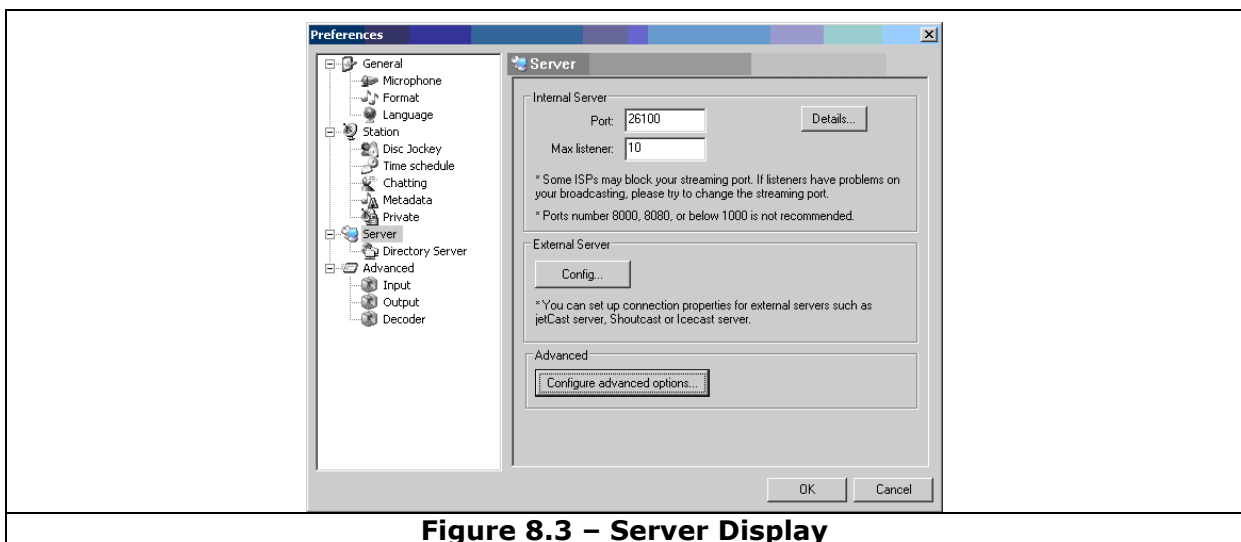


Figure 8.3 – Server Display

Next, click on the “Config...” button under “External Server”. A window similar to the next figure will be shown.

