Compact Disks: What, Why and How

Alka Bansal & Dipti Arora

Abstract

This article introduces the basic concept of compact disks (CDs), their types and uses. The technology behind CDs and CD burner is discussed in brief. It describes in detail how to use CD burning software Adaptec Easy CD Creator 4 to burn various types of CDs like data CD, audio CD, and multisession CD. Other features of the software are also introduced.

1. INTRODUCTION

The compact disks (CDs) were introduced in 1980's to hold music in a digital format. Now CDs are everywhere. They have become the standard medium for distributing not only large quantities of music, but data, video, computer software, multimedia presentations, etc.

2. RECORDING INFORMATION ON CDs

According to their recording behaviour, there are mainly two type of CDs (a) CD ROMs and (b) Recordable CDs. In CD-ROMs, user can't change data in CD-ROMs itself, he can only download it to computer hard disk and make changes but can't save back on CD-ROMs. Recordable CDs are also of two types:

❑ CD-R (CD-Recordable) or writable

❑ CD-RW (CD-ReWritable)

CD-R media can be read by virtually all CD-ROM, CD-Recordable, and CD-ReWritable drives. CD-R is excellent for permanent data storage and is used if one does not need to erase the data. They are less expensive per CD than CD-RW. But unlike tapes, floppy disks and many other data-storage mediums, users cannot re-record on CD-R disc once they have filled it up.

CD-RW media can only be used in CD-ReWritable drives or newer MultiRead CD-ROMs. It can be used when users need to erase the data and re-write new information (for example, updating files). It can be used to make a practice CD or to test the contents of a CD before making a permanent one.

Blank recordable CD-R and CD-RW are currently available in two capacities: 74 minutes (both CD-R and CD-RW) and 80 minutes (CD-R only at this time).

The actual capacity of blank CDs can vary slightly; some 74-minute CDs can hold up to two minutes more than their stated capacity.

CDs of all types share certain features: they all have the same physical dimensions, are made at least partially from clear polycarbonate plastic, and have a metallic layer to reflect the laser beam that reads the data. All CDs are 'groovy'— they have a microscopic spiral groove pattern molded into the polycarbonate plastic. The lines of this spiral are so small and close together that they act like a diffraction grating. The spiral groove is continuous on writable CDs because it's needed to guide the laser during writing.

The major identifying difference between currently manufactured read-only discs (CD-ROM) and writable CD discs can be seen at first glance: CD-ROMs have a silver metallic sheen on both sides, whereas writable CDs are typically metallic gold on the top and green or green-golden on the bottom. The top of a CD bears a label, logo, or other printed information. The bottom has no markings except in the area near the center hub. The laser reads the disc from the bottom, so the bottom is always unobstructed, its overall color—whether silvery (CD-ROM) or green/green-golden (writable CD or CD-Recordable)-provides quick identification.

CD-ROMs:

A CD-ROM is a simple piece of plastic, about four one-hundredths (4/100) of an inch i.e., 1.2 mm thick. Most of a CD-ROMs consist of an injection-molded piece of clear polycarbonate plastic. During manufacturing, this plastic is impressed with microscopic bumps arranged as a single, continuous, extremely long spiral track of data. Then a thin, reflective aluminum layer is sputtered onto the disc, covering the bumps. Then a thin acrylic lacquer layer is sprayed over the aluminum to protect it. The label is then printed onto the acrylic. (Fig 1)

A CD-ROM has a single spiral track of data, circling from the inside of the disc to the outside. The data track is approximately 0.5 microns wide, with 1.6 microns separating one track from the next. (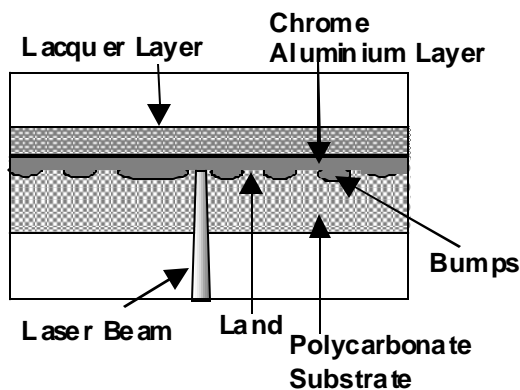A micron is a millionth of a meter.) The elongated bumps that make up the track are each 0.5 microns wide, a minimum of 0.83 microns long and 125 nanometers high. (A nanometer is a billionth of a meter.). If users could lift the data track off a CD and stretch it out into a straight line, it would be 0.5 microns wide and almost 3.5 miles (5 km) long.

