

CHAPTER

8

Optical Media

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Introduction

Optical media refers to data storage media, such as a Compact Disc (CD), Digital Versatile Disc (DVD), and Blu-ray Disc, which are read by a laser beam. You can store data on various CD and DVD types, such as Compact Disc-Recordable (CD-R), Compact Disc-Rewritable (CD-RW), Digital Versatile Disc-Recordable (DVD-R), and Digital Versatile Disc-Rewritable (DVD-RW). The data stored in these formats can be accessed with the help of a CD/DVD-Read Only Memory (ROM) drive. Compared to a hard disk drive, optical media has low seek time (the time taken to access information from a disc). In addition, optical media is less likely to lose its data and has a longer shelf life – about seven times longer than magnetic media. It is also ideal for taking backups and transferring data between different computers. In this chapter, you learn about important terms related to a CD/DVD-ROM drive. You also learn about the CD-ROM drive, Magneto-optical drive, and Blu-ray. In addition, the chapter explores the combo drive and discusses how to decode optical media. Apart from this, you learn how to maintain and clean a DVD/CD drive; write data on a CD/DVD using the Windows 7 wizard and Nero software; and create an image of a CD/DVD. Towards the end, the chapter discusses common problems of optical media along with their solutions, and explores a flowchart to troubleshoot these problems.

Let's begin the chapter by learning some important terms related to a CD/DVD-ROM drive.

Understanding the Key Terms of a CD/DVD-ROM Drive

Before learning about a CD/DVD-ROM drive, you need to understand basic terms associated with it. Some key terms related to the CD/DVD-ROM drive are as follows:

- Interface:** Refers to a connector, which connects a CD/DVD-ROM drive to a computer. A CD/DVD-ROM drive connects to a computer by using the Integrated Drive Electronics (IDE) or SATA interface. Fig.HD-8.1 shows the interface of a CD/DVD-ROM drive:

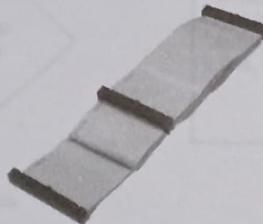


Fig.HD-8.1

- Storage capacity:** Refers to the amount of data that you can write on a CD/DVD.
- Buffer:** Refers to the memory of a CD/DVD-ROM drive, which is used to hold data temporarily. In other words, the size of the buffer is the amount of memory space that is used to store data, which is to be written on a CD/DVD.
- Format:** Refers to the specification that defines the type of CD/DVD accepted by a CD/DVD-ROM.
- Speed:** Refers to the rate at which a CD/DVD rotates in a CD/DVD-ROM drive.

Now, let's explore a CD-ROM drive.

Exploring a CD-ROM Drive

A CD-ROM drive uses a round shaped optical disc, which is used to store different types of data, applications, games, and audio files. The disc of a CD-ROM drive is known as a CD, CD-ROM disk, or just disk. The data storage capacity of a CD is 700 megabytes (MB). Apart from its high storage capacity, a CD is very reliable. These factors have ensured its widespread use in most organizations. Using a single CD to store or install software is easier than using 40 floppy disks for the same purpose. Therefore, using a CD not only saves time, but also makes the process of installing the software easier. CD-ROM drives have a variety of controls on their front panel. Some of these controls are:

- Headphone jack:** Connects a headphone to a CD-ROM drive and allows you to listen to audio.
- Volume control button:** Controls the volume of the connected headset.
- Eject button:** Ejects a CD or CD tray.

A CD-ROM drive can be classified by the x factor, which refers to the speed or rate of data transfer of the drive.

For example, 1x refers to single speed, 2x refers to double speed, 4x to quad speed, and so on. Similarly, some CD-ROM drives have been classified as 8x, 10x, 12x, 16x, 24x, 32x, 36x, 40x, 48x, 52x, 56x, and 72x.

Table 8.1 shows the transfer rate of different CD-ROM drives:

Table 8.1: Transfer Rate of Different CD-ROM Drives

Type of CD-ROM Drive	Transfer Rate in Kilobyte(KB)/sec
1x	150
2x	300
4x	600
8x	1200
10x	1500
12x	1800
16x	2400
24x	3600
32x	4800
36x	5400
40x	6000
48x	7200
52x	7800
56x	8400
72x	10800