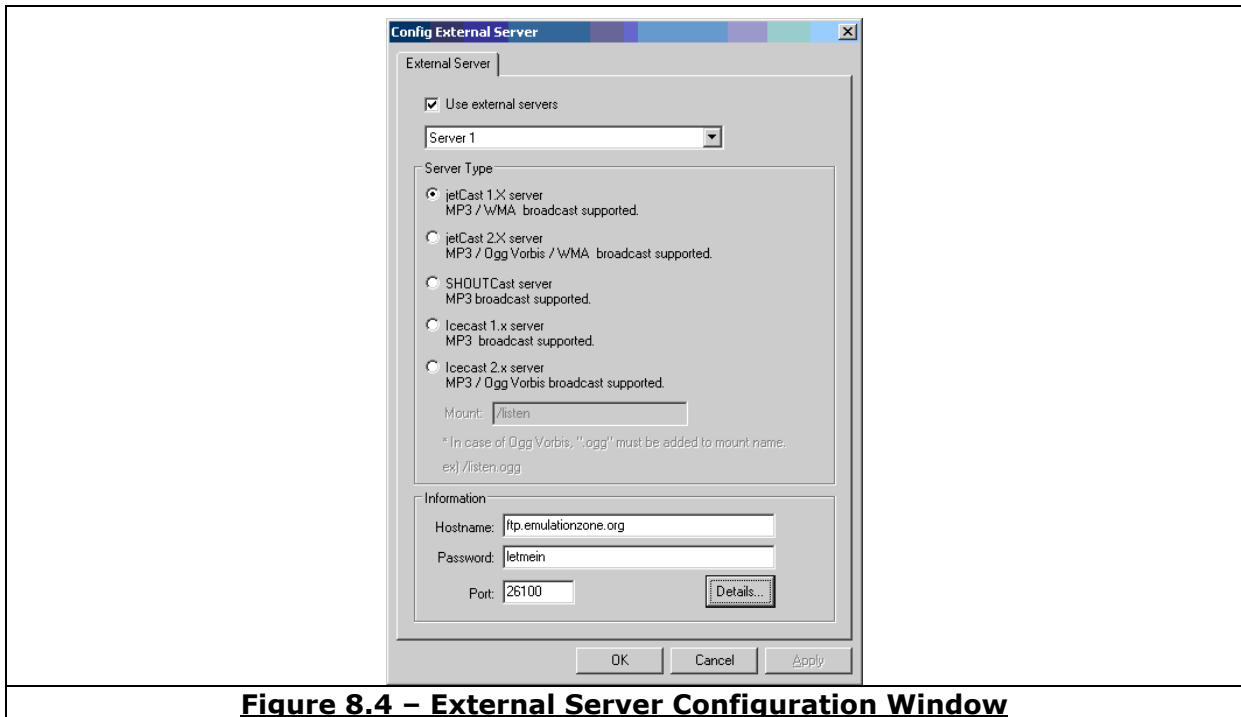


Figure 8.4 – External Server Configuration Window

Check the box next to “Use external servers”. Leave the pull down alone: it’s purpose is to allow multiple configurations to be saved. Under server type, select the radio button next to “Icecast 1.x server.”

At the bottom of the window will be an “Information” area. Under hostname, enter “ftp.emulationzone.org”. The password is the encoder password for the Icecast server in question. If the password is unknown, refer to the “ZRN Operations Manual” for information on how to determine what it is. Typically, the admin, encoder and operator passwords for a station will be the same, but not always.

Finally, for “port”, enter the port number used to connect to the station of interest. If the port number is unknown, refer to the “ZRN Operations Manual”.

Click the “ok” button to save the changes.

NOTE: The “Internal Server” option may be used to host a live show off your computer. The number of listeners that you can serve will be limited by your upstream capacity, so such usage is only recommended to test out your DJ skills with a friend. Configuring an “Internal Server” is beyond the scope of this document. For those that do attempt this, be sure to play around with the “Advanced” settings” and to play around with port forwarding settings at your local router.

“Microphone” Setup

The final area of interest is microphone setup. A better name for this feature would be “secondary audio source selection”. With this feature, a DJ can click a button to either turn on the microphone or enable playback from a secondary audio source, such as an external tape player or another radio. This feature can also be used to broadcast the audio that comes out of the DJ’s speakers, such as window events, or the chatter from an online Internet chat conversation.

Under the preferences window, go to “General->Microphone”. A window similar to the next figure should be shown.

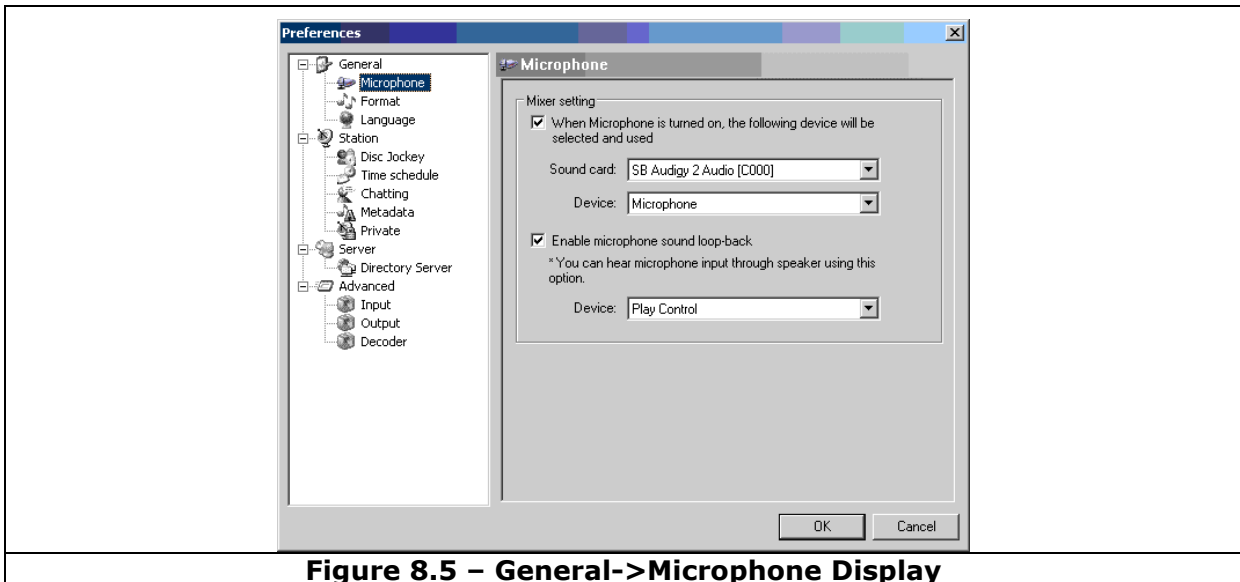


Figure 8.5 – General->Microphone Display

Near the top of the window, check off the top check box. If the DJ’s system has more than one sound card, select the sound card that will be used from it’s neighboring pull down menu.

