

# Cleaning a Disc, Repairing Scratched Discs, and More

**W**E'LL BEGIN THIS MONTH'S DISCUSSION OF CD-PLAYER/CD-ROM-DRIVE REPAIR BY LOOKING AT ONE OF THE MOST COMMON SOURCES OF PROBLEMS—THE DISCS THEMSELVES.

THEN WE'LL LAY SOME OF THE GROUNDWORK WE'LL NEED TO

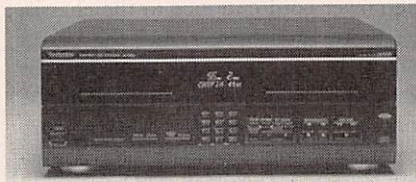
get into the process of troubleshooting and repairing a defective player or drive.

Cleaning a CD is not a difficult chore, and you most certainly do not need a fancy CD-cleaning machine. Instead, just use a soft cloth, tissue, or paper towel moistened with water. Add a little mild detergent, if needed (Ivory soap works well). Wipe from the center of the disc out toward the edge—*not* in the circular motion usually recommended for a vinyl LP. *Never* use any strong solvents. Even stubborn spots will eventually yield to your persistence. Washing under running water is fine as well.

Once done, gently dry with a lint-free cloth. Do not use a dry cloth as any dirt particles may cause scratches. The polycarbonate the CD is made of is tough, but don't expect it to survive everything. Very fine scratches are not usually a problem, but why press your luck?

Something that not everyone is aware of is the multilevel error handling technology in a CD player. Therefore, a dirty CD may not instantly produce obvious audio problems, but can nevertheless result in less-than-optimal audio performance. Very severe errors—long bursts—will result in audible degradation, including noise and/or muting of the sound. Even that might not always be detectable, depending on the musical content. Shorter runs of errors can result in the player interpolating between what it thinks are good samples. That process isn't perfect, but any inaccuracies proba-

bly will not be detected during casual listening. Errors within the correcting capability of the Cross Interleave Reed Soloman Code (CIRC), which is used to encode the data on a CD, will not be noticed at all. In principle, it should be possible to drill a 2.5mm-diameter hole in the discs (in fact, some test discs have such a hole), but not all players implement all of the possible error-handling strategies.



A DIRTY DISC OR LENS might cause even the best CD player to sound poor, but it is unlikely to cause damage to the unit itself.

## Can Dirt Damage My Player?

One common thing you might hear from the man behind the counter in your local CD store is "Dirty CDs could do irreparable harm to your CD player, your stereo, your disposition, etc. Buy our \$19.95 Super-Laseriffic CD Cleaning Kit." One claim I heard at a store that was part of a major chain was that dirt or dust on the laser lens would cause heat buildup that would burn out the mechanism. What he was promoting here was not a disc cleaner, but a little brush attached to a CD that brushed off the lens as it played.

This kind of stuff is total rubbish. The power of a CD laser is less than 1 mW, and it is not concentrated at the lens. And, those cleaning CDs with the little brush are almost useless on anything but the smallest amount of dry dust. If the lens or disc is dirty, the worst that can happen is that the CD will not play properly. There could be audible noise, or the disc might fail to track properly, abort at random times, or not even be recognized. However, the electronics will not melt down because of dirt on the disc or the laser lens.

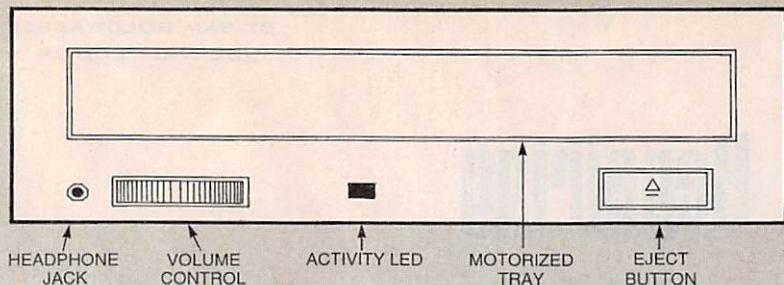
In short, it is just about impossible for a dirty CD to do any damage to the player, and a dirty lens will only result in disc recognition or play problems similar to those caused by a dirty CD; the laser will not catch on fire. About the only way damage could occur is if you loaded a cracked CD and the crack caught on the lens.

In any case, you do not need any fancy CD cleaners—soap or mild detergent, water, and a soft cloth will do the job. If the CD looks clean, it will probably be fine. If there are serious smudges or fingerprints, then cleaning could make a significant difference in performance.