Users will often read about 'pits' on a CD-ROM instead of bumps. They appear as pits on the aluminum side, but on the side the laser reads from, they are bumps.

The molded polycarbonate substrate layer is on the bottom of a CD (the side from which the laser reads the data). The pits must be read through it. This part of a CD's design helps make it tolerant of scratches. The lens of the reading laser focuses the beam directly on the pits, through the 1.2-millimeter thickness of the polycarbonate. The beam 'looks past' scratches on the bottom of the disc, unless they are really deep. This first line of defense against scratches is not the only one. There is a second in the software that decodes the data stored on the disc. Known as 'error detection and correction,' this technology is able to deal with errors in the data because some degree of redundancy and cross-checking is built into the encoded data in the first place. This technique is generally more effective for images and music.

Together, the acrylic layer, the out-of-focus scratches, and software error correction adds more life to CDs.

Writable CDs or Recordable CDs:

The physical structure of a writable CD differs from that of a CD-ROM. A writable CD is molded from polycarbonate too, but without pits. Like a long-playing phonograph record, a writable CD has a smooth spiral groove running over most of its surface. This groove, molded into the top side of the polycarbonate substrate, serves to guide the powerful laser beam that does the writing.

Just as in a CD-ROM, the bulk of the substance of a writable CD is a clear polycarbonate substrate about one millimeter thick. The layer above this one is something writable CDs have but CD-ROMs don't have:

Figure 1. Cross section of CD-ROM

a layer of light-sensitive green organic dye. Above this dye layer is a thin film of metallic gold. The gold layer has the same purpose as the aluminum-chromium layer in a CD-ROM, namely, to reflect the reading laser beam back into the photodetector (Fig. 2). In its original state, the dye isn't dark enough to block light reflection from the gold layer above. But when the dye has been 'zapped' by the writing laser (which has about ten times the power of the reading laser), a dark discoloration is created that blocks reflections and forms a permanent, readable mark. The dye molecules absorb enough energy during the writing process to break down physically and chemically, leaving an area that no longer reflects light. The marks made by the writing laser follow the same encoding scheme as the pits in a CD-ROM, so writable CDs can be read by CD-ROM drives.

A writable CD starts out blank. A laser 'writes' data on it by creating discolored areas in a layer of greenish dye. The areas of discolored dye on a writable CD act like the pits in a CD-ROM: they interrupt the beam of the reading laser. Writable CD technology makes it possible for people to create their own CDs, which then can be read by computers equipped with CD-ROM drives or (providing the data is written as music) on home audio CD players.

Both reading and writing are done from the bottom side of the disc, through the full thickness of the polycarbonate substrate. This provides scratch resistance as it does for the
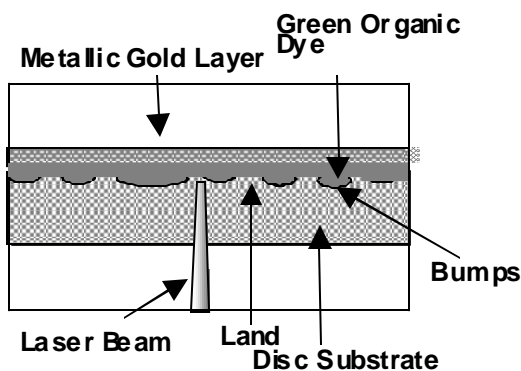

Figure 2. Cross section of CD-Recordable

CD-ROM, but it takes a fair bit of energy for the laser beam to make a 'mark' on a writable CD. That's why scratches, fingerprints, dirt, etc., are much more dangerous to a writable CD before writing than afterward. The fingerprint, dirt, or smudge can scatter the beam of the writing laser, perhaps weakening it to the point where the mark it makes is too small or too light to be read. So extra care must be taken in the handling of writable CDs before the data is written.

All writable CD products are made with a unique factory-applied serial ID number. They are used in managing a collection of digital information. Located near the center hub of the disc, this number is both human-readable (alphanumeric) and machine-readable (bar code).