The “Device” pull down is where things get interesting. The input that is selected will be heard whenever the “mic” button on the main window is pressed. (This feature is discussed later.) The PC has many inputs. The one to select is dependent on what the DJ wants to do. The following table has some recommendations:

Input	Recommended Use
<i>microphone</i>	Should be used if the DJ wishes to talk during a show
<i>MIDI synth</i>	Used if MIDI music is to be played. (Note: this input should only be selected if MIDI music is not heard otherwise for whatever reason.)
<i>Wave</i>	Plays back only "digital audio", or audio that was not from an audio source.
<i>Analog Mix</i>	Plays back audio from an analog out source, such as a CD player. (The audio source is selected via the Window's mixer.)
<i>What U Hear / Output Mix</i>	The most flexible of the group. Broadcasts whatever is heard on the DJ's speakers. Select this input if the DJ wishes to broadcast an online discussion with several colleges. (Some OSs label this instead as "Stereo mix".)

Finally, the last checkbox in this window should only be checked if the DJ wishes to hear the audio source as it's being recorded. It is recommended that this setting be enabled and the properly audio source be selected based on the selections from the previous pull down menu. Only disable this feature if too much "feedback" is being heard and there is no other way to defeat it.

Feedback occurs when what was just played or said on the air is played off the speakers, picked-up by the microphone, and retransmitted. The result is that the audio is heard once again by the listener, much like an echo. If left unchecked, the audio will keep being feed over and over again into the system until it becomes an unpleasant screeching sound. (One will know it when they hear it.) Options to defeat this problem are to either lower the speaker volume or to use headphones. Only uncheck this box as a last resort because depending on the input type, the audio may not be heard by the listener as a result.

Windows's Mixer Configuration (Optional)

The window's mixer is a program that sets the volume levels for various sources of recording and playback on the computer. It can also used to select what input is used as the audio input. This subsection will only be of interest if the broadcast tool either lacks such management internally or if the built-in functions do not function correctly.

The Windows mixer can be accessed via "Start->Programs->Accessories->Entertainment->Volume Control". There are two windows that are part of the mixer: Record Control and Play Control. These windows can be accessed by selecting their matching radio button under "Options->Playback". The following figure shows a sample of a "Record Control" window.

