

Troubleshooting a CD Player or CD-ROM Drive

I KNOW YOU CAN'T WAIT TO GET TO THE GOOD STUFF AND START REPAIRING, BUT THERE IS JUST A LITTLE MORE PREPARATION THAT NEEDS TO BE COVERED FIRST AS I OFTEN SAY, "SOME OF THE MOST DESIRABLE TEST EQUIPMENT THAT YOU CAN OWN

sits right between your ears." In other words, do a bit of analytical thinking before breaking out the spectrum generators and such. Many problems do not require a schematic of the equipment (though one is always useful). The majority of CD-player problems are mechanical and can be dealt with using little more than a set of precision hand tools, some alcohol, degreaser, contact cleaner, light oil and grease, and your powers of observation.

That said, a good or at least decent test bench is an asset. Let's look at some of the things that you might need to repair a CD player or CD-ROM drive. Some you likely already own. Other pieces of gear might be a little scarcer, but we'll show you how you can work around that in some cases.

One piece of equipment that you are likely to own and need is a DMM or VOM to check power-supply voltages and sensors, LEDs, switches, and other components. Since you will be depending upon these readings, accuracy is important, yet many inexpensive meters will do the job nicely.

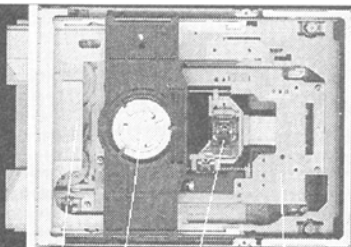
For other electronic problems including servo circuits, an oscilloscope is desirable. However, it too does not have to have all the bells and whistles. A 10- to 20-MHz dual-trace scope with a set of 10X probes is more than adequate for all but the most esoteric troubleshooting tasks.

To determine if the laser diode is

working properly, a laser power meter is handy. Unfortunately, those instruments are expensive, but they are essential if you are to properly and safely adjust laser power. Fortunately, that's something that does not have to be done too often and for most common problems, all you need to know is if the IR laser beam is being emitted. An inexpensive IR detector card or even some camcorders can handle that job.

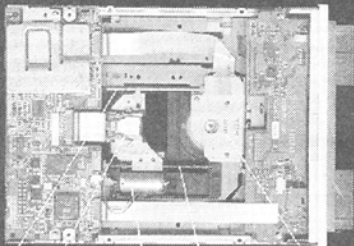
A stereo amplifier with loudspeakers is essential to allow your most important piece of audio test equipment—your ears—to function effectively. A lot can be determined by listening to the audio output of a drive or player. Over time, you will learn to distinguish between problems caused by dirt, lubrication or lack thereof, servo control, and other mechanical or electronic problems. By the way, when troubleshooting a CD player or CD-ROM drive, I suggest that you avoid using headphones as a sudden burst of noise could blow out your eardrums and spoil an otherwise perfectly good day.

An inexpensive test CD is also a nice thing to have. It will let you play known frequencies and volume levels. Note that a special test CD is not essential—just about any music CD will work just fine for most tests. However, to fully exercise the limits of the player, a disc with a full 74 minutes of music will be needed—Beethoven's Ninth Symphony is a good choice (even if you are not into classical



Tray Clamper Pickup Optical Deck

Top View



Rail Pickup Sled Motor, Drive Screw Spindle Motor

Bottom View

Teac CD-516S CDROM Drive (Tray Extended)

THE TEAC CD-516S CD-ROM drive is typical of late-model (1997), low-cost, high spin-rate units. Access to nearly everything is quite easy—just take out four screws total to remove the top and bottom covers.

music), since most recordings of it are very close (or sometimes even over) that length of time.

Hang on to old demo CDs and even obsolete CD-ROM discs (like the ones from AOL and MSN). They can be used for testing. When an optical deck develops a servo problem, the disc can end up spinning out of control. Stopping it suddenly can result in the CD scraping against the drawer or the base of the deck and getting scratched. Therefore, some “garbage” discs are always handy when testing.

To evaluate tracking and error-correction performance, any CD can be turned into a test CD with strips of black

tape, a felt-tip marker, or even a hand drill! In fact, some professional test discs are made in exactly that manner.

CAUTION: The electronic components-especially the laser diode-in CD players, CD-ROM drives, and similar devices, are vulnerable to ESD (electrostatic discharge). There is no need to go overboard, but do take reasonable precautions like not wearing clothing made of wool (which tend to generate static). Get into the habit of touching a ground like the metal chassis before touching any circuit components. The use of an anti-static wrist strap would be further insurance, especially if the optical pickup assembly needs to be unplugged for any reason.

