

VideoCD Audio: an alternative to MP3 CD compatible with DVD players

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1. INTRODUCTION

This manual is a translation into English from the original Spanish document available in www.videoedicion.org and www.vcdsp.com, firstly published on April-2002.

When sound compression system MPEG-1 Layer 3, better known as MP3, appeared, it was a big success for music enthusiasts. Apart from the advantage of easy Internet transmission, it is a very recommended way for storing the contents of several CD-DA (the standard digital audio CD) in a single disc, preserving (more or less ;-)) the original sound quality.

The main MP3 drawback is that, to play a CD with MP3 files, you need a computer. It is true that more and more new DVD players are MP3 compatible, but in practice their performances are often limited. In fact it is not unusual to meet some problems at playing them. They are usually related to coding (constant or variable bit rate, CBR or VBR), bit rate amount, CD file structure, number of characters for the filenames,.....

In this manual, it will be describe a procedure for making a CD with compressed music, similar to MP3 but playable in many presently available DVD players. The proposed method takes advantage of VideoCD (VCD) standard that is readable by almost any DVD.

2. VCD, CVCD y VCD-A

A VCD, as its name shows, is a CD that stores audio and video. Audio is compressed following the standard MPEG-1 Layer 2, also known as MP2. For the same quality level, MP2 compresses less than MP3. Anyway, at a bit rate of 224 kbps (or even less) the quality offered by MP2 is excellent.

Video is compressed at (about) 1.150 kbps constant bit rate. A standard VCD, fully compliant with the White Book specifications, can store about 70 minutes of information (audio+video+menus) with picture quality equivalent to VHS and CD like sound quality.

An excellent introduction to VideoCD concepts, from a technical point of view, can be found in the GNU VCDImager manual available in <http://www.vcdimager.org/>

From a commercial point of view, VCD did not have too much success in Europe, but in Asia it was very successful, even more than videotapes.

Some years later, when DVD had already been commercially launched, someone discovered that many DVD players were able of reading, not only standard VCD, but also some not fully standard discs. These not standard VCD used to be made with variable bit rate for video (like in fact DVD does) and constant bit rate for audio (but at a bit rate lower than standard 224 kbps). A new range of possibilities was open.

This VCD variant, often named CVCD, was quickly used for "backup" copies of DVD movies over CD-R/RW media.

Another use, surprisingly little spread, is based on **using most of VCD capacity for storing audio data, instead of video data**, as the standard sets. As a consequence, much more music can be put in a single CD and besides, as we will see, it can be played in many home DVD players (but not in everyone). This new kind of non-standard VCD can be called **VideoCD Audio (VCD-A** if shortest acronym is preferred due to DVD Audio concept similarity).

A CD-DA uses 1.411,2 kbps for PCM audio encoding (44.100 samples per second x 2 channels x 16 bits per sample). If audio is compressed at for example 192 kbps, the compression ratio with the CD-DA is 7,35:1. This means that a VCD-A can store more than 9 hours of high quality music.

You can also take advantage of additional VCD standard facilities **for theme selection through menus displayed in the TV screen**. The White Book standard support up to **99 tracks in a single VCD**. Menus are included in an additional track.

3. STEPS AND TOOLS FOR VCD-A AUTHORIZING

The guideline described next is only one of the existing possibilities, I hope I chose the easiest one. Software tools selected are high quality ones and all of them are available in Internet, in free or shareware versions. New versions of most of these programs often are released, but concepts remain unchanged. Steps and programs are summarised in the following table.

	Step	Program	Web
1^a	Audio ripping from CD-DA and volume normalisation	CDex 1.40b9	www.cdex.n3.net
2^a	Audio encoding and generation of .mpg files	TMPGEnc 2.50	www.tmpgenc.net
3^a	Menu design and CD-R/RW writing	Nero 5.5.7.2	www.nero.com

Some previous considerations about source audio files should be taken into account.

- They can be files ripped directly from a CD-DA (for example with CDex) or any other available .WAV file, but always PCM encoded, with 44,1 kHz sampling frequency, 16 bits per sample and 2 channels (stereo). This is the recommended option for best quality assurance.
- They could be also .MP3 files because TMPGEnc accepts them as input, but sampled at 44,1 kHz. Not recommended due to added quality losses (first at MP3 encoding and later on at MP2 encoding).
- If audio files have different sources of origin, then applying **volume normalisation** is very convenient in order to avoid some themes to sound much louder than others. CDex includes this functionality.
- Long filename facility offered by Windows is extremely useful. Take into account that filenames, without the extension, will be displayed in the menu screen for theme selection.

This manual does not cover audio ripping details. There are many common (and free) software tools for doing it, not only CDex.

Warning: Spanish versions of TMPGEnc 2.50 and Nero 5.5.7.2 were used for preparing the original release of this paper. This is the reason why, although this text is written in English, every image included, like screens captured, windows and buttons, are in Spanish.

4. AUDIO ENCODING AND GENERATION OF .MPG FILES

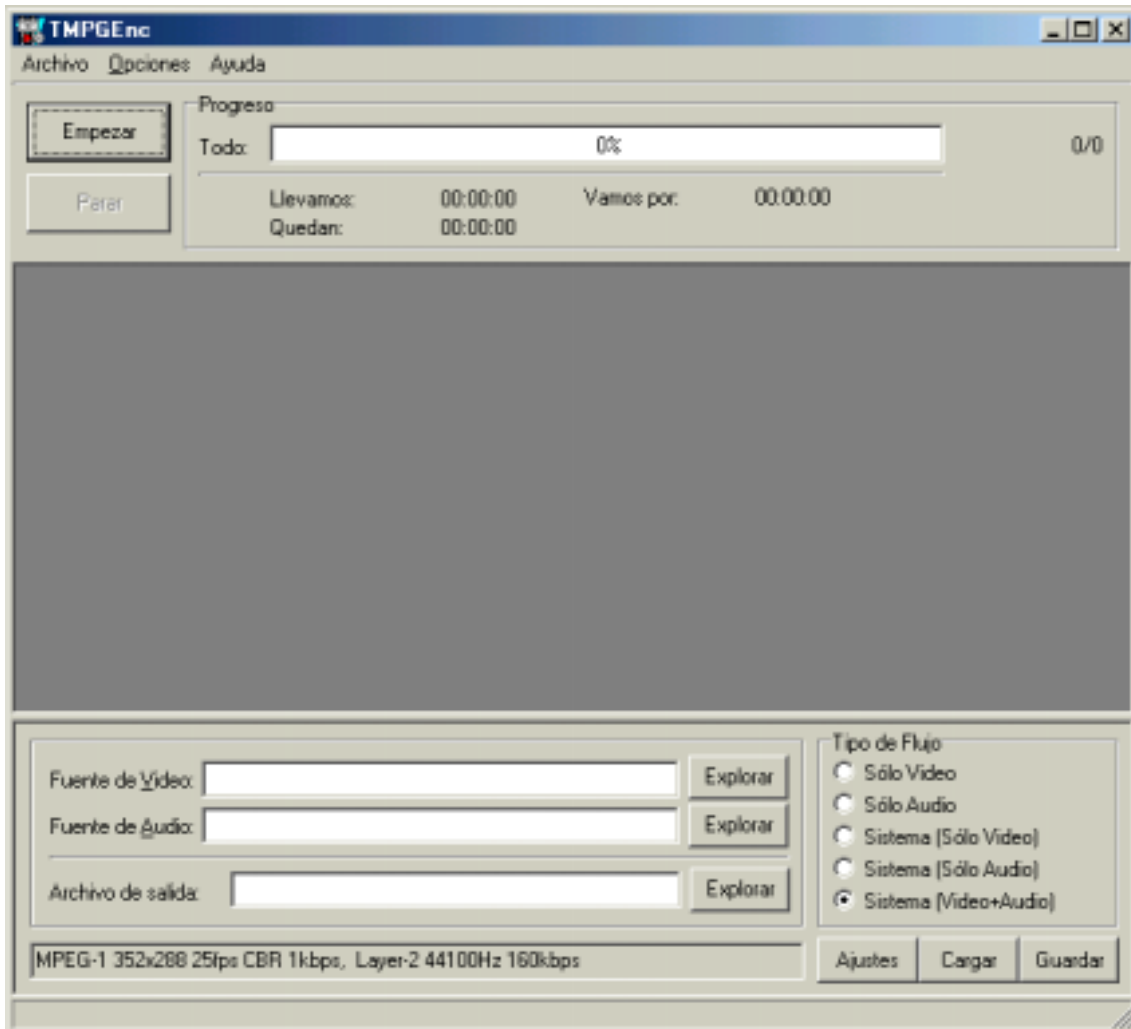
At this point it is assumed that a set of ripped audio files is ready. Each file must have a right filename. Now the MPEG-1/2 encoder program TMPGEnc will be used for generating a set of .MPG files, each one containing an audio file compressed in MP2 and a video stream. These .MPG files will be used at VCD recording time.


