Preparing Laser-Disks

for best operation and performance

By Barbara E. Gerhold "TUBECLINIC"

Anyway, there was written so much about this chapter in the past. While most of it was mystical or purely commercial nonsense, some articles were based on real world physical explanations. Why do I now write another article about that? There is no snake-oil for sale …

Well, many people do not know about, although it is an absolutely easy task and the increase in performance is much bigger than you would probably expect … (!)

How does any laser-disk work?

There is a path of "pits and lands" written to the disk. It is so tiny from its elements, that it can only be seen under a microscope. The laser follows this path and reads the elements by use of their reflection. OK – I do not want to bother you with the Reed-Solomon code and the modes (books) as well as the methods of failure correction. All this is not essential to know, if we want to prepare such a disk for best operation and performance. Needless to say, that CD and DVD operate in a similar manner – the DVD only has more information on it, combined with bigger data density.

What are the critical points of the reproduction?

There are two related points:

1. The grade of reflection on its reading (data) surface, and
2. The reflection of laser-light within the disk itself.

Ad 1. If the reflection of the disks data surface is bad - due to scratches, dust or any deposits (e.g. fingerprints) - the disk may still be functioning but it will give the error correction system big work. If a disk is already in this condition, we could wipe or even wash the disk. This will not remove the scratches but all other disturbing factors. In many cases it will help to wash the disk using simply water and soap. Wipe the disk afterwards using a soft cloth and be sure never to insert a wet disk into a player! In the back of this article you find more help for scratched disks …

Ad 2. A simple estimation shows that the lasers stray-light at the inside of the disk is bigger than the reflected light to the reading sensor. This stray-light will be reflected many, many times inside the disk (by total internal reflection), because the disks material is a good conductor for laser-light and if it shows glossy inner and outer edges, they will reflect the light easily. Although the speed of light is very high, this reflected light must lead to jitter when reaching occasionally the reading sensor, because it will be delayed in every case. This will again present much work to the failure correction.

What to do against this jitter?

There is only one possibility: We have to minimize the stray-light. The stray-light's effect is worst, where it shows the longest path through the disk. This is the path from the outer edge to the inner edge and back. It is not possible to reduce it at the reading surface and at the label side. Here we have to live with it, but these are short paths not doing all too much harm.

If you ever had a look at a fiber optic, you guessed what I am talking about: The light is entering on one side of the fiber and exits at the other side while looking at the fiber from alongside you cannot see anything. Generally spoken, it does not matter where the light is entering the fiber and

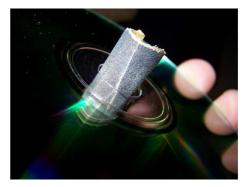it would not change anything if the light would enter alongside. In this case both ends would appear lit.

We can utilize this effect, if we approve, that all edges of the disk are not glossy but matted. This will lead to the fact, that most of the light inside the disk will not be reflected many times but will exit the disk at these edges. Less reflected laser-light keeps jitter low!

In the old days of CD (when they were still expensive!), most disks were treated this way after manufacturing. Today they are mostly not. This will also be true for self-burnt disks (CD-R and CD-RW).

The how to do

Simply take a small piece of sanding paper (app. 120 grain; 2,5 x 5 cm or 1" x 2"), fold it and sand along the outer edge. Afterwards roll the sanding paper and take the inner edge. Then clean the disk thoroughly from the generated dust.

OUTSIDE

INSIDE

You can check your work by using a LED flashlight before and after. The lit edges must be easily visible afterwards.

BEFORE

AFTER

Now we can increase the effect of the sanding job, if we take a fat-point water-resistant black felt-pen (e.g. Edding 550 or similar) and paint across both edges. To be sure, that all the edge material is covered by the pen, do a stroke across into both directions. Be sure here too, that no paint from the pen is applied to the data surface but only to the edges. If you had a slip on it, you can remove the black paint by the use of alcoholic spirit.

Why leads increased work of the error correction system to decreased performance?

Well, this system was only intended to keep a bad condition disk operating. The math work of this system is astonishing and it works astonishing well too! On the other hand it will never lead to increased performance. It has to do its job in real time so the results are poor sometimes.

Now there is a special help for such scratched disks as well as for so-called Un-CDs, which were loaded with artificial failures already at the production moment as a copy-protection. There is a little but useful program at the web, called "EAC – Exact Audio Copy", which everyone can download (freeware).

You can find it at: http://www.exactaudiocopy.de/en/index.php/resources/download/

This program reads the CD correctly and if the error correction needs to work, it will slow down and do the job properly. Then you get a <wav> file on your computers hard disk and you can burn a new disk. This one will mostly give better performance than the original scratched disk. There are some adjustments to be made at the programs options so please read the handbook.

FAQ

Why do you use a black pen? I read about to use a green one …

In former time there were only red lasers and so it was true, that a green pen gave good results, because green is the compliment color to red. Today we have many different colors – only think about "blue-ray". Taking that into account, a black pen gives best results with all colors in service.

To which extent will a Super-Clock correct the jitter disturbance from the disk reading?

Sorry – but such a Super-Clock will not be able to correct anything that already had happened! I am always frightened about Audiophile listeners who buy "Formula 1" CD-players and even tune them by such efforts - not knowing anything about the playback system! No – sorry guys – this feature will not help at all. Please understand that more than 90% of all jitter possible happens within the disk and during the reading of it. If we could only reduce this value by 50%, what could remain the sense of such a Super-Clock?

I heard about demagnetizing should improve performance, what do you think about?

Sorry – but that is the same thing as that of the super-clock. In this case a bit more mystical, because in and on a CD there is nothing, that has any relation to magnetism. I heard about this myth too, but trying by myself did not make any change as well as I even could not imagine how this should work, anyway …

Why can a program like EAC correct failures better than a player?

It is simply a matter of time! If the CD-ROM reads incorrect data, it will try once more. Again and again … If inconsistent data are the trouble it uses the ones which are read more often. If the failure cannot be corrected this way, it will use the same correcting features like the player – but without any hurry …

I am thinking about a small tool that chamfers the edge of a CD, always exactly the same way. Never thought about such?

Well, I saw such a tool some years ago at the "HiEnd Audio Show" in Munich. It is already invented although I neither could find its manufacturer nor the tool itself at the web. Maybe some other reader knows about?

If you have further questions or advices on improvements that you feel should be published here, please contact me via eMail.