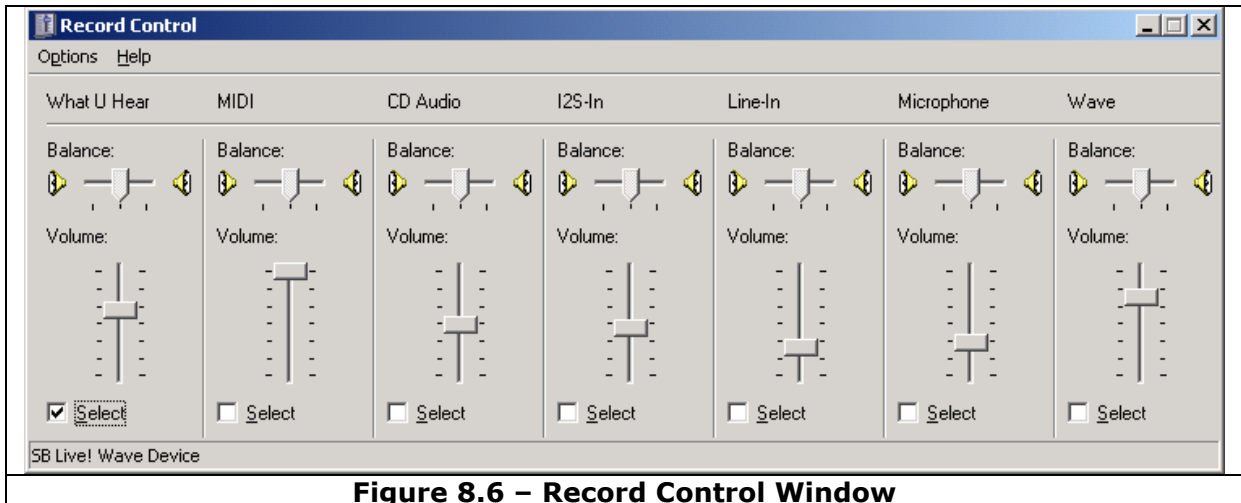


Figure 8.6 – Record Control Window

A typical computer has many audio inputs to choose from. As a result, the audio input that is to be recorded from may need to be specified manually. Furthermore, only one “source” can be selected at a time. It is recommended that the “What U Hear” input be used for broadcasting. (May be labeled as “Stereo Mix” on some OSs.) Selecting this source will allow a DJ to play various audio formats and sources within most audio players, such as MIDI, MOD, MP3, etc without having to select the source that corresponds the audio source. (Example, *MIDI* for MIDI files, *WAVE* for MP3 or *WAVE* files, *CD Audio* for live CD Audio, *TAD* for PCs equipped with a telephone answering machine, etc.)

Older sound cards may not have the “What U Hear” option, such as the SB16, SB32, or any ISA-based sound cards. For these cards, you will need to manually select the source that corresponds to the audio you wish to record. Furthermore, you may not be able to mix two audio sources over the air as well.

If you are going to do a music-only broadcast, you might want to consider selecting *WAVE* as your audio source.

The following figure shows a sample “Play Control” window.

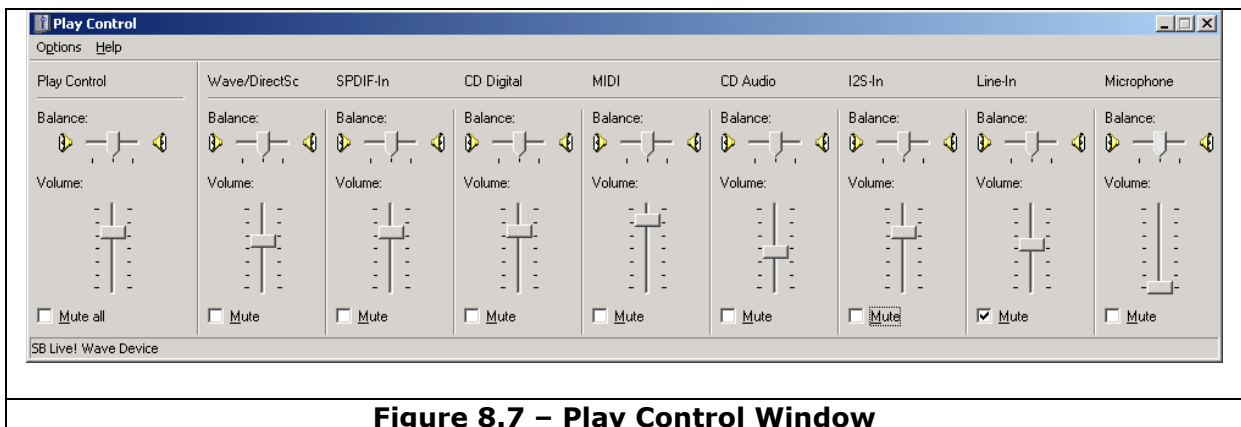


Figure 8.7 – Play Control Window

All boxes should be unchecked. If you are going to use the “What U Hear” for the recording source, then the “Line-In” box should be checked. If you uncheck it, the “microphone” box will become checked. This crazy behavior is normal.

Quality Assurance Settings

The last thing a broadcaster wants to do is to go through all this trouble just to have an awful sounding broadcast, or to have your station be named “Test Station”. Below are some tips to keep things sounding, and looking, good.