The procedure is as follows.

4.1 Start TMPGEnc

Once TMPGEnc main screen appears, several parameters must be configured. Process is much easier if you use a template, but here we will go step by step. The target is to get a good comprehension of the settings. Anyway, after finishing, configuration settings can be saved in a template file for future use.

Tip: even if a template is loaded, you should have a look to every configuration parameter value. Some less important fields were not affected by template values, at least in version 2.50.



To start configuration click on button  (**Settings**)

A new window with six thumb indexes will appear, each one containing several fields.

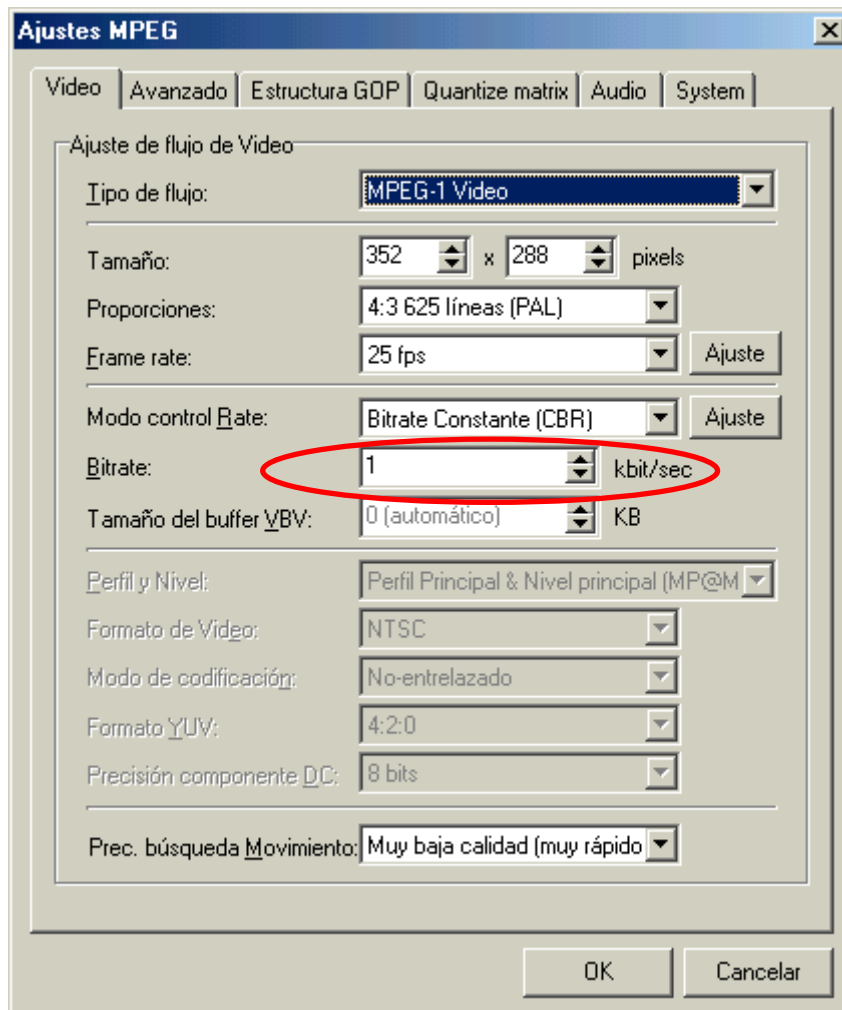
4.2 TMPGEnc settings: Video

Set every field as showed in the following figure (assuming your TV colour system is PAL).

Notice that **Bitrate** selected is only **1 kbps**, instead of 1.150 kbps used with VCD standard.

Remaining fields (**Stream type**, **Size**, **Frame rate**, **Rate control mode**,....) take the same values than standard VCD.

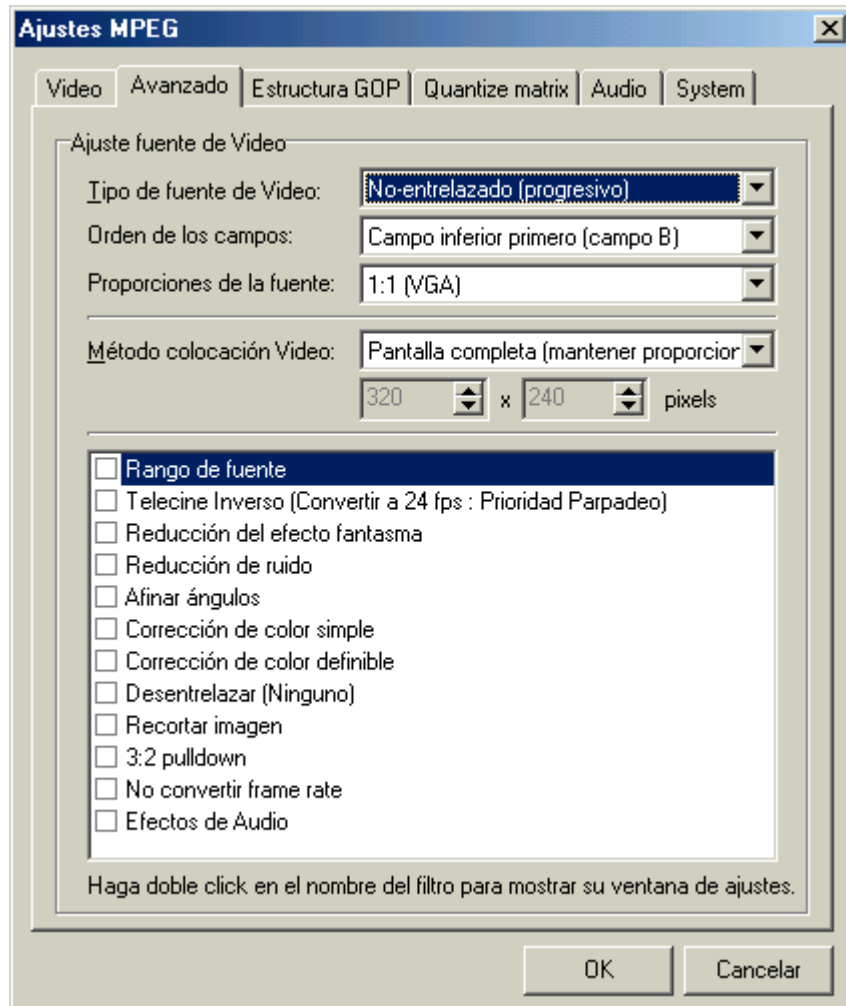
Field **Motion search precision** will be fixed at **Very low quality (very fast)** because no picture will be played, only sounds while the TV screen displays all in black.