## Repairing a Scratched CD

So your favorite CD has turned up badly scratched (maybe your five-year-old decided that it would make a nice Frisbee), is there anything you can do? The answer is yes. There actually are three basic techniques for repairing scratches. They are: Mild Abrasives, Fillers, and Blowtorch.

- Mild abrasives: Use plastic or furniture polish, Brasso metal polish, or toothpaste to try and remove minor scratches. (Don't worry too much about causing damage; if the disc doesn't play, you can't



WHEN TROUBLESHOOTING A CD-ROM drive, the first step is to play an audio CD. If basic audio playback is fine, you can be reasonably certain that the optical pickup, the front-end electronics, and the servo systems are working correctly.

do any more harm.) When applying or rubbing any of these materials, wipe only from the center to the outside edge. A CD player can generally track across scratches that are perpendicular to its path reasonably well. It is the scratches that are parallel to the path that cause all the problems. If the scratch is minor, a mild abrasive may actually remove it completely. This is more effective when the surface has been scuffed or abraded rather than deeply scratched.

- **Fillers:** These include such typical items like car wax or furniture wax. Apply over the whole disc and buff out with a lint-free cloth. Filling larger scratches should be fairly effective, but be aware that the repaired disc will be more prone to damage in the future because of the soft wax filler. This technique works because the wax will fill in the space where the scratch is. Even deep scratches might give in to this approach.

- **Blowtorch:** A least one person who claims to have worked for several years in a used CD store swears by this technique. Supposedly, he uses a pencil-type pocket butane torch and with great dexterity fuses the surface layer of the readout side of the disc so that scratches and unsightly blemishes—well—melt away. Now there are obvious dangers in using fire on plastic and this is likely a last resort. I cannot tell you how many years of practice are required to get a CD-repair license. However, I am highly skeptical of this approach and suspect that destruction of the CD is the most likely outcome.

As an alternative to home repair, there are companies that actually specialize in fixing damaged discs. A couple of these are Aural Tech CD ([www.nsynch.com/~auraltech](http://www.nsynch.com/~auraltech)) and CD Repairman ([www.cdrepairman.com](http://www.cdrepairman.com)). I have no experience with any of these companies, so I can't comment on their effectiveness or

cost, but if you have an irreplaceable CD that has become damaged, they might be worth considering.

That concludes our discussion on the media itself. Assuming that cleaning of fixing a disc has not cleared up your problem, it will be necessary to deal with the CD player or CD-ROM drive itself. Let's begin that topic next with some preliminary information and tips.

### Safety at All Times

While there are far fewer potential dangers involved in servicing a CD player compared to a TV, monitor, or microwave oven, some precautions are still required when working on a line-powered unit with its cover removed. There may be electrically live parts connected to the power line, usually around the power cord entrance to the chassis, the power transformer, and the on/off switch. If there are, tape them over or cover them somehow so you need not be concerned with a shock. Unless you are troubleshooting a primary-side power-supply problem, there should be no need for you to go near the AC line. For portable players, the internal voltages are all quite low, so shock is less of a concern than accidental damage to the equipment due to carelessness.

The laser in a CD player is infra-red. It usually operates at 780 nm—while that wavelength is at the edge of the visible range, for all intents and purposes, the beam is invisible. Note that the beam is very low power (under 1 mW), and coupled with the optics, presents very little danger. Nonetheless, don't go out of your way to look closely into the lens while the unit is on!

**Note:** With most CD-type lasers, if the lens is viewed from an oblique angle, you'll usually see a deep-red spot, about the size of a period. This emission

appears to be low intensity, and might be a spurious emission in the red part of the spectrum or just your eye's response to the near IR energy of the main beam. In any case, do not be misled into thinking that the laser beam is weak. The main beam is up to 10,000-times more intense! Take care. However, the red dot is an excellent indication that the laser is being powered and is probably functioning. To be sure, you need an IR detector to confirm the existence of the laser beam. A circuit for testing IR remote controls, like the one presented in the June 1997 installment of "Service Clinic," could also be used for this purpose.