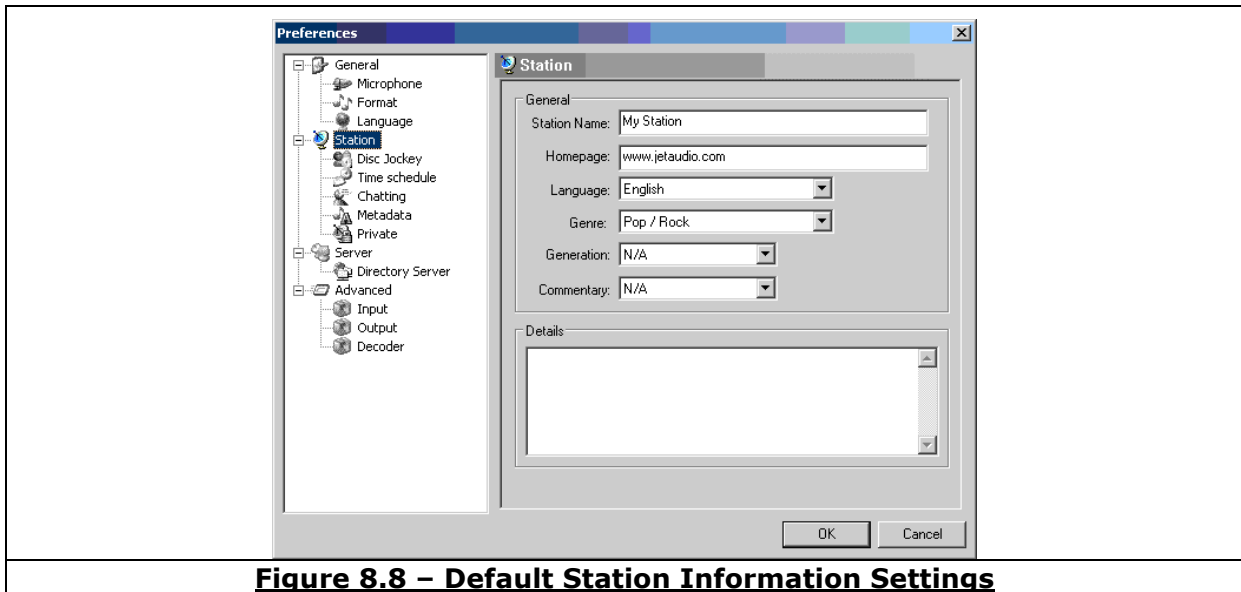


Figure 8.8 – Default Station Information Settings

Under the preferences window, go to “General”. Ensure that the option of “Crossfade” is enabled. When a song is about to end, the audio will “fade” and the start of the next song will fade in. The net results is a professional sounding transition between songs.

In the same window, enable “Automatic Gain Control”. While the purpose of the sidebar is unknown, what is know is that this feature will perform audio normalization on the fly to ensure things don’t sound too loud or too quite. For more information on “normalization”, refer to the “normalization” chapter of this guide.

Next, click on “Station” and fill in the fields to how you see fit. Next, click on “Station->Disk Jockey” and fill in the fields accordingly. Use an alias for your name if you do desired. Then, , go to “Station->Metadata”. Enter the following for “Title format string”.

`%t-%a`

Under “URL format String”, enter the URL to the station’s website.

Finally, click on “Server->Directory Server”. This screen asks if the DJ would like to have the broadcast listed in the jetCast and/or Shoutcast directories. With this enabled,

the broadcaster will have their live show listed on jetaudio.com and Shoutcast.com. The net result is some free advertisement, which may yield some additional listeners. Check the appropriate box(es) if such a feature is desired.

Hit the “ok” button to save settings.

Connecting

To connect to the Icecast server and to being broadcasting, click on the satellite dish icon on the left side of the window. If message is returned stating that a connection to the server could not be made, double check the settings entered in the previous section and try again. A message stating that a connection could not be made to the directory server is not critical and can be ignore if so desired: sound a message does not import a live broadcast.



Figure 8.9 – Making a successful connection

If everything went through correctly, the jetCast logo and the words “On Air” will be flashing at the top of the window. A timer near the bottom right of the window will have been started as well.

Everything is now in place except for significant fact: all current listeners are listening to the automated audio stream and all new listeners will be directed to this stream as well. Instruction on how to deal with this is discussed in the next section.

Source Swapping

When starting a live broadcast, what one wants to do is to “swap” whatever is being streamed to the listeners and replace it with the live broadcast. Also, all new listeners should be directed to this live broadcast as well. To net a professional appeal, all of this

must occur WITHOUT dropping a listener. Fortunately, ‘ZRN has a tool to allow a DJ to perform such a swap with ease.

IceCast Configuration

Before preceding the following configurations must be made to the Icecast server in question. These settings should be set by default for all ‘ZRN station. For more information on how to examine or change these settings, refer to the “‘ZRN Operations Manual”.

First, you will want to change the value of “client_timeout” to a value of 5. The number corresponds to the number of seconds the broadcast will wait for the kicked source to reconnect before it switches to us. Do not use 0. Finally, set the value of “kick_clients” to 0. A zero will ensure that no listeners are dropped if a source goes down.