4.3 TMPGEnc settings: Advanced

The fields of this window are less important because they are related to video processing.

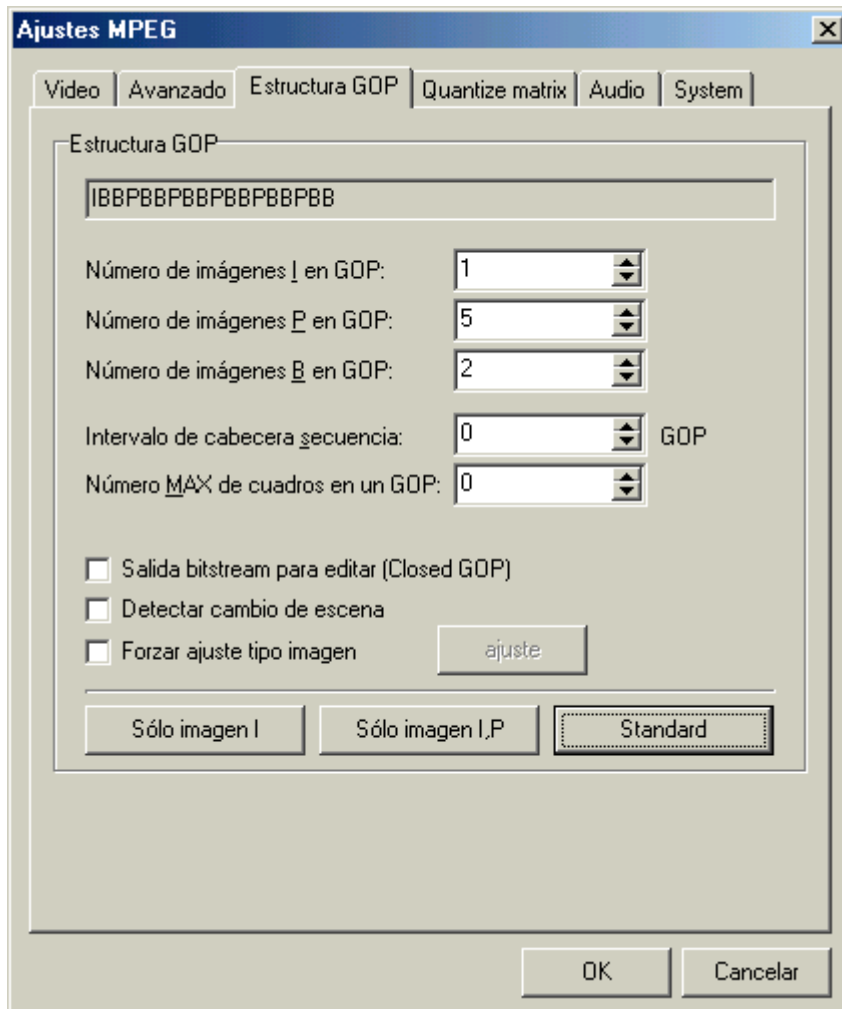
In this case we do not use video source, only audio, and we must take care only of disabling every filter. This is in order to get a TMPGEnc faster processing.



4.4 TMPGEnc settings: GOP

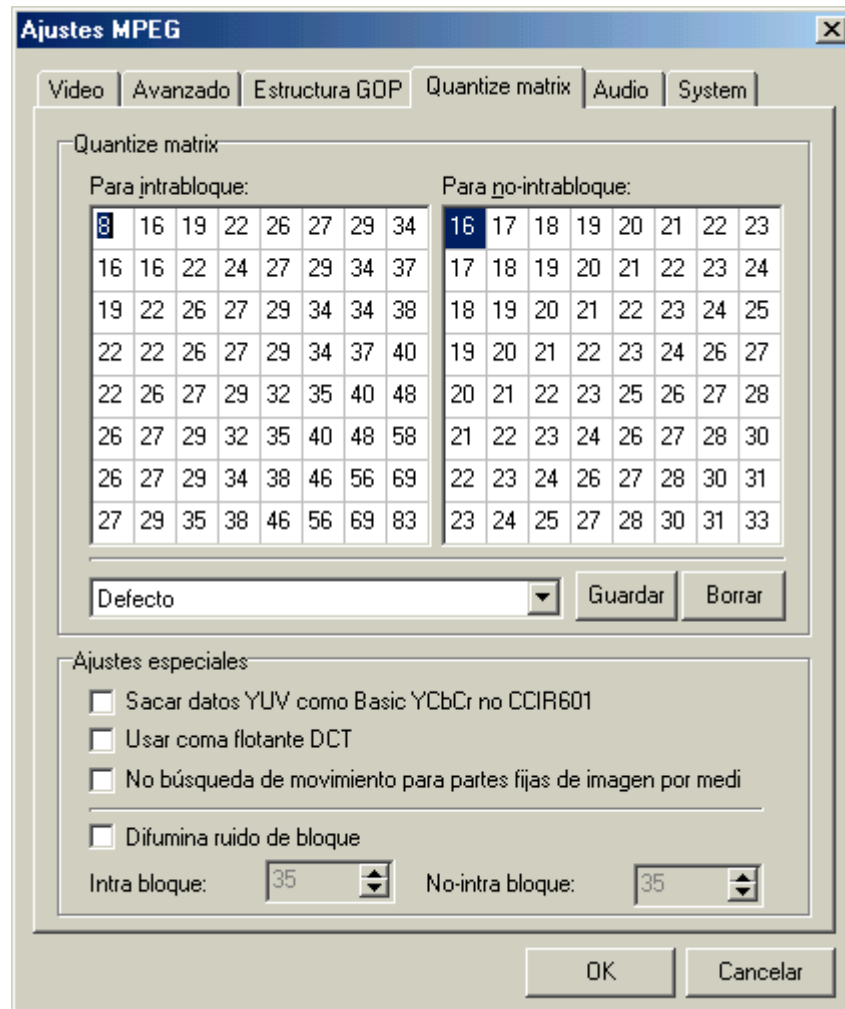
Same comments than in previous point (GOP structure is of critical importance in case you use a still picture with each audio file, but this will be explained in other manual).

Make sure that **Detect scene change** is deactivated, especially if you are using a template.



4.5 TMPGEnc settings: Quantize matrix

Same comments than in previous point.