The working of a CD-ROM drive depends on several factors, such as the type of microprocessor, capacity of Random Access Memory (RAM), and type of video card installed on a computer. Let's try to understand this with an example. Suppose a 40x CD-ROM drive is installed in two different computers. One computer has a 3.0 Gigahertz (GHz) Pentium microprocessor, 2 MB Cache memory, 512 MB of RAM, and an Industry Standard Architecture (ISA) video adapter with 256 MB of video memory. The other computer has a 3.0 GHz Pentium microprocessor, 2 Gigabytes (GB) of RAM and a Peripheral Component Interconnect (PCI) video adapter with 1 GB of video memory. The CD-ROM drive in the second computer displays superior graphics on the screen, or plays audio files more quickly than the drive of the first computer. This enhanced efficiency of the second computer is due to the high capacity RAM and large memory on the video card as compared to the first computer. However, just having a faster CD-ROM drive does not necessarily mean that the drive is performing optimally. For that, you must ensure that all the devices and components in your computer work together efficiently to produce the desired result.

The two most common terms related to CD-ROM drives are average seek time and average access time. The average seek time is the time that a CD-ROM drive requires to rotate a disk. The average access time is the amount of time a CD-ROM drive requires to retrieve information from the disk. A CD-ROM drive with lower access time performs better than one having higher access time.

Table 8.2 lists the average access time for different CD-ROM drives:

Table 8.2: Access Time of CD-ROM Drives

Type of CD-ROM	Typical Access Time (in milliseconds)
1x	400
2x	300
4x	150
8x	120

Table 8.2: Access Time of CD-ROM Drives

Type of CD-ROM	Typical Access Time (in milliseconds)
10-12x	100
16-24x	90
32x and higher	85 or less

You have learned about a CD-ROM drive. Let's now explore the buffer/cache of a CD-ROM drive.

Discussing the Buffer/Cache of a CD-ROM Drive

The data transfer speed of a CD-ROM drive can increase or decrease depending on the size of its buffer. When Central Processing Unit (CPU) requests data, the CD-ROM drive retrieves it and places it into the buffer of the CD-ROM drive. The buffer ensures the constant flow of requested data to the microprocessor of the computer. The size of a buffer typically ranges from 128KB to 8MB. A minimum of 500 KB buffer must be installed in a computer for a CD-ROM drive to run efficiently.

Now, let's learn how a CD-ROM drive operates.

Understanding the Operation of a CD-ROM Drive

A CD-ROM drive reads a CD and displays its content on the screen. Every CD is coated with a reflective metallic aluminum alloy, which is covered with a thin layer of lacquer for protection. This aluminum metallic alloy layer stores data. This reflective metallic aluminum alloy generally found on both sides of the CD.

A CD contains thousands of spiral tracks. These tracks run from innermost area towards outside of the disc. The spiral tracks are somewhat same as grooves of a gramophone record.

A laser beam reads the data of a CD. The device that creates this laser beam is located inside the CD-ROM drive. When you insert a CD in the CD-ROM drive, the laser beam shines through the protective coating of the aluminum alloy layer where data is stored. From the aluminum alloy layer, the beam passes through an optical system, which consists of a series of lenses, prisms, and mirrors.

A servomotor inside the CD-ROM drive positions the laser beam on the track. After that, the laser beam reflects on a photodiode detector that converts it into a binary format, that is, in the format of 0s and 1s. Next, the binary format is converted into ordinary language that can be understood by a user and displayed on the computer screen.

Fig.HD-8.2 shows the inner architecture of a CD-ROM drive:

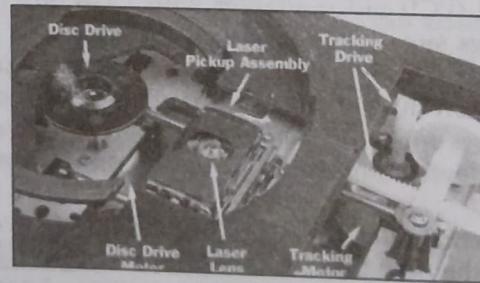


Fig.HD-8.2

Now let's learn about internal and external CD-ROM drives and CD-ROM disk loading methods.

Internal and External CD-ROM Drives

A CD-ROM drive can be mounted either internally in a bay provided in the cabinet where the motherboard, RAM, microprocessor, and hard disk drives are placed, or outside the cabinet as an external unit. An internal CD-ROM drive uses the IDE interface as well as SATA interface to transfer data from the CD-ROM drive to the processor of the computer. On the other hand, an external CD-ROM drive uses the Small Computer System Interface (SCSI), USB, or eSATA interface to transfer data from the CD-ROM drive to the processor.

The IDE interface used by the internal CD-ROM drive can't be used with the external CD-ROM drive. However, internal CD-ROM drives are less expensive than external CD-ROM drives. Let's now learn about different methods to load a disk into a CD-ROM drive.