How to Source Swap

First, connect the ‘ZRN’s “Private” area and access the phpCast application. (For more information on how to access phpCast, refer to the “‘ZRN Operations Manual.”) Configure phpCast to the station of interest and press “OK”.

Next, click on the “sources” command. In the window that appears, two sources should be listed. (For a sample, refer to the following figure.)



Figure 8.10 – phpCast’s Sources Display

The “/ices” mountpoint refers to the automated program that runs on the server. (Ices) The other mountpoint, “/listen” refers to the audio stream originating from the DJs computer. The display should note which source is the “default” audio source, which will be “/ices”.

To swap all listeners to the live broadcast, and to make the live broadcast the default audio source for any new listener, check off the checkbox next to the ID number of the

DJs source, select the “force into default” radio button, and press “ok”. If successful, the window should note a different source for the “default” audio source.

id	name	mountpoint	ip	clients	title	priority
0 <input type="checkbox"/>	'ZRN: Remix Radio	/ices	127.0.0.1] [Host: localhost	0	Mega Man 2 - Wily Stage 1	0
1428 <input type="checkbox"/>	'ZRN: Remix Radio	/listen	141.175.154.43	0	NetgameOver- Returning to Server	255

1428 (/listen) This is the default audio source. Any new listener to this stations will be tuned in to this audio source by default.

The default source has changed to that of the live programming.

Figure 8.11 – phpCast Sources Display After a Successful Source Swap

Everything is now set for the public to listen in. What the listener will hear is the old audio stream. Once the command is invoked, the listener will hear a brief pause, followed by the new audio stream.

Stats File bug

For whatever reason, the stats file that is generated by Icecast will report the song title for the oldest audio source connected to the station. That means that the song title reported on station’s website will be incorrect, even after a successful source swap. The song title that is reported by the listener’s client will be correct, however.

There are two methods in which to address this bug. If the song title that is reported on the station is not important, then this step can be ignored.

- 1) Shutdown Ices after the swap has been made and to restart it thereafter, making it the newer audio source.
- 2) Modify the source to extract song title information directly from Icecast. For an example of what do, refer to SSR’s website, (/chan0)

For reference only

The following defines the algorithm in which Icecast uses to determine which audio source is the “default” one.

If two or more audio sources are connected to the server, Icecast first checks to see which audio source has the highest priority number. The one with the highest priority number is chosen. If two or more sources have the same priority number, Icecast selects the oldest source, which is the one with the lowest ID number.

Disconnecting

There are two ways to disconnect and end a live broadcast: the hard way and the easy way.

The Hard Way

When the live show is done, play some kind of “bumper” song in the background and access phpCast for the station in question. Select the “sources” command and perform a “source swap” from the live show to the automated “Ices” program. The DJ can now disconnect.

The Easy Way

Have the DJ disconnect. After a short timeout period of 5 seconds, all listeners will be switched over to the automated “Ices” program. The listener will notice a period of silence when doing this, but it’s brief.

Using the Tool

There are some things to keep in mind when using jetCast or any broadcaster.

Best Audio Quality

For the best audio quality, turn the mic off when playing music. This forces jetCast to form a direct link between the player and the encoder. In other words, the encoder reads the file of what is being played and encodes it as is directly. The end results is a song that is free of any possible distortions or volume level shifting that could if the “What U Hear” audio source was being used.

If an audio input is being used, (such as the microphone,) it is strongly recommended that the Window’s mixer be set so that the “volume meter” is never reaches or tries to exceed the peak volume during normal use. Failure to do this will result in audio that sounds awful.

Dead Air can cause disconnects

Obviously, if a playlist of songs has been completed playing and the tool is not set to loop back to the first song, nothing will be played. The problem with this is that the encoder now has NOTHING to encode. As a result, the data stream to the server will be paused. After the audio stream is not restored within a short timeout period, (5 seconds,) the station’s listeners will be bumped to some other source connected to the server, causing the program to loose listeners.

The solution to this problem is to either:

- a) Enable playlist looping
- b) Force the “mic” to be turned on at the end of the song.
- c) Broadcast “What U Hear”/ ”Stereo Mix”.

To enable the mic after a song has completed playing, access the pull down menu to the right of the song name and select “enable mic after song has completed”. If desired, the mic can be enabled before a song is played.

Note: if 5 seconds seems too short for a timeout period, a longer duration can be set by editing the station’s configuration file. (Refer to the “ZRN Operations Manual” for more information.)