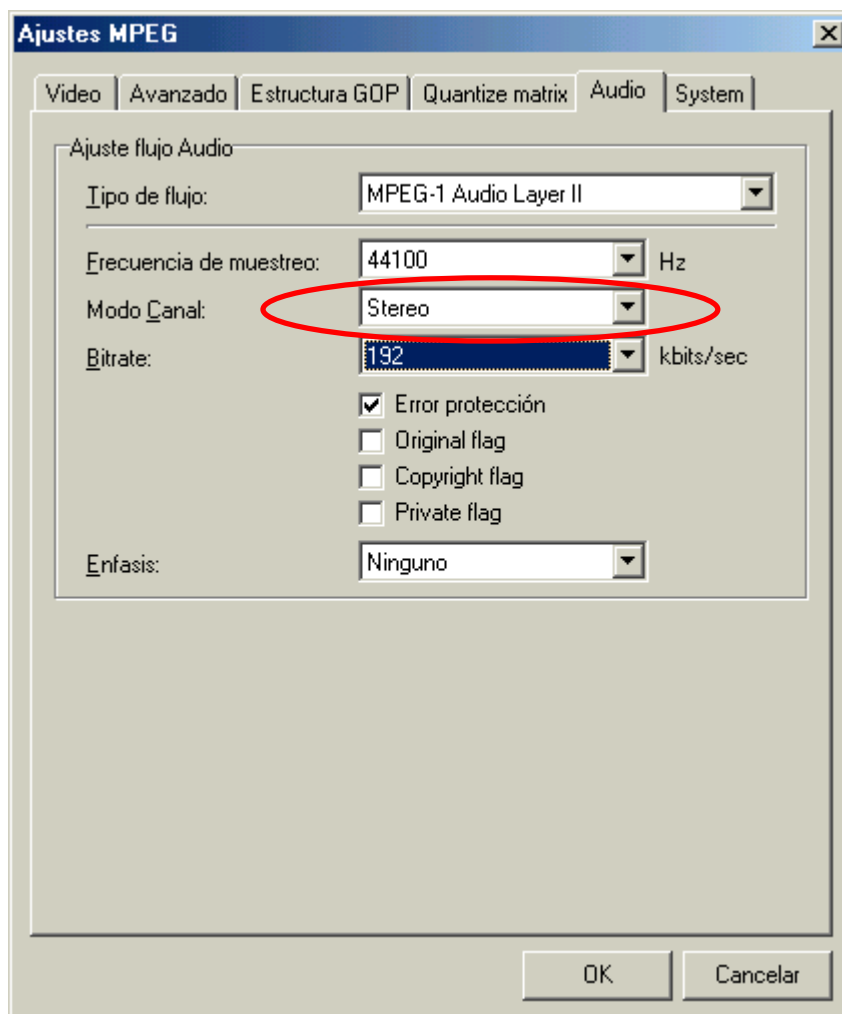
4.6 TMPGEnc settings: Audio

This is one of the most important windows. Select for the field **Channel mode** the option **Stereo**. Problems were found with some DVD players if option **Joint-stereo** is chosen.

Value selected for the field **Bitrate** depends mainly on total playing time and on CD size. It is a matter of working out total file size, without losing the 99 tracks per VCD limit.

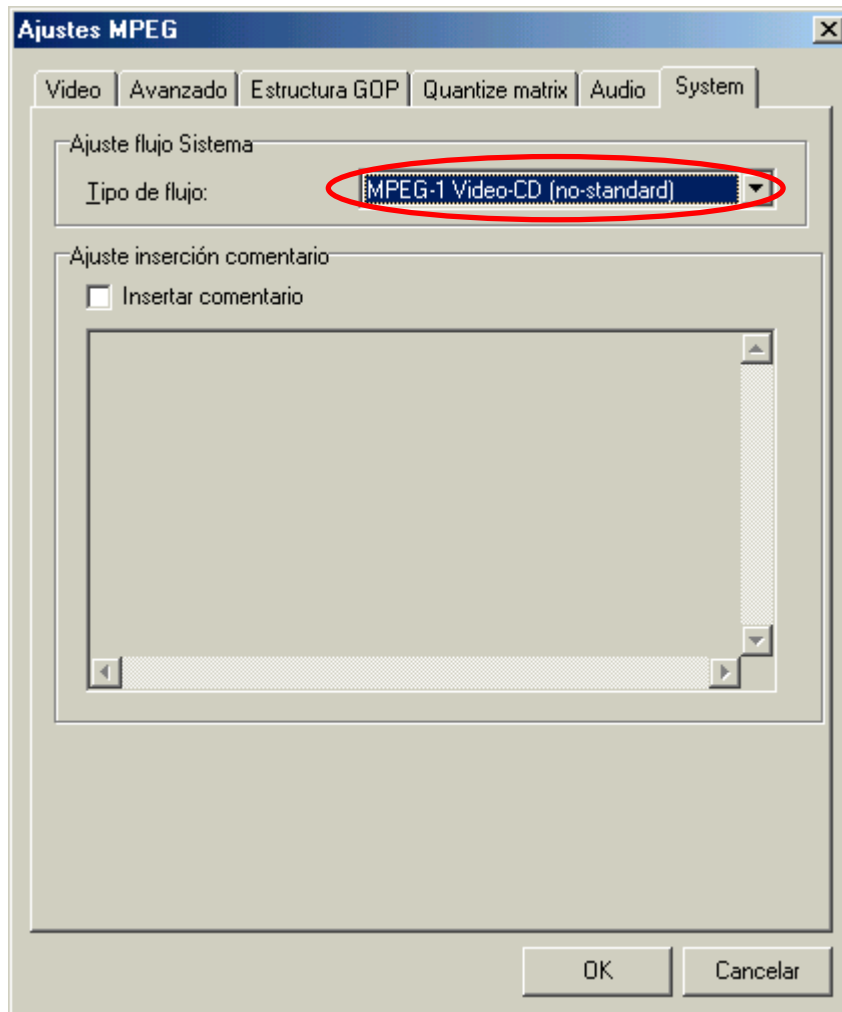
My own experience is that CVCD movies sound quite well with 128 kbps audio. At 160 kbps the music sounds very good. At 192 kbps it is difficult to distinguish between the original and the compressed music. At 224 kbps, the normal audio bitrate for standard VCD, it sounds like the original CD-DA. But this is only a matter of taste (and personal ear sensitivity :-)

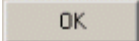
Tip: it is possible to use different audio bit rates for different tracks in the same VCD. Compare and make your own election.



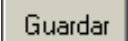
4.7 TMPGEnc settings: System

Here, the main point is to select for the field **Stream type** the option **MPEG-1 Video-CD (no-standard)**.




Now, after clicking on button  you go back to TMPGEnc main screen, as seen in 4.1.

At this point, if the configuration process is being carried out for the first time, you should click

on button  **to save the present adjusts in a template file.**

The next step is to select the audio files to encode.