Disk Loading Methods in a CD-ROM Drive

The three methods used to load a CD into a CD-ROM drive are:

- Tray loaded
- Caddy loaded
- Slot loaded

Let's now learn about these methods in detail in the following section.

The Tray Loaded Method

In the Tray loaded method, the CD is held in a plastic tray. When you press the Eject button of the CD-ROM drive, the tray slides out on which the CD can be placed. After placing the CD, press the Eject button again to load the CD into the CD-ROM drive. These days, the Tray loaded method is the most common method used in a computer.

Fig.HD-8.3 shows a CD-ROM drive with a tray:



Fig.HD-8.3

The Caddy Loaded Method

A caddy refers to a small carrier which is made up of plastic. A joint on one side (Fig.HD-8.4) allows you to open the cover, so that the CD can be placed inside. After inserting the CD, close the cover and insert the caddy into the CD-ROM drive. A metal cover at the bottom of the caddy slides out so that the CD can be accessed by the CD-ROM drive. The working of a CD inside the caddy is similar to the working of a 3.5" floppy disk inside its jacket. Many old CD-ROM drives use the Caddy loading method.

Fig.HD-8.4 shows a CD inside a caddy:

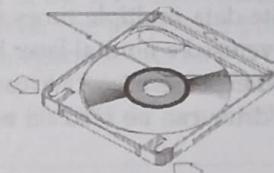


Fig.HD-8.4

The Slot Loaded Method

The Slot loaded method is not used much these days because it causes frequent CD jams. Removing a jammed CD is also tedious, as you need to remove the CD-ROM drive from the computer and disassemble it to retrieve the CD.

Fig.HD-8.5 shows a CD inside the Slot loaded CD-ROM drive:



Fig.HD-8.5



Disk loading methods in a DVD-ROM drive are similar to the disk loading methods in a CD-ROM drive.

Let's now learn about different CD technologies.

Exploring CD Technologies

Two CD technologies, namely CD-R and CD-RW allow you to create CDs. These technologies have several similarities with each other, but CD-RW is more popular because it allows you to write data more than once.

Now, let's learn about these technologies in detail, starting with CD-R.

The CD-R Technology

In the CD-R technology, data on a CD can be written only once. In other words, you cannot erase the data once it is written on a CD using the CD-R technology. The CD based on this technology is created by a CD-R drive, but such CDs can be read by any CD-ROM drive. The CD-R technology is also known as the Write Once-Read Many (WORM) technology. You can use the CD's (created using the WORM technology) for taking backup or distributing software. Such CDs have a temperature sensitive dye coating on their surface. While writing the CD, a laser beam falls on a particular area on the surface of the CD, changing the color of the area. You will notice that the area where data is written appears in a different color than the original color of the CD surface.

CD-R drives come in the IDE, SCSI, and Universal Serial Bus (USB) models.



IDE, SCSI, USB, and SATA are interfaces for storage devices, such as a CD-ROM drive.

A disadvantage of writing data on a CD with using a CD-R drive is that if the CD-R drive does not receive data in a steady stream, an error occurs, resulting in damaging of the CD. You can avoid this problem by using a high-end computer that has at least 512 MB of RAM.



A mini-disk is another type of CD, which can be created using a CD-R drive. Most CD-ROM drives accept a standard CD and mini-disk.

The CD-RW Technology

CD-RW (also called Compact Disk Erasable) is a technology that allows you to create CDs on which data can be written multiple times. CD-RWs are good for creating data backups, archiving, or distribution. CD-RW CDs are written with help of CD-RW drives and these drives can be connected with the SCSI, IDE, USB, or FireWire port. The FireWire port is a serial computer port that connects digital media devices, such as digital cameras and camcorders, with a computer.

Originally, the technology to write data multiple times on a CD was known as the Phase-change Dual (PD) technology, as a PD/CD drive used a normal laser beam to read a PD disk. However, these days, a PD/CD drive uses a high-powered expensive laser to read a PD disk.

The CD created using a CD-RW drive can be read on any standard CD-ROM drive or a drive labeled MultiRead.



MultiRead or MultiRead2 is an Optical Storage Technology Association (OSTA) specification, which states that a CD-RW drive is compatible with CD-ROM and CD-R disks.

While purchasing a CD-ROM drive, make sure the CD-ROM drive is capable of reading CD-RW disks. The drawback of the CD-RW disc is that it gets damaged after multiple writes.

Let's now learn about different CD standards.