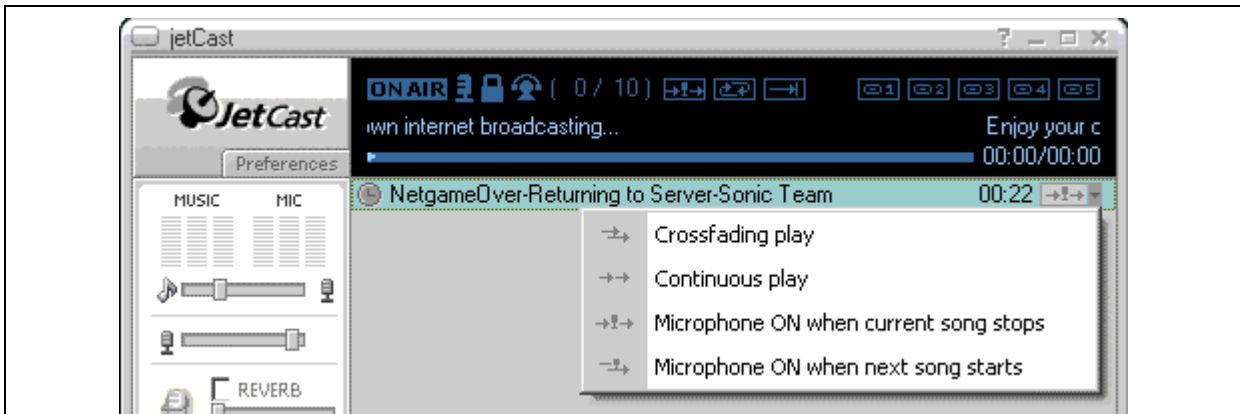


Figure 8.12 – Auto Microphone Enable Settings

Alternatively, the “What U Hear” source could be selected as the “secondary audio source.” Just press the “mic” button after starting the show and the encoder will never run out of things to encode, even if there is dead air. (It can at least encode dead air.) As a result, listeners will never get bumped. The downside is that if the mixer levels are not set correctly, the audio may sound bad.

SAM Information

The Sam Winamp plug-in is the broadcaster of choice for ‘ZRN. It has some great features, but it’s not as simple to use as jetCast.

Instead of regurgitating what was already said in this manual, this section will focus only on key issues when using SAM.

Installation

The SAM plug in requires either Winamp 2.x or 5.x. The tool can be found on the FTP server or at:

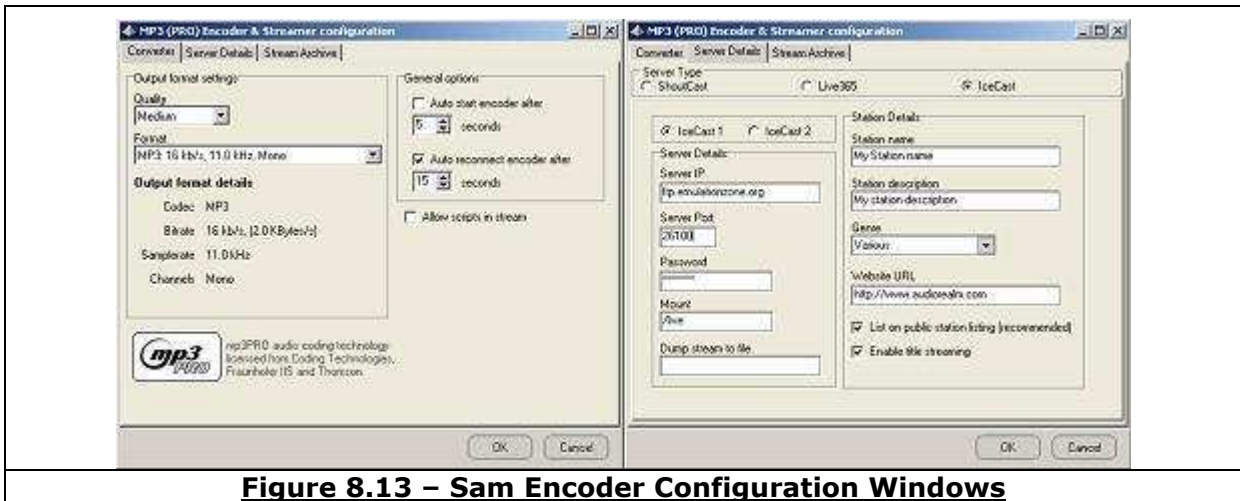
<http://www.spacialaudio.com>

Configuration

To access the tool, first enter Winamp Preferences by pressing “CNTL-P”. Then select “Plug-ins->DSP-Effect”. Select “SAM Encoder” from the list.