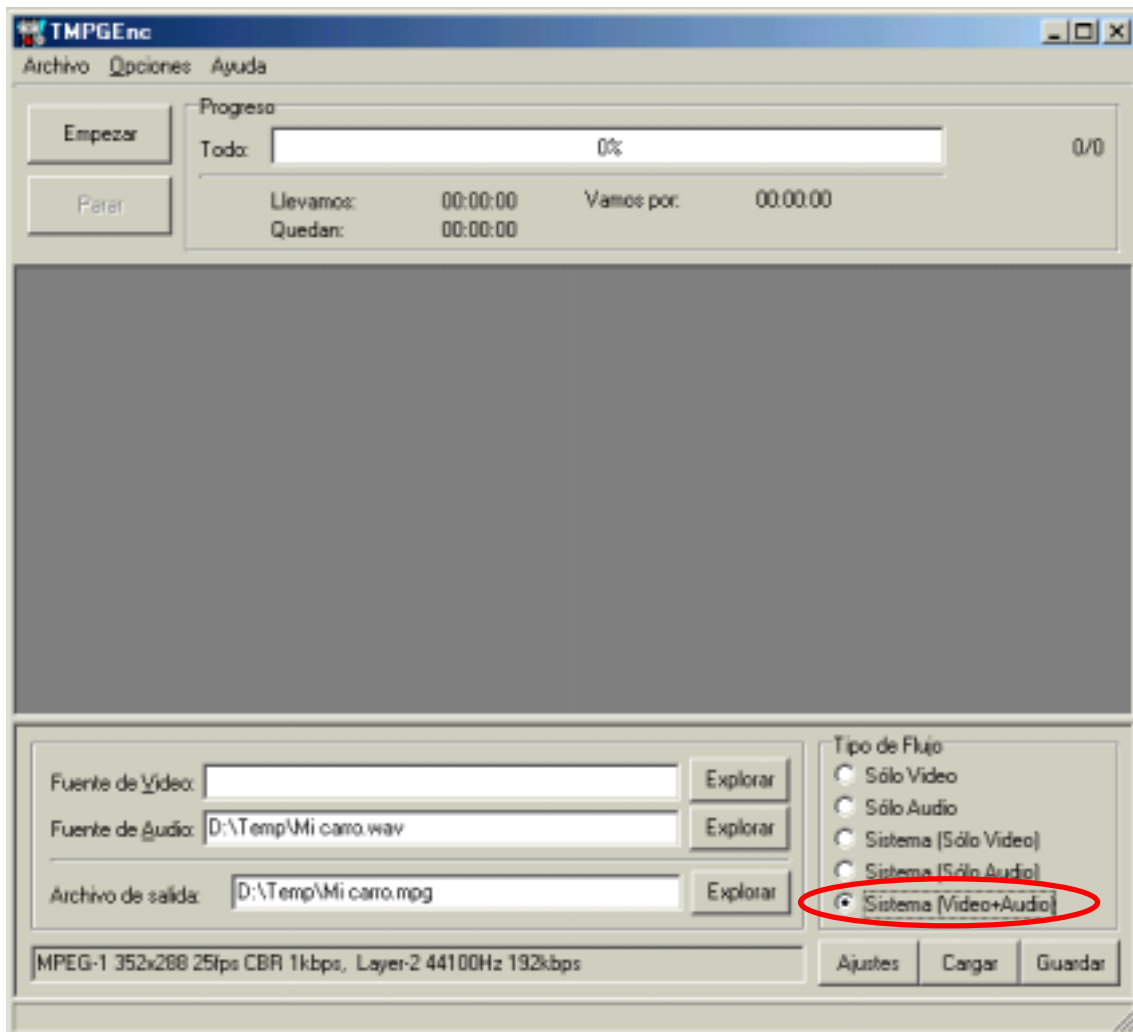
4.8 Selection of files to encode

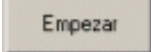
Click on button  of the field **Audio source** and browse to find the audio file you want to encode. Select it when found.

At this point it is very important to select for the field **Stream type** the option **System (Video+Audio)** because the option **Audio only** becomes activated by default.

Notice that **Video source** field must remain blank.

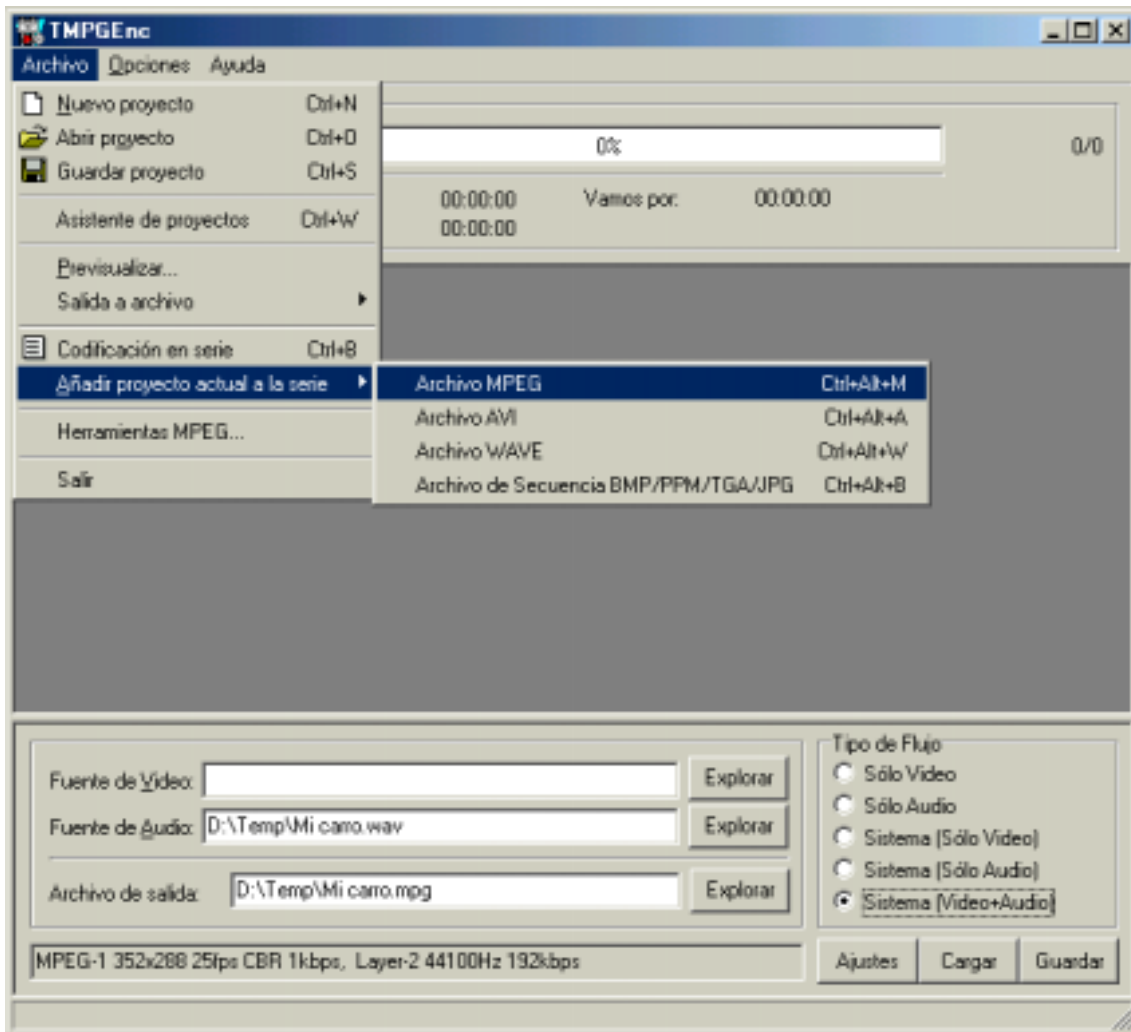
Output file will have the extension .MPG what means that it is an audio+video stream (only audio streams have the extension .MP2).

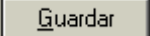


If you want to start encoding immediately you can click on button  (**Start**) but often it is more convenient to configure TMPGEnc for several files batch processing.