Erasable CD-RW Discs:

On CD-RW discs users can erase old data and record new data. These discs are based on phase-change technology. In CD-RW discs, the phase-change element is a chemical compound of silver, antimony, tellurium and indium. As with any physical material, this compound's form can be changed by heating it. When the compound is heated above its melting temperature (around 600 degrees Celsius), it becomes a liquid; at its crystallization temperature (around 200 degrees Celsius), it turns into a solid.

In a CD-RW disc, the reflecting lands and non-reflecting bumps of a conventional CD are represented by phase shifts in a special compound. When the compound is in a crystalline state, it is translucent, so light can shine through to the metal layer above and reflect back to the laser assembly. When the compound is melted into an amorphous state, it becomes opaque, making the area non-reflective.

In the compound, used in CD-RW discs, the crystalline form is translucent while the amorphous fluid form will absorb most light. On a new, blank CD, all of the material in the writable area is in the crystalline form, so light will shine through this layer to the reflective metal above and bounce back to the light sensor. To encode information on the disc,

the CD burner uses its write laser, which is powerful enough to heat the compound to its melting temperature. These 'melted' spots serve the same purpose as the bumps on a conventional CD and the opaque spots on a CD-R: They block the 'read' laser so it won't reflect off the metal layer. Each non-reflective area indicates a 0 in the digital code. Every spot that remains crystalline is still reflective, indicating 1 in the digital code.

As with CD-Rs, the read laser does not have enough power to change the state of the material in the recording layer — it's a lot weaker than the write laser. The erase laser falls somewhere in between: While it isn't strong enough to melt the material, it does have the necessary intensity to heat the material to the crystallization point. By holding the material at this temperature, the erase laser restores the compound to its crystalline state, effectively erasing the encoded 0. This clears the disc so new data can be encoded.

CD-RW discs do not reflect as much light as older CD formats, so they cannot be read by most older CD players and CD-ROM drives. Some newer drives and players, including all CD-RW writers, can adjust the read laser to work with different CD formats. But since CD-RWs will not work on many CD players, these are not a good choice for music CDs. For the most part, they are used as back-up storage devices for computer files.

The reflective and non-reflective patterns on a CD are incredibly small, and they are burned and read very quickly with a speeding laser beam. In this system, the chances of a data error are fairly high. CD burners compensate for various encoding problems.

The established form for music CDs, called ISO 9660, was the foundation for later CD formats.

3. CD EQUIPMENT

3.1 CD Player

The CD player has the job of finding and reading the data stored as bumps on the CD. The drive consists of three fundamental components (Fig. 3):

♦ A drive motor spins the disc. This drive motor is precisely controlled to rotate between 200 and 500 rpm depending on which track is being read.

♦ A laser and a lens system focus in on and read the bumps.

♦ A tracking mechanism moves the laser assembly so that the laser's beam can follow the spiral track. The tracking system has to be able to move the laser at micron resolutions.

The fundamental job of the CD player is to focus the laser on the track of bumps. The laser beam passes through the polycarbonate layer, reflects off the aluminum layer and hits an opto-electronic device that detects changes in light. The bumps reflect light differently than the 'lands' (the rest of the aluminum layer), and the opto-electronic sensor detects that change in reflectivity. The electronics in the drive interpret the changes in reflectivity in order to read the bits that make up the bytes.

The hardest part is keeping the laser beam centered on the data track. This centering is the job of the tracking system. The tracking system, as it plays the CD, has to continually move the laser outward. As the laser moves outward from the center of the disc, the bumps move past the laser faster— this happens because the linear, or tangential, speed of the bumps is equal to the radius times the speed at which the disc is revolving (rpm). Therefore, as the laser moves outward, the spindle motor must slow the speed of the CD. That way, the bumps travel past the laser
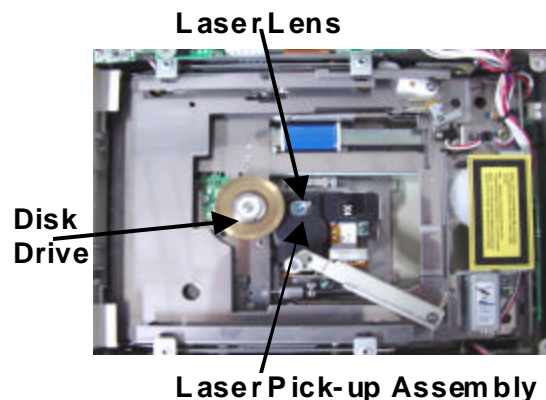

Figure 3. Internal view of CD drive

at a constant speed, and the data comes off the disc at a constant rate.