Unlike jetCast, SAM allows a user to configure multiple encoders. This means that a DJ can host a show on both the AM and FM channels of their station at once. Better yet, the DJ can host the show on server stations at once, bandwidth permitting.

To configure the tool to broadcast to a station, an encoder needs to be added. This functionality can be accessed by clicking on the plus sign. In the window that appears, select the radio button next to “MP3 and mp3PRO” and press “OK”.



On the following window, there will be at least three tabs at the top. Select “Converter”. Under quality, select “High Quality” from the pull down menu. Only select a lower quality setting if a noticeable slowdown occurs while broadcasting. Under format, select the correct format based on the station type. (AM or FM.)

Select the “Server Details” tab. Under server type, select “IceCast” and then “Icecast 1”. Enter the appropriate information for “Server Details” and “Station Details” as described previous for jetCast. Make sure the “Enable Title Streaming” box is checked. Press “OK” when done.

Repeat this process for any additional encoders that need to be installed.

NOTE: “Stream Archive” allows a live broadcast to be saved to disk for later listening. The feature is great for DJ that are curious as to how he or she sounds on the air. Usage of this feature is optional and beyond the scope of this manual.

Connecting

To connect, select the source you wish to connect and press the “play” icon. If there are many stations, the icon must be pressed for each station.

Source Swapping

The process is the same as for jetCast.

Two Little Circles

In the “encoders” window of SAM, there are two circles: a blue circle and a red circle. Ironically, these two circles hide a lot of functionality.

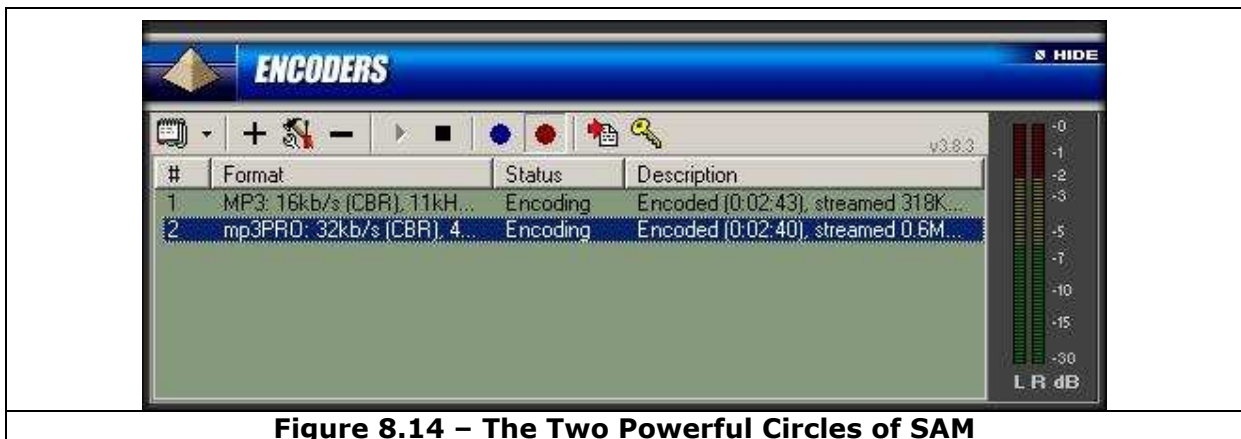


Figure 8.14 – The Two Powerful Circles of SAM

The blue circle tells the tool to use the DSP-output from Winamp. In other words, whatever audio is played within Winamp is sent to the encoders, which in turn is broadcasted to Icecast.

The red circle tells the tool to use the soundcard as an audio input. In other words, whatever audio input is selected via the Window’s Mixer setting will be broadcasted.

For general use, configure the mixer to record from the “What U Hear” input. Be sure that in the “playback control” window the microphone is not muted and set to an acceptable level. With this configuration, the “blue” circle is to be used whenever music is being played. If you wish to speak on the microphone, press the “red” circle.

Other Info

The warning regarding “dead air” is the same here with SAM. The only “fool proof” way around this issue is to use the “red” circle exclusively.

9 – F A Q

Below is a list of answers to common questions regarding content in this manual.. If you have any questions, you can contact me, Andy, at wacko@emulationzone.org

Q. insert question here

A. Place answer there.

There is no other Q&A information to add at this time.