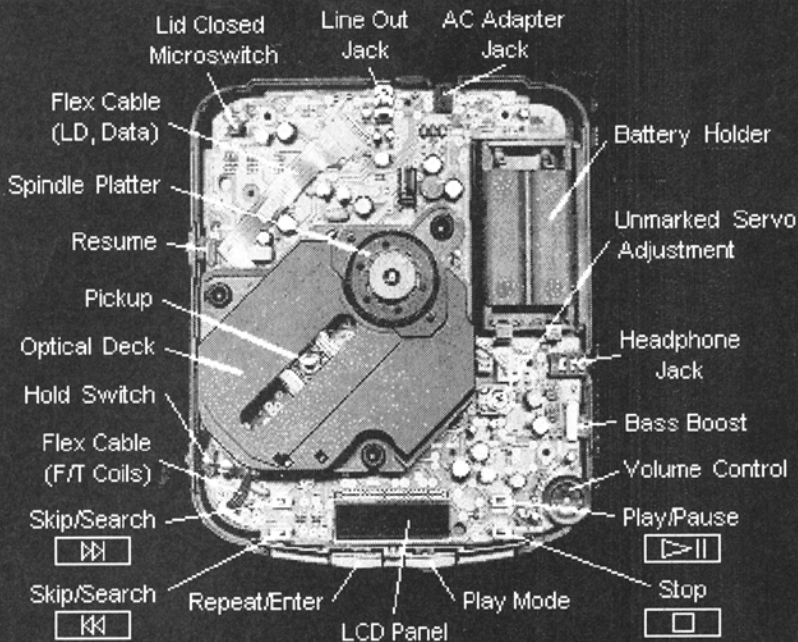
Getting Inside the Player

OK we're almost ready to start. But first, here are some words of warning: By opening the case of the player you will void any warrantee. Obviously that means if a unit is still under warranty, it should be taken to an authorized professional for any covered repair.

Even if the unit is not under warrantee, you should be aware that by working on the unit yourself, you might make the problem worse-after all, you are not a professional service technician: If the player partially worked when you got it, it may no longer even recognize the disc directory if you make things worse. If you decide after working on it, that it should be taken to a pro, you may find that the service center will simply refuse to touch it. There is nothing worse than having to undo a "fix" introduced by a well-intentioned do-it-yourselfer. At best, you will be charged for this effort on a time and materials basis. It could well be very costly and not worth the expense. Be warned.

In other words, if the player or drive in question is one that must be returned to working order, the smart thing might be to take it to a professional from the beginning. On the other hand, **if you** are dealing with a unit that would be discarded anyway, why not give it a shot. Even if your repair is not successful, you will learn a lot in the process and therefore will be more likely to succeed the next time a similar problem crops up. Besides, it can be a lot of fun.

Once you've decided to try to repair your CD player, it is fairly easy to remove the top cover of most units. There are usually some very obvious screws on the sides, and possibly on the back as well.



RCA RP-7903A Portable CD Player (Cover Removed)

THE RCA RP-7903A PORTABLE CD PLAYER is typical of modern portables in that everything is crammed into a much-too-small space. Access to adjustments and circuitry are "conveniently" blocked when a disc is in place. The solder side of the PC board is even more fun to probe since the bottom cover also supports the optical deck assembly!

These are nearly always Philips-head types—make sure you use the proper screwdriver, especially if you expect to put the screws back again. Once all the screws are out, the top cover will lift up or slide back and then come off easily. If it still does not want to budge, don't force it. Take another, more careful look, for an additional screw or two that you missed the first time around.

Once the top cover is removed, the optical deck and electronics board will usually be readily accessible. In most designs, the entire optical deck can be lifted out after removing the 3 or 4 screws that hold it in place. One of those screws may have a grounding contact under it. Make sure you remember where it came from and reinsert it carefully when you put the player back together after completing the repair. As you lift the deck out, watch for fragile flexible cables. Be careful and work slowly so that you do not damage them. These cables usually plug into connectors on the electronics board. Unplug them carefully.

In rare cases, removing the bottom cover will provide access to the solder side of the electronics board. However, in most CD players the bottom of the case is solid and the only way to get at the foil side of the board is to lift the board out of

the case. In portable players, the bottom cover can usually be removed after taking out several very tiny screws. Use the proper-size Philips-head jewelers screwdriver. For CD-ROM drives, both top and bottom covers may be removable—it depends upon the model and manufacturer.

Make notes of screw locations and types. Immediately store the screws away in a pill bottle, film canister, or even an ice-cube tray.