Data storage on a normal CD is simple. The surface of the CD contains one long spiral track of data. Along the track there are flat reflective areas and non-reflective bumps. A flat reflective area represents a binary 1, while a non-reflective bump represents a binary 0. The CD drive shines a laser at the surface of the CD and can detect the reflective areas and the bumps by the amount of laser light they reflect. The drive converts the reflections into 1s and 0s to read digital data from the disk. Normal CDs can't be modified—they are read-only devices.

When users write data to a CD-R, the writing laser (which is much more powerful than the reading laser) heats up the dye layer and changes its transparency. The change in the dye creates the equivalent of a non-reflective bump. This is a permanent change and both CD and CD-R drives can read the modified dye as a bump later on.

It turns out that the dye is fairly sensitive to light—it has to be in order for a laser to modify it very quickly. Therefore one should avoid exposing CD-R disks to sunlight.

3.2 CD Burner or CD Writer

CD Burner is an external writable CD drive with which user can take music or data files from their computer and make their own CDs. A CD burner's job is to burn the digital pattern onto a blank CD. Now writable CD drives (CD burners) are standard equipment in new PCs, and more and more audio enthusiasts are adding separate CD burners to their stereo systems.

CD burning is very simple. once users have the right software and know the general procedure. The CD burner has a moving laser assembly, just like an ordinary CD player. But in addition to the standard 'read laser,' it has a 'write laser.' The write laser is more powerful than the read laser, so it interacts with the disc differently: It alters the surface instead of just bouncing light off it. Read lasers are not intense enough to darken the dye material, so simply playing a CD-R in a CD drive will not destroy any encoded information.

The write laser moves in exactly the same way as the read laser: It moves outward while the disc spins. The bottom plastic layer has grooves pre-pressed into it, to guide the laser along the correct path. By calibrating the rate of spin with the movement of the laser assembly, the burner keeps the laser running along the track at a constant rate of speed. To record the data, the burner simply turns the laser writer on and off in synch with the pattern of 1s and 0s. The laser darkens the material to encode a 0 digit and leaves it translucent to encode a 1 digit.

The machinery in a CD burner looks pretty much the same as the machinery in any CD player. There is a mechanism that spins the disc and another mechanism that slides the laser assembly.

Most CD burners can create CDs at multiple speeds. At 1X speed, the CD spins at about the same rate as it does when the player is reading it. This means it would take users about 60 minutes to record 60 minutes of music. At 2X speed, it would take users about half an hour to record 60 minutes, and so on. Actually 2X, 4X, 8X, etc., are data transfer rates. To convert data transfer rates into kilobytes, the number with X should be multiplied by 150. For example, if we have 4X drive then data transfer rate will be 600kb/s. For faster burning speeds, users need more advanced laser-control systems and a faster connection between the computer and the burner. users also need a blank disc that is designed to record information at this speed. Blank CD-R of 8x speed and CD-RW of 4X are available in the market.

The main advantage of CD-R discs is that they work in almost all CD players and CD-ROMS, which are among the most prevalent media players today. CD-Rs are relatively inexpensive also.

These days, most burners are packaged with one or more music programs which convert songs to the correct format for burning. It controls the encoding process for writing to the CD, but users can also buy programs or download them over the Internet.

Some CD burning software packages are:

♦ Nero Burning ROM

♦ Adaptec Easy CD Creator 4

♦ Platinum Toast 5

♦ Titanium Gear Pro 5.0

4. ADAPTEC EASY CD CREATOR 4

Easy CD Creator 4 (Fig. 4) lets users record as much data or audio as the CD can hold. To see a blank CD's capacity in sectors, megabytes, or minutes, insert the CD into their CD-Recorder and select CD Information from the CD menu.
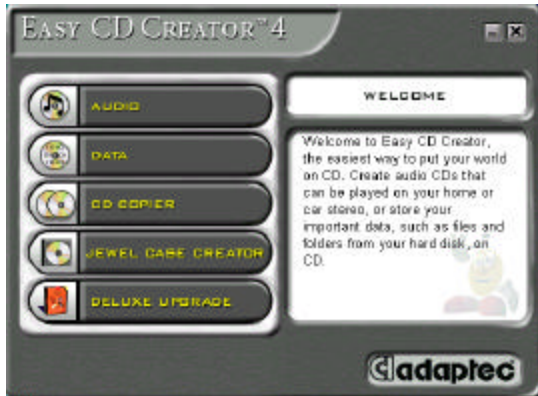