### Troubleshooting Tips

As in all electronics troubleshooting, many problems have simple solutions. Don't immediately assume that the problem you are looking at is some combination of esoteric, complex, convoluted failures. For a CD player, it may just be a bad belt or a dirty lens. Try to remember that the problems with the most catastrophic impact on operation (a CD player that will not play past track 6) usually have the simplest solutions (the gears that move the optical pickup need lubrication). The kinds of problems we would like to avoid at all costs are the ones that are intermittent or difficult to reproduce: the occasional audio noise or skipping, or a CD player that refused to play classical CDs of music composed between 1840 and 1910. (If you come across a player that won't play heavy-metal rock, send it to me—please.)

When attempting to diagnose problems with a computer's CD-ROM drive, start by trying to get it to play an audio CD. Data read-back is more critical since the error correction needs to be perfect. But if the audio playback works, you know that the optical pickup and most of the servo systems and front-end electronics must be working. A CD-ROM drive that won't play a music CD has no chance of loading Windows 95

If you get stuck, sleep on it. Sometimes, just letting the problem bounce around inside your head will lead to a different, more-successful approach or solution. Don't work when you are really tired—it is dangerous and mostly non-productive.

Whenever you work on precision equipment, make copious notes and diagrams. You will be eternally grateful that you did when the time comes to put the

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## SERVICE CLINIC

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unit back together. Most connectors are keyed against incorrect insertion or unintentional interchange of cables, but that's not always the case. Apparently identical screws might have different lengths or have slightly different thread types. Little parts may fit in more than one place or orientation. Try using pill bottles, 35mm film canisters, and plastic ice-cube trays to sort and store screws and other small parts.

Another consideration is ESD—Electro-Static Discharge. Some of the electronic components in CD players, CD-ROM drives, and similar devices, are vulnerable to ESD. There is no need to go overboard, but taking reasonable precautions like not wearing clothing made of wool, which tends to generate static, is a good idea. When working on component CD and laserdisc players, get into the habit of touching a ground, like the metal chassis, before touching any circuit components. An anti-static wrist strap is another good idea.

A basic set of precision hand tools should be all that you will need to disassemble a CD player and perform most adjustments. Needed tools include a selection of Philips and straight-blade screwdrivers, needle-nose pliers, wire cutters, tweezers, and dental picks. A jeweler's screwdriver set is a must, especially if you plan to work on a portable unit. For adjustments, a miniature ( $1/16$ -inch blade) screwdriver with a non-metallic tip is desirable (the non-metallic tip prevents the screwdriver from detuning the circuit as you make your adjustments).

Unless you get into optical alignment of the laser assembly, no special tools will be needed, and the service manual will indicate what you do need if you are faced with that kind of repair. A low-wattage fine-tip soldering iron and fine rosin-core solder will handle any soldering or desoldering that needs to be done along the way.

For thermal or warm-up problems, a can of "cold spray" or "circuit chiller," and a heat gun or blow drier can come in handy. Use them to locate thermally sensitive parts that are causing problems. Use the extension tube of the spray can and make a cardboard nozzle for the heat source to provide precise control of which components you are affecting.

That wraps it up for this time. Until next month, if you have any specific problems or questions, you can reach me by e-mail at [sam@stdavids.picker.com](mailto:sam@stdavids.picker.com). For general information on electronics troubleshooting and repair visit my Web site at [www.repairfaq.org](http://www.repairfaq.org). EN

## LETTERS

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tricity beyond the abilities of the grid, and power-plant construction will have to mushroom to keep up. I know there are other ways to generate electricity that are non-, or at least not as polluting, but they are dwindling and not expanding. No new nuclear reactors have been commissioned for over a decade, the hydroelectric situation is even worse, solar is not an option due to poor efficiency, and geothermal cannot supply enough to handle even a fraction of the added load.

The one solution to this problem is the Hybrid Vehicle, in which the size of the internal combustion engine is reduced and attached to a generator. The batteries are used for acceleration and hill-climbing assistance. The emissions of this type of vehicle are greatly reduced by increasing efficiency and not overpowering the power plant to accelerate the car. Most charging would be handled by the motor/generator combination, thus only using the grid for light charging and not for a deep charge. The battery weight could also be reduced, since it is in a supporting role only.

Thanks for your time and your ear, and by the way, I do like your magazine very much!

RICHARD PERCIFIELD  
Tonganoxie, KS

## Editorial Approval

Regarding the recent dialog between yourself and your readers, I thought you might want to know that, in my opinion, your editorials about the Internet are right on target. While I agree that the signal-to-noise problem on the Net/Web is a bad one, my entire research agenda is being immeasurably helped by data and contacts that I have been able to make using that valuable resource.

Keep up the good work.  
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