When reassembling the equipment after the repair is done, make sure you route cables and other wiring carefully, so they are not pinched, snagged, or broken. Be sure you do not nick the insulation on any wires and keep the cables clear of moving mechanical parts. Replace any cable ties you cut or removed during disassembly and add additional ones of your own if needed. A little electrical tape provides handy insulation insurance as well.

A Few Notes

Before we begin the troubleshooting part of this discussion, there are a couple of things that didn't really fit conveniently in our earlier discussions, but that you should be aware of before we proceed. Let's cover those now.

While CD players and CD-ROM drives have a common origin, and still have much in common, over time their technologies have diverged somewhat. The optical pickups remain similar, but the data processing and servo systems needed to support 24X and higher speed CD-ROM technology are much more sophisticated than those needed for 1X speed CD audio. So when you peek inside your shiny new CD-ROM drive, don't be surprised to see parts that differ rather considerably from those that you will find in a Discman.

The power supply in a component-stereo CD player is normally a linear supply that is both very reliable and easy to repair when necessary. In portables, however, you are likely to encounter a switching supply, possibly sealed in a shielded can, and difficult to repair. Usually, at least three voltages are needed: logic power (+5Vcc) and a pair of voltages for the analog circuitry ($\pm 15V$). However, some designs use a variety of voltages for the various portions of the analog circuitry.

The microcomputer controller, servos, read-back electronics, audio D/A(s) and filters are found on the unit's electronics board. Most servo adjustment potentiometers will be located there as well. In many cases, their functions are even clearly marked, but not always. Use some common sense here; do not turn anything unless you are absolutely sure of what you are doing-and then only after marking the potentiometers' original positions precisely.

Instant Troubleshooting Chart

Now for the good stuff (and it's about time!). In this section I am going to present a variety of common problems and nearly all possible causes. You'll of course need to use diagnostic procedures to see which ones actually apply in your particular case. The possible causes are listed in approximate order of likelihood. While this chart lists many problems, it does not cover everything that can go wrong. However, it does offer a starting point for guiding your thinking in the proper direction..

CD player is totally dead.

Possible causes:

1. Power outlet, wall adapter, or batteries are dead.
2. Damage to line or wall-adapter cord or plug.
3. Bad connections or faulty compo-

nent in power supply (including blown fuse).

4. Defective microcontroller.

CD player is operational but there is no or partial display.

Possible causes:

1. Burned out backlight bulb(s).
2. Bad connections to display panel (totally dead or erratic).
3. Bad solder connections on display panel (some segments work).
4. Bad power supply.

CD player ignores you.

Possible causes:

1. Bad connections to one or more buttons or sets of buttons.
2. Microcontroller failed to reset properly.
3. Missing/incorrect voltages from power supply.
4. Defective microcontroller or other logic.

Drawer does not open or close.

Possible causes:

1. Worn, stretched, or oily belt.
2. Dirty mechanism or gummed-up lubrication.
3. Stripped gear or other mechanical damage.
4. Defective motor or bad connections to motor.
5. Bad drawer/eject button.
6. Missing/incorrect voltages from power supply.
7. Defective microcontroller or other logic.

Drawer operation is erratic.

Possible causes:

1. Dirty sense-switch contacts or bad connections.
2. Worn, stretched, oily, flabby, belt.
3. Dirty mechanism or gummed-up lubrication.
4. Defective motor or bad connections to motor.
5. Stripped gear or other mechanical damage.
6. Missing/incorrect voltages from power supply.
7. Defective microcontroller or other logic.

Drawer does not close (or open) completely.

Possible causes:

1. Worn, stretched, or oily, belt.
2. Dirty mechanism or gummed-up lubrication.

3. Foreign object such as a toy, rock, or runaway disc blocking drawer.

4. Stripped gear or other mechanical damage.
5. Gear timing is incorrect.

Spindle table loose or sticks to clamper upon eject.

Possible causes:

1. Set screw loosened or glue holding spindle to motor shaft has failed.
2. Parts of spindle table broken.

Intermittent or erratic operation.

Possible causes:

1. Dirty, scratched, or defective disc.
2. Dirty lens.
3. Extended length discs too long for player.
4. Loading (mechanical) not completed reliably.
5. Bad connections including missing/erratic optical-deck shield.
6. Cracks in ribbon cable to optical pickup.
7. Dirty drawer or limit switches.
8. Power supply or logic problems.
9. External interference.

CD player or CD-ROM drive overheats.

Possible causes:

1. Excessive ambient temperature.
2. Failing/marginal part in power supply or logic.

Disc is not recognized (unit displays "disc," "error," etc.)