Figure 4. Adaptec Easy CD Creator 4

4.1 Types of Burned CDs

Using Easy CD Creator 4, we can create the following four types of CDs:

Data CD

A Data CD is used to store computer data such as the files and folders. Unlike an Audio CD, it is used for data storage only and cannot be played on home stereo CD player or car CD player. It can typically hold upto 650 MB of data and can be accessed on any computer that has a CD-ROM or CD-Recorder drive. It is used for backing up and archiving files such as spreadsheets, tax records, and financial data, multimedia presentations, graphics, CAD files, internet downloads, etc.

Audio CD

An Audio CD is used to record music from tracks and audio files (WAV, MP3, etc.) that can be played on home or car stereo CD player. An Audio CD can't be used for data storage. It can also be played on just about every computer that has a CD-ROM drive using a program such as the Windows CD Player, etc. It can typically hold up to 74 minutes of music.

Mixed-Mode CD

A Mixed-Mode CD is a single session CD that contains both computer data and audio tracks, and is typically used for entertainment and educational programs. Data is written to the first track on the CD followed by one or more audio tracks. Mixed-Mode CDs are used with CD-ROM or drives only and cannot be played in home or car stereo CD players.

When we create a Mixed-Mode CD, the CD Layout contains both a data and an audio section. First add files and folders to the Data CD Layout section; then add the tracks, WAV or MP3 files to the Audio CD Layout section.

Multisession CD

A multisession CD contains both audio files (tracks, WAV, or MP3) and computer data. The first session contains the audio files, so a home or car stereo CD player can play them. The second session contains data intended for CD-ROM drive. Many music CDs are created as multisession CD to provide music CD tracks and a music video all on the same CD.

When users add files or tracks to a Data or Audio CD Lauserst, the Status Bar shows the amount of data or audio in the CD Lauserst, and how much space remains on the CD. The 'Estimated space free' amount is based on a 74-minute CD; however, users can still record 80 minutes on an 80-minute CD. For Data CDs, the space is shown in MB; for Audio CDs, it is shown in minutes:seconds.

4.2 Using CD Creator 4

To create any type of CD, users must select the files, folders, or tracks that they want to record from the Explorer section and then add them to the CD Lauserst (as explained below).

★ **Explorer Section**

The Explorer section in Easy CD Creator Program is where users select the files,

folders, and tracks users want to add to the CD Lauserst. In the Explorer section, users can see how folders are organised on their computer and all the files and folders in each selected folder. If users click a hard disk or folder in the left box of the Explorer section, the right box displays its contents. If users click a CD-ROM drive that has a music CD inserted, the right box displays the tracks.

★ **CD Lauserst**

The CD Lauserst in Easy CD Creator is where users assemble and organise the files, folders, or tracks that they want to record. The CD Lauserst must contain all of the files and/or tracks before users can create a CD. When creating a Data CD, the CD Lauserst is called a Data CD Lauserst (Fig. 5). When creating an Audio CD, the CD Lauserst is called an Audio CD Lauserst.

Users may want to save their CD Lauserst so that users can use it to record the same CD at a later time. Once saved, users can add or remove items from the CD Lauserst. This is especially useful if users want to create the same CD at a later time.

A Data CD Lauserst can consist of files and folders, as well as audio files (such as WAV or MP3 files, but not music CD tracks). To create a CD that includes files and folders, as well as music CD tracks, use the advanced features of Easy CD Creator for creating a Mixed-Mode CD or a CD Extra CD.

An Audio CD Lauserst can contain tracks from multiple music CDs. Insert their music CD into their drive and then add the track
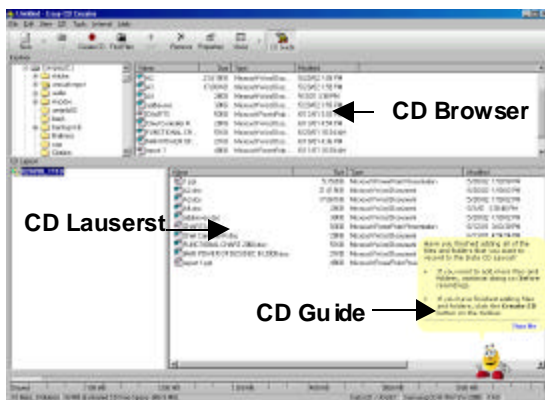

Figure 5. Data CD Browser and Lauserst

from the Explorer section to the Audio CD Lauserst. Repeat for each track users want to record. When the actual recording begins, Easy CD Creator prompts users to insert the appropriate music CD in their drive.