Understanding CD Standards

A CD stores different types of data, such as audio, video, and text. According to the type data they store, CDs are categorized according to different standards. Manufacturers of CD-ROM drives occasionally use the CD standards to mention the type of data format their CD-ROM drive can read. CD standards can be classified in the form of colored books.

Table 8.3 summarizes CD standards for the type of data format:

Table 8.3: CD Standards for Data Formats

Standard	Purpose
Red Book	Audio CD
Yellow Book	Data CD
Green Book	CD-i (interactive) format for making multimedia CD
Orange Book	Data CD as well as Audio data

Table 8.3: CD Standards for Data Formats

Standard	Purpose
White Book	Video CD and Super Video CD (SVCD uses a digital format to storing video)
Blue Book	Enhanced CD, CD Plus, and CD Graphics
Scarlet Book	Super Audio CD (SACD) format that uses a high resolution for making audio CD
Purple Book	Double Density CD (DDCD) format
Beige	Photo CD designed by Kodak

Let's now learn about the DVD-ROM drive.

Discussing a DVD-ROM Drive

Earlier, you could play DVDs only on a DVD player. However, nowadays, computers are equipped with a built-in DVD-ROM drive to play DVDs. Moreover, DVDs are not only used for watching movies or listening to songs, but also serve as a high capacity storage medium for data.

To use a DVD-ROM drive, a computer must meet the following hardware and software requirements:

- 3.0 GHz Pentium IV microprocessor or higher
- 512 MB of RAM or higher. 1 GB is recommended
- DVD-ROM drive and the SCSI, IDE, USB, or SATA interface
- PCI/ Accelerated Graphics Port (AGP) audio/video adapter that can handle Motion Picture Expert Group (MPEG)-2 video
- Windows XP, Windows Vista, or Windows 7
- Decoder (optional)

Manufacturers specify a code for every DVD and DVD-ROM drive produced by them. For a DVD to work in a DVD-ROM drive, the code of the DVD must match the code of the drive. Otherwise, the DVD cannot be used in that DVD-ROM drive. The purpose of proving these codes is to prevent unauthorized distribution of DVDs. The world is categorized into nine DVD regions and the DVD-ROM drive must be set to the correct region code. When a DVD is inserted in a DVD-ROM drive, a decoder checks the code of the drive and the region code of the DVD. If the two match, then the DVD is played.

Table 8.4 shows the region codes:

Table 8.4: Region Codes for a DVD

DVD Region Code	Geographical Area
0	No Region Code (DVD can be played in all regions, that is, 1 to 6, except for region 8).
1	United States of America, Canada
2	Europe, South Africa, Greece, Saudi Arabia, Turkey, Egypt, and Japan
3	North Korea, South Korea, Thailand, Vietnam, Borneo, and Indonesia
4	Australia, New Zealand, Mexico, Caribbean, and South America
5	India, former USSR countries, Russia, and Africa
6	China
7	Unused
8	International territories such as airlines and cruise ships

Ensure the configuration for the appropriate region, if you are using a hardware decoder. Also, you have to configure the program for the exact region, if you are using software decoder. Some freeware programs are available on the Internet to check the DVD drive for its region.

Let's now learn about storage capacity of a DVD.

Storage Capacity of a DVD

A DVD can store more data than a CD. While the storage capacity of a CD is about 700 MB, a common DVD has a storage capacity of 4.7 GB. The diameter and thickness of a CD and DVD are almost the same; however, a CD-ROM drive cannot read a DVD. This is because of the difference in the arrangement of pits on the surface of the DVD. The pits on a DVD are smaller and more closely spaced in comparison to the pits on a CD. DVDs provide high video resolution and good quality of sound and can transfer data at the speed of 21.13 megabits per seconds (Mbps). A 4.7 GB DVD (sometimes known as DVD-5) has a single layer on one side (bottom) of the DVD to store data. An 8.5 GB DVD (known as DVD-9) has two layers on the same side of the DVD to increase storage capacity. Other DVDs come with the storage capacity of 9.4 GB and 17.8 GB. The 9.4 GB DVD, also called DVD-10, has a single layer on both sides. The 17.8 GB DVD is also known as DVD-18 and has two layers on both sides.

Let's now learn about various types of DVD technologies.

DVD Technologies

Recordable DVD (DVD-R and DVD+R) and Rewritable DVD (DVD-RW, DVD+RW, and DVD-RAM) are two DVD technologies that you can use to record or write data on a DVD. These technologies have several similarities; however, Rewritable DVD is more popular, as it can be used a no. of times to write the data. Let's now learn about these DVD technologies in detail, starting with the Recordable DVD technology.