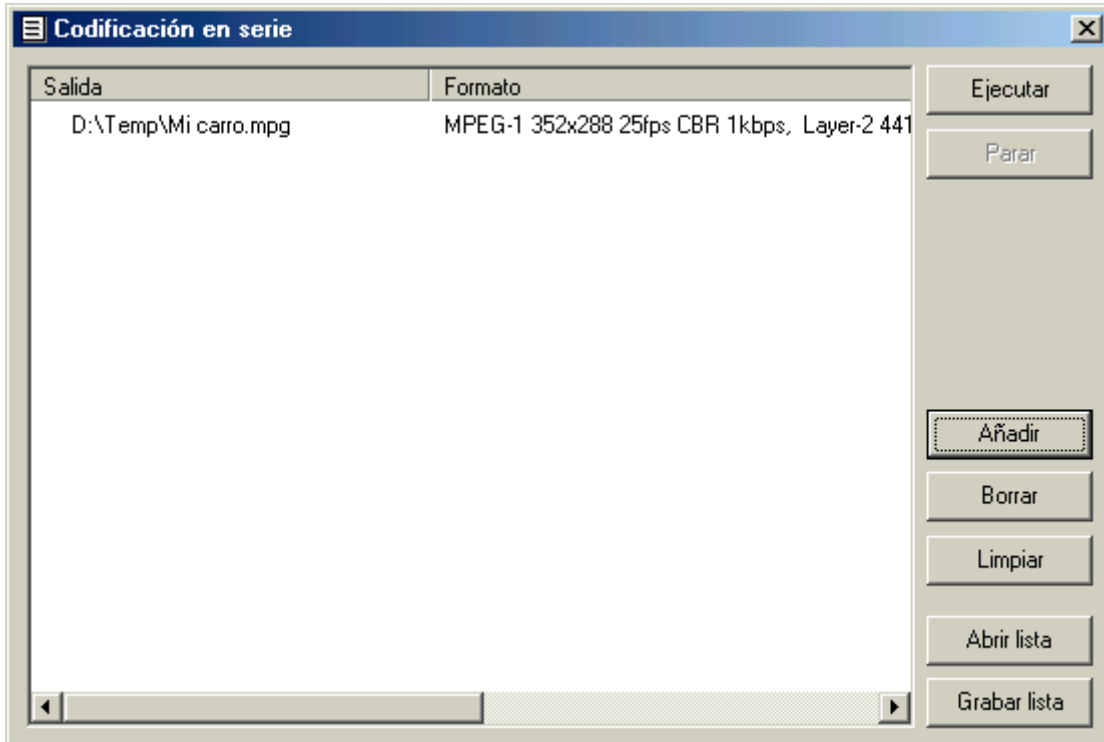
4.9 Batch encoding

Go to the menu bar and click on **File**. A drop menu appears. Click then on **Add current project to batch list** and next in **MPEG file**.

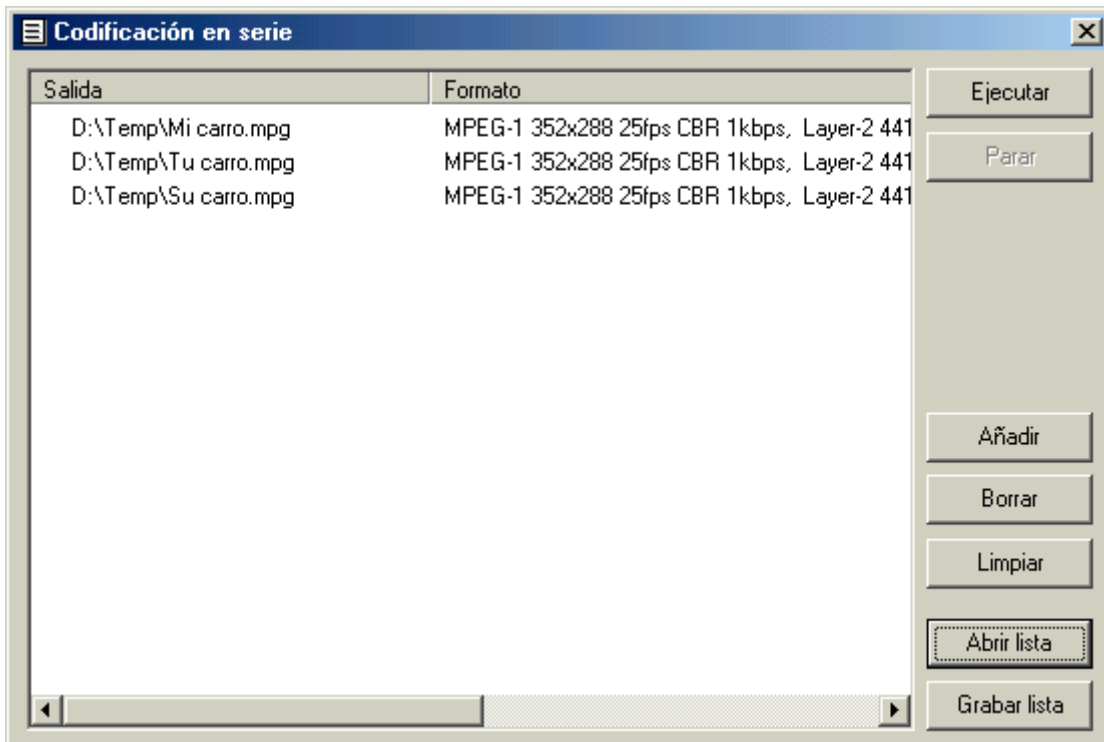


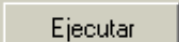
A new window appears with our file selected. Click on button  (**Save**)

The window disappears and another one opens.



There is no need to close this window, but you can do it if you want. Repeat described process (points 4.7 y 4.8 as many times as required to complete the list of files to encode.



Then click on button  (**Start**) to begin TMPGEnc codification work.

When TMPGEnc finishes it supplies a detailed report about results and problems. Next steps will guide you about how to generate menu screens and to write the VCD-A on a CD-R or, better for testing purposes, on a CD-RW. But from now on Nero will do everything.

5. MENU DESIGN AND CD-R/RW WRITING

5.1 Start Nero

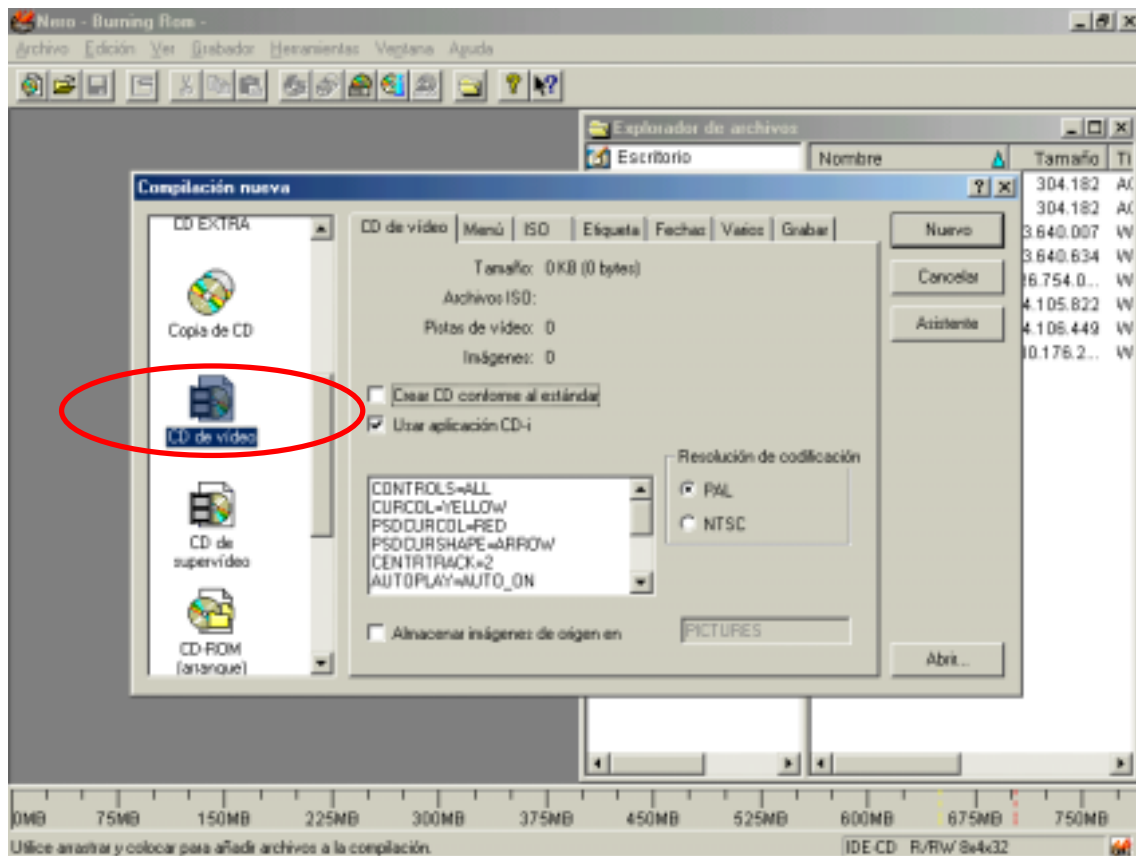
In the window **New compilation (Compilación nueva)** click on **VideoCD (CD de video)** and start to configure the fields in every window associated to the thumb indexes.