The CD Lauserst acts like a pointer only it does not store the actual data. When users add files or tracks to the CD Lauserst, the CD Lauserst keeps track of where the information is located and uses this information when recording a CD.

★ **CD Guide**

The CD Guide is the animated character that assists users in creating their CDs. When displayed on their screen, the CD Guide offers instructions or tips for the specific task users are performing. To show or hide the CD Guide, click the CD Guide button on the toolbar.

4.3 Creating Data/Audio CDs

(a) Open Easy CD Creator from the Start menu. Click Start, point to Programs, point to Adaptec Easy CD Creator 4. Screen in fig 4 will appear.

(b) Click the Audio or Data button accordingly whether to create audio or data CD

(c) Data/Audio browser and lauserst screen will appear

(d) Users can use any of the following two ways to add the files, folders, and music tracks from the Explorer section to the CD Lauserst:

   ○ Select the item users want to record in the Explorer section, and then click the Add button on the toolbar. The item is added to the CD Lauserst or

   ○ Select the item users want to record in the Explorer section, and then drag and drop it into the CD Lauserst

(c) Once all the files are added in Lauserst that we want to add in our CD, click Create CD. The CD Creation Setup box appears. (Fig. 6)

(d) Click OK to start recording

(e) When CD is created 'CD Created Successfully' appears on the screen.

4.4 Creating a CD Extra CD

When users create CD Extra CD, the CD Lauserst contains both an Audio and a Data section. First add the tracks, WAV or MP3 files to the Audio CD Lauserst; then add files and folders to the Data CD Lauserst.

(a) Open Easy CD Creator from the Start menu. Click Start, point to Programs, point to Adaptec Easy CD Creator 4, point to Features, and then select Easy CD Creator.

(b) Open an CD Extra CD Lauserst. Click the small arrow next to the New button on the toolbar and select CD Extra from the drop-down list. A CD Extra CD Lauserst appears.

(c) Insert a blank CD into the destination drive

(d) Add the audio files users want to record to the audio section of the CD Extra Lauserst.

   ○ Select the Audio CD Lauserst icon in the left pane of the CD Extra Lauserst window.

   ○ If users are recording tracks from an existing music CD, insert the music CD into their CD-ROM drive (the source drive). If users are recording WAV or MP3 files, continue with the next step. Note: users can record any combination of tracks, WAV, or MP3 files to an Audio CD.

   ○ In the left pane of the Explorer section, select the CD-ROM drive containing the music CD; a list of the tracks on the CD appears to the right. If users are recording WAV or MP3 files, select the folder where their files are located.

(e) In the right pane of the Explorer section, select the track, WAV, or MP3 file that users want to record, and then click Add. Repeat until the Audio CD Lauserst contains all of the tracks and files that users want to record.

Note: If users have tracks on other music CDs that users want to record, repeat steps 3-5 for each music CD from which users want to record from. During the actual record process, Easy CD Creator prompts users to reinsert the appropriate music CD for the music track being recorded.

(f) Add the data files users want to record to the data section of the CD Extra Lauserst.

○ After adding all the audio files that users want to record into the Audio CD Lauserst, click the Data CD Lauserst icon in the left pane of the CD Extra Lauserst window. The icon is labeled with the date (year:month:day).

○ In the Explorer section, select the data files or folders users want to record, and then click Add. Repeat until the Data CD Lauserst contains all of the files and folders that users want to record.

(g) Click Create CD. The CD Creation Setup box appears.

(h) Click OK to start recording.

4.5 Write Method on CD

When we click 'Create CD' (Fig. 6), one of the following options can be chosen for creating a CD:

Track-at-Once: Click this option to record a single track at a time. Tracks recorded in Track-at-Once mode are separated by gaps. If a data track is followed by an audio track, the gap is 2 or 3 seconds. The gap between audio tracks is usually 2 seconds.