Possible causes:

1. Disc loaded upside-down.
2. Transportation lock engaged.
3. Dirty, scratched, or defective disc.
4. Dirty lens.
5. Loading (mechanical) not completed reliably.
6. Dirt, gummed-up lubrication, or damage in sled-drive mechanism.
7. Dirty/defective limit switch or sensor.
8. Defective spindle motor.
9. Spindle table height incorrectly set.
10. Bad component in optical pickup.
11. Cracks in ribbon cable to optical pickup.
12. Need to adjust servo (or less likely, optical) alignment.
13. Faulty power supply, electronics or control logic.
14. Bad connections including missing/erratic optical-deck shield.
15. External interference.

Disc spins in wrong direction or too fast and is never recognized.

Possible causes:

1. Disc loaded upside-down.
2. Dirty, scratched, or defective disc.
3. Dirty lens.
4. Tracking or CLV servo out of adjustment or faulty.
5. Bad component in optical pickup.
6. Microcontroller or control logic problems.
7. Bad connections or defective ribbon cable to optical pickup.

Pickup attempts to reset past inner track.

Possible causes:

1. Dirty or defective limit switch, or faulty connections to it or its electronics.
2. Broken parts preventing limit switch from being activated.
3. Tracking servo out of adjustment or faulty.
4. Microcontroller or logic problems.

Player won't let you go near it and/or use your favorite lamp.

Possible causes:

1. Missing optical-deck shield, ground strap, or other connection.
2. Outside interference.

Seek operations take too long or fail to complete.

Possible causes:

1. Dirty, scratched, or defective disc.
2. Transportation lock engaged.
3. Dirty lens.
4. Tracking or CLV servo out of adjustment or faulty.
5. Mechanical problems with sled movement.
6. Faulty sled motor or drive IC.
7. Faulty control logic.
8. Bad flex cable to optical pickup.

Search, seek, or play starts correctly, then loses time or position.

Possible causes:

1. Dirty, scratched, or defective disc.
2. Dirty lens.
3. Tracking or PLL servo out of adjustment or faulty
4. Stuck button.
5. Defective sled motor or drive IC.
6. Faulty control logic.

Short-distance skipping.

Possible causes:

1. Dirty, scratched, or defective disc.
2. Dirty lens.
3. Fine tracking servo out of adjustment or faulty.
4. Weak laser or other defective part in the optical pickup.

Playback gets stuck (rapid repeat).

Possible causes:

1. Dirty, scratched, or defective disc.
2. Dirty lens.
3. Dirt, gummed-up lubrication, or damage in sled-drive mechanism.
4. Transportation lock engaged.
5. Servo alignment needed.

Occasional long-distance skipping or repeating.

Possible causes:

1. Dirty, scratched, or defective disc.
2. Dirty lens.
3. Dirt, gummed-up lubrication, or damage in sled-drive mechanism.
4. Transportation lock engaged.
5. Servo alignment needed.

Player gets stuck at approximately same time on different discs.

Possible causes:

1. Dirt, gummed-up lubrication, or

damage in sled-drive mechanism.

2. Sled reaching mechanical stop with extended-length (longer than 74 minutes)

disc.

3. Transportation lock engaged.
4. Servo alignment needed.
5. Defective spindle motor.

Various tracking problems on portions of discs:

Possible causes:

1. Dirty, scratched, or defective disc.
2. Faulty spindle motor.
3. Misalignment of spindle table and sled track.
4. Need for CLV adjustment.

Repetitive noise at disc rotation rate.

Possible causes:

1. Dirty, scratched, or defective (possibly warped) disc.
2. Dirty lens.
3. Loose spindle or foreign material on spindle table.
4. Disc not firmly clamped.
5. Bent spindle.
6. Excessive spindle run-out due to worn bearing.
7. Servo alignment needed.
8. Weak laser or other component in optical pickup.

Audio muting, noise, or distortion.

Possible causes:

1. Dirty contacts on RCA jacks on CD player or amp.
2. Bad connections to RCA jacks.
3. Dirty/defective muting-relay contacts.
4. Defective components in the analog circuitry (final filter, muting, amp).
5. Faulty power supply (for audio circuits, if used)

Wrap-Up

With the information we've presented thus far, in this section of CD and CD-ROM servicing, you have enough basic information to get started in your troubleshooting task. Next time we are going to look at what I call "General System Problems" and take a closer look at some of the items touched on in the troubleshooting chart.

That's all we've got room for this time. Between now and the next issue, if you have any specific problems or questions, you can reach me by e-mail at sam@stdavids.picker.com. For general information on electronics troubleshooting and repair visit my web site at www.repairfaq.org.