5.2 New compilation: VideoCD

Configure the fields of this window such as appear in the figure taking into account the TV colour standard used in your country, PAL or NTSC.

Do not forget to unmark the option **Make a CD according to the standard (Crear CD conforme al estándar)**. Anyway, it will be automatically deactivated later on, if you force to use non-standard .MPG files (and our files are non-standard).

The option **Use CD-i application (Usar aplicación CD-i)** is not very important. It could be useful only if you want to play the VCD-A on a CD-i player (very strange!). If you mark it then the VCD-A will be a little bit more similar to a VCD standard. But either marked or unmarked, no differences are expected in playing.



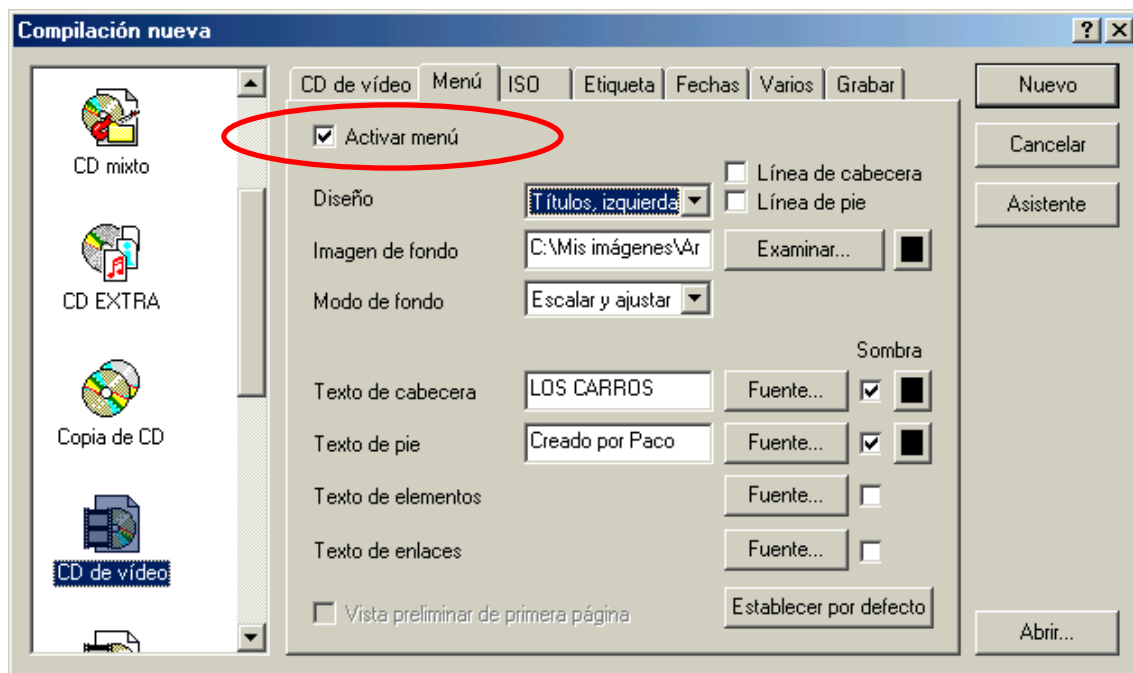
5.3 New compilation: Menu

In the window associated to the thumb index **Menu** you can define the aspect of the menus to be displayed on the TV screen. They will allow you to access to any theme in the CD.

The first and more important step is to mark **Activate menu**. Then the picture to be used as background for the titles must be selected. The same background is used for every menu page. Nero will transform automatically this image to 704x576-pixel resolution.

Several parameters can be set in this window: font, size, colours and shadows for titles, separation lines, page heading and bottom, alignment,..... The best design is the one derived from your own experience. Make your trials on a CD-RW but take into account the following points:

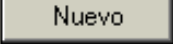
- Heading and bottom horizontal lines use to flick on 50 Hz TV screens. In general, it is better not to use them.
- Human eyes have different sensitivity for each colour. Choose them carefully. Often readability problems derive from wrong contrast between background and titles colour.
- Nero presents 7 rows of titles in one column per menu page. It does not support more rows, even if smaller font size is used. Titles 1, 8, 15,.... will be on the top of different pages. For example, 98 titles need 14 menu pages.
- Nero supports also 14 titles per page in 2 columns. But in this case it is very common a readability problem on TV screen, mainly due to very small size of characters required.

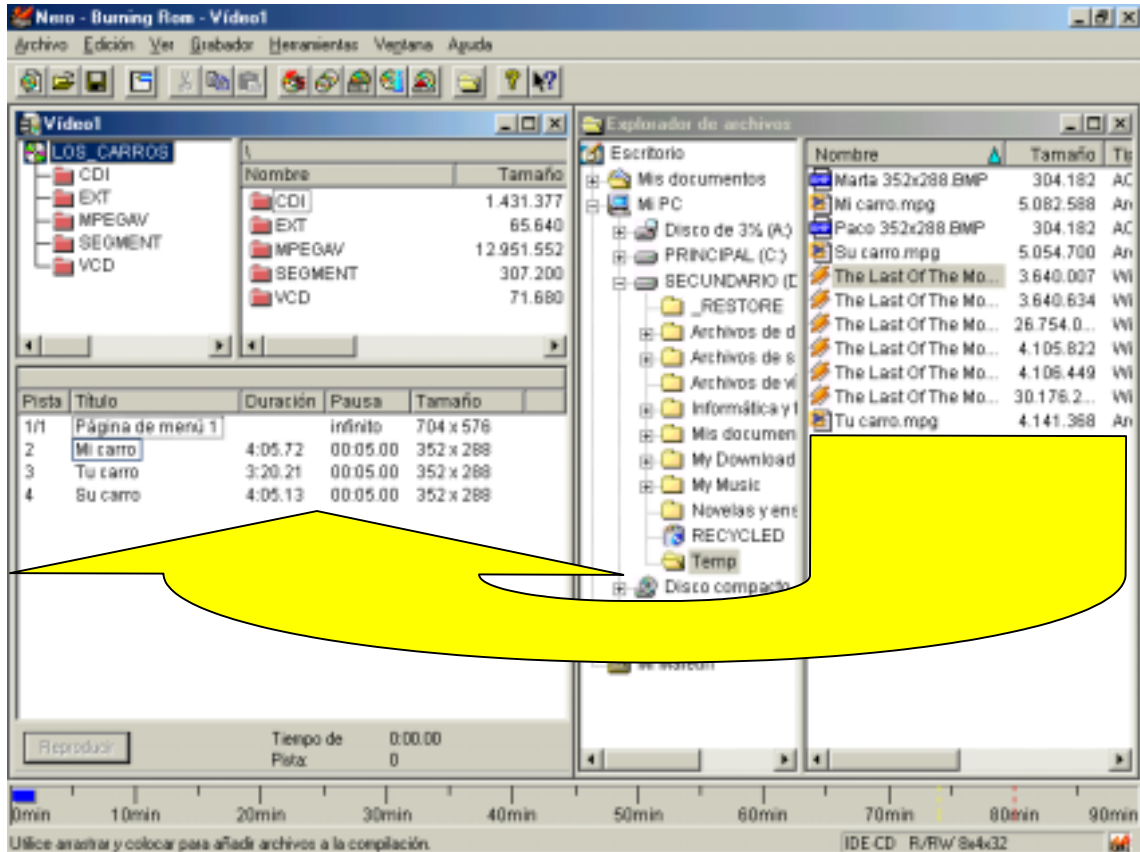


5.4 New compilation: ISO, Label, Date, Others and Record

Fields of windows associated to the remaining thumb indexes can keep their default configuration values. Anyway, changes are very easy to do, in the same way as for another type of CD.