○ **Leave Session Open:** Click this option to add more songs to the CD at a later time. By keeping the session open, we can record additional songs to the first session at different times. Once all the songs are added, for listening to it on a home or car stereo CD player, we must close the session. (For Audio CDs only)
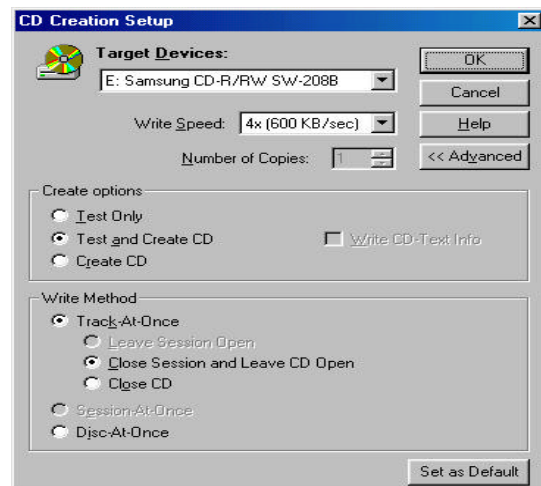

Figure 6. CD creation setup

❍ **Close Session and Leave CD Open:** Click this option to close the session so that audio tracks (if in the first session) can be played back in home or car CD players. This option is the default option and is applicable for most CD recording purposes. Because the CD remains open, we can continue to record additional sessions to the CD until it is full.

❍ **Close CD:** Click this option to write-protect the CD. When this option is selected, no more data can be recorded to the CD.

Session-at-Once: Click this option to record a single session and leave the CD open. For example, we can use Session-at-Once to make CD Extra CD. First record the audio tracks in the first session and leave the CD open. Then record a second (data) session and close the CD.

Disc-at-Once: Click this option to write and close a CD in one operation without turning the writing laser on and off between tracks. This eliminates the two second-gap between tracks and write-protects the CD. We can select this option if we are recording WAV or MP3 files stored on hard disk, or music CD tracks.

Set as Default: We can click this button to change the CD Creation Setup default options.

4.6 Erasing Contents of a CD

To erase the contents of a CD disc, follow these steps:

✄ Open CD Eraser Menu (Fig. 7)
✄ In Windows Explorer, select the files to be erased
✄ Select Delete from the File menu, or press the Delete key.
✄ Click Yes to confirm erasing of the files from the CD.

DirectCD erases the selected files from the CD.

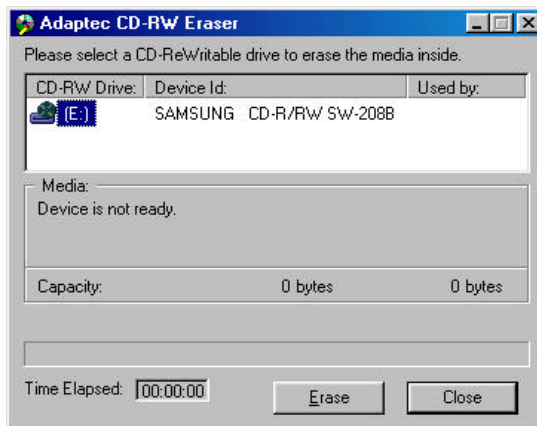Note: Only CD-RW drives can read from, write to, and erase data from CD-RW discs.

Figure 7. CD-RW Eraser

4.7 Making Copy of a CD

To copy directly from a source CD to a blank CD in CD-Recorder, users must have a CD-R drive to use.

♦ Insert the original CD from which copies are to be made into CD-ROM, CD-R, or CD-RW drive.

♦ Select the drive containing the original CD in the Copy from drop-down list box. (Fig. 8)

♦ Click **Copy** (CD Copier temporarily records the CD contents to hard drive as an image file, then a message prompting to insert the destination drive appears, insert the blank CD then it will record all data to the blank CD. CD Copier automatically removes the image file after the CD has been copied).

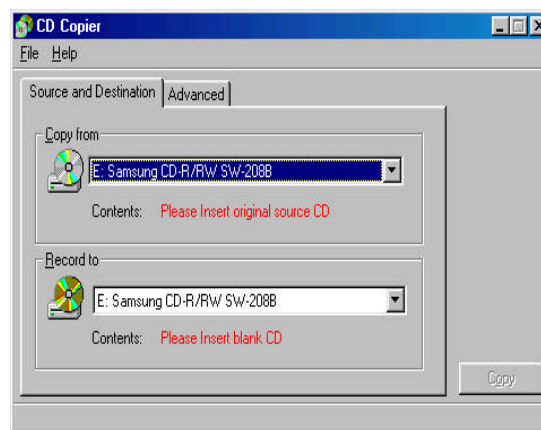♦ When the CD is finished, a final message box appears notifying that the copying is complete.

Figure 8. CD Copier

4.8 Creating Label for a CD Jewel Case

A jewel case feature is provided by the Adaptec CD creator to indicate the contents of a CD. Both the front and inside covers of the insert are printed on a single sheet of paper that is folded in half and slides into the top lid of a jewel case (a plastic case that holds the CD). (Fig. 9)

Figure 9. Jewel Case

5. CD RECORDING TIPS

♦ No run ning pro grams in the back ground

If we have Windows 9X, we can check this by pressing and holding Ctrl+ Alt + Del which will bring up a close program window.

♦ Disable power management

Ensure that all power management is disabled on the computer. If the computer or a computer component goes into power saving mode during the recording process this can cause issues.

♦ PC defrag and scandisk hard disk drive

Run defrag and scandisk on hard drive recently which will help prevent the computer from having to search the hard disk drive longer.

♦ De vice con flicts

Get to device manager by clicking Start/ Settings/Control panel/double click the System icon/click the Device manager tab. Ensure within device manager there are no conflicts.

6. HANDLING OF CDs

♦ Do not fold, spindle, or mutilate

♦ Use good en clo sures. Cheap plas tic sleeves (those some times used to hold CDs in the backs of books or in some types of mul ti ple CD holders) are not suitable for long-term storage. Upon exposure to extremes of temperature, direct sunlight and humidity, the disc and sleeve may adhere to each other.

♦ Pro tect the in di vid u ally cased CDs fur ther by placing them in a closed box, drawer, or cabinet. This gives additional protection from light, dust, and cli mate fluc tu a tions.

♦ Never allow CDs to remain out of their en clo sures for long pe ri ods of time.

♦ Al ways han dle discs by their edges.

♦ Don't eat, drink, or smoke around CDs.

♦ Don't write with sharp point to the top surface. These actions wipe out pits and causing areas of the disc to become unreadable. This can happen to both CD-ROMs and writable CDs

♦ Don't peel off a la bel.

♦ Don't ap ply sol vents.

♦ User-applied labels of any kind may un bal ance the CD and make it dif fi cult for the player to read. La bels may peel off in hu mid con ditions.

♦ To clean a CD, use lens cleaner and lens tissue from a quality man u facturer. Al ways wipe from the cen ter hub to ward the out side edge. The motion should be in a radial di rection, not in a cir cumfer en tial di rection.

♦ Store CDs in cool and moderately dry environments for greater life expectancies. In general, storage temperatures for CDs should not be any warmer than about 25°C (77°F) when archival permanence is desired. Cooler temperatures (down to about 10°C or 50°F) will help ensure the longest possible life expectancy. At present, no national or international standards for long-term storage conditions for CDs have been published by ANSI or the International Standards Organization (ISO).

7. CONCLUSION

Introduced in 1980, CDs were intended for musical recordings; but now with their ability to hold large amount of music, data, audio, video, etc., they have brought revolution in library and information science field, multimedia industry, education, entertainment industry, and so on.

CDs as a storage and dissemination medium have become a necessity in library market all over the world. This technology has provided new avenues to store and retrieve library's vast bibliographical as well as full text data. CDs have been extensively used by the library professionals in numerous services such as cataloguing support (bibliofile), online public access catalogue, collection development (bibliographical sources, full text journal articles, reports, standards, patents, etc.) and reference services, and so on.

With the growth of CD manufacturing industry, we may expect compact disks which will be less vulnerable of temperature, humidity, etc., and can store larger amount of data.

FURTHER READINGS

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4. Neelima Vaid. Born to Burn. *PC Quest*, May 2002, 36-42.

5. http://www.cdconnection.com

6. Inventors.about.com/library/blcompact disk.htm

7. http://www.footslog.com

Contributors: **Smt Alka Bansal** is Scientist C at Defence Scientific Information and Documentation Centre (DESIDOC), Delhi - 110 054.

Smt Dipti Arora is STA at DESIDOC, Delhi - 110 054.