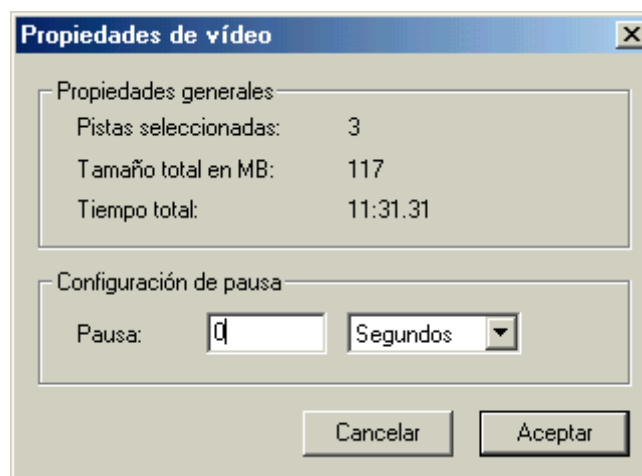
5.5 Tracks selection

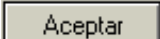
In the former window, click on button  (New) and start to drag the .MPG files to the Nero compilation window, as showed in the figure.



Nero makes automatically the folders and files structure used by the VCD standard. It also makes the track 1 containing the menu pages.

Nero associates a pause to each track. Its value can be changed by selecting one or more tracks, clicking on right mouse button and then in **Properties (Propiedades)**.



Suggested values are infinite for the menu (displayed page will change only by DVD infrared remote command) and 0 seconds for the music tracks. As usual, finish by clicking on 

5.6 Recording

Go to the toolbar and click on button  to open the dialog box **Write CD (Grabar CD)** and then click on button 

With a bit of luck, your VCD-A will be ready in a few minutes.

6. USER'S GUIDE

If the DVD player has the PBC (Play Back Control function) activated then, just introduced the VCD-A, the first page of the menu will be displayed on the TV. An example is shown in the following figure.



Navigation through menus and playing control are managed from the DVD infrared remote controller. Depending on brand and model of the DVD player, differences in the way of jumping to a specific track can be found. Typical navigation is as follows.

- **Start to play a music track:** type the digit(s) of a track number included in the menu page displayed on the TV (some players accept any track number and/or you could need also to press PLAY or OK).
- **Change of menu page:** press NEXT (SKIP or >>) key for going to next menu page and BACK (PREVIOUS or <<) key for going to the previous one.
- **Change of track while playing:** press NEXT (SKIP or >>) key for going to next track and BACK (PREVIOUS or <<) key for going to the previous one. To go to another track different from previous or next you should pass through the menu (some players accept any track number and/or you could need also to press PLAY or OK).
- **Back to the menu from playing:** press RETURN key. Most players jump to the menu page corresponding to the track that was playing.

If the DVD player does not have the PBC (Play Back Control function) activated then, after introducing the VCD-A, the first music track will start to play. No menu will be displayed on TV screen.

Note that **TV screen remains in black during music track playing.**

The main advantage of this feature is that TV tube is not burnt during listening. Besides, VCD-A authoring is very simple and files have small size.

The drawback is that you have no information about features of the playing track (song name, performer, date,....).

Other points to be taken into account are:

- Do not use either FAST FORWARD or FAST BACKWARD while playing (some DVD players could become locked and a switch off and on required).
- VCD-A made by this procedure, have been tested to perform properly with DVD players of different models and brands. In a few cases some problems were found (mainly occasional leaps while playing or no playing at all).
- In case leaps happen while playing music there are several solutions to try:
 - Apply exactly the described procedure but recording with Nero as Super VideoCD instead of VideoCD (see point 5.2).
 - De-multiplex audio and video of .mpg files generated with TMPGEnc (Menu File/Tools MPEG/Simple de-multiplex) and multiplex them again but now with the program bbmpeg (<http://members.home.net/beyeler/bbmpeg.html>).
 - Increase video bitrate. For example, instead of 1 kbps try out with 32 kbps and, if necessary, with higher values, but always CBR. As expected, .mpg files size will increase with video bitrate.
- If navigation in your DVD through Nero generated menus has any problem there are several solutions to try:
 - Disable, if possible, the PBC function in the DVD player. The PBC function enables the access and use of menus. These are recorded in track 1 (some people call it track 0) and, if PBC is disabled in the DVD player, VCD playing starts automatically from track 2, where the first music theme is recorded.
 - Record the VCD-A without menus (**Activate menu** option unmarked). The VCD-A will be now similar to a CD-DA, but with much more music time.
 - Use a program different from Nero for VCD-A authoring and recording (for example EasyCD Creator).
- Information shown by the DVD player (not in the TV set, but in the DVD player display) is different depending on models. For example, in some players track number and/or playing time is displayed, but in others it is not. Wrong values of playing time could also be displayed.
- VCD-A plays fine on PC but not with any software player. Best results were found with WinDVD.

7. RELATED LINKS

- <http://www.videoedicion.org>
- <http://www.vcdsp.com>
- <http://www.vcdhelp.com>
- <http://www.planete-numerique.com>
- http://perso.wanadoo.fr/lelab/video/videocd_en.htm
- <http://www.media-video.com/>
- <http://www.lukesvideo.com/>
- <http://www.indicedivx.com>
- <http://www.uwasa.fi/~f76998/video/>
- <http://nickyguides.digital-digest.com/index.htm>
- <http://www.doom9.org/>
- <http://www.labdv.com>
- <http://cvcd.multimania.com/>
- <http://www.flexion.org/>
- <http://titirs.galeon.com/inicio.html>
- <http://www.lostboysoft.com/Principal.htm>
- <http://www.vcdimager.org/>
- <http://www.vcdgear.com>
- <http://hv.greenspun.com/bboard/q-and-a.tcl?topic=Video%20CD>
- <http://hv.greenspun.com/bboard/q-and-a-unanswered.tcl?topic=Video%20CD>
- <http://www.coyote01.freemove.co.uk/>
- <http://www.vcdeasy.org>

8. SUMMARY

This paper describes a quite simple and flexible solution for recording several hours of high quality compressed music in a VCD that can be played in many DVD.

VideoCD-Audio is not fully VCD standard compliant, but experience shows that many commercial DVD players do not support either the full range of possibilities covered by the White Book. On the contrary, most of modern DVD players are very "tolerant" with CVCD (and VCD-A). Moreover most of VCD-A playing problems found have often simple solutions.

There are many additional possibilities and tricks but they can not be compiled here in this paper. Some examples are,

- How to use other MP2 encoders, like CDex or toolame, different from TMPGEnc one.
- How to use other tools, different from Nero, to generate more sophisticated menus, like VCDEasy.
- How to include more than 99 themes in a VCD (e.g., by linking two songs in the same track).
- How to automate VCD-A authoring (for example, by using Visual Basic Scripts).
- How to associate a still picture to each track in order to display it while listening to the music (this subject will be covered in other manual ;-)

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