The Recordable DVD Technology

In the Recordable DVD technology, the data on a DVD cannot be erased once it is written. DVD is created and read with the help of recordable DVD drives. DVD-R and DVD+R are DVD types that use the Recordable DVD technology.

Let's learn about DVD-R and DVD+R in some detail.

DVD-R

DVD-R is a single-layered disk that uses the WORM technology and is similar to CD-R. DVD-R is available in the market with the storage capacity of 3.95 GB, 4.7 GB, and 9.4 GB.

The format of DVD-R is divided into two versions:

- **General version:** Refers to a format of DVD, which is written with a 650-nanometer (nm) laser. The General version of DVD-R is abbreviated as DVD-R (G). This DVD format is intended for home purposes.
- **Authoring version:** Refers to a format of DVD written with a 635-nm laser. The Authoring version of DVD-R is abbreviated as DVD-R (A). This DVD format is meant for business use. Most DVD-ROM drives and DVD players can read these types of formats, but DVD-R (G) discs can't be written in DVD-R (A) recorders and vice-versa.

DVD+R

DVD+R is a recordable DVD similar to DVD-R as it also uses the WORM technology. It is compatible with most of the DVD players and DVD-ROM drives. However, the difference between the two is that DVD+R is a multi-layered disk that can store more data than DVD-R.

Let's now learn about the Rewritable DVD technology.

The Rewritable DVD Technology

In the Rewritable DVD technology, the data on a DVD can be written more than once. These days, various types of DVDs using the Rewritable DVD technology are available in the market, such as DVD-RW, DVD+RW, and DVD-RAM. DVD-RW and DVD+RW closely resemble CD-RW and use the PD technology, but have higher storage capacity than CD-RW. DVD-RAM, a type of DVD, also uses the PD technology and writes faster than DVD-RW/DVD+RW.

Let's now learn about various types the Rewritable DVD technology DVDs.

DVD-RW

DVD-RW (DVD-Rewritable) is similar to DVD-R, with a single difference that you can erase and rewrite information on the DVD. A DVD-RW has a storage capacity of 4.7 GB and it can be read by most DVD-ROM drives and DVD players. DVD-RW technology is sometimes known as DVD-R/W.

DVD+RW

DVD+RW is used for video recording and is compatible with DVD-ROM drives and DVD players. The storage capacity of a DVD+RW is 2.8 GB per side. Phillips, Sony, HP, Mitsubishi, Yamaha, and Ricoh are some organizations that manufacture DVD+RW.

DVD-RAM

DVD-RAM is used as a storage device for the computer system due to their high storage capacity. These DVDs are used for video recording purposes. DVD-RAM is incompatible with old DVD-ROM drives, but is compatible with MultiRead2 capability drives. DVD-RAM comes with the storage capacity of 2.6 GB and 5.2 GB.

After learning the DVD Rewritable technology, let's learn about Magneto-Optical Drives.

Understanding Magneto-Optical Drives

Magneto-Optical (MO) is a technology that is used to read and write CDs. You need a Magneto-Optical drive to read and write data on a Magneto-Optical CD. The working of the Magneto-Optical drive is based on a laser beam, which writes data on the surface of the CD. Magneto-Optical drives are ideal for offices, organizations, or business units to keep a large volume of data backups.

Next, we explore a new type of disk storage technology, called Blu-ray.

Exploring Blu-ray

Developed by Blu-ray Disk Association (BDA), Blu-ray (also known as Blu-ray Disk or BD) is an optical storage medium that records, stores, and plays high-definition (HD) videos and digital audio. Blu-ray uses a blue-violet laser, instead of a red laser that is used by current optical disk technologies, such as DVD, DVD±R, DVD±RW, and DVD-RAM, to read and write data. Blu-ray can store about 25 GB of data on its single-layer disk and up to 50 GB data on the dual-layer disk. In addition, it has a higher data transfer rate of 36 Mbps compared to a DVD, whose transfer rate is 10 Mbps. Moreover, you can have nine hours of HD video on a Blu-ray disc or about 23 hours of Standard Definition (SD) video on a 50 GB disk.

Similar to CD and DVD technologies, Blu-ray also uses different technologies:

- **BD-R:** Refers to the Blu-ray technology that is used for recording HD videos as well as storing data. In this technology, data can be written only once.
- **BD-RW:** Refers to the Blu-ray technology where data can be written more than once.

After learning about Blu-ray, let's now explore the Combo drive.

Exploring the Combo Drive

A Combo drive supports the functionality of both a CD-ROM drive and a DVD-ROM drive. In other words, a Combo drive can be used to read and write CDs and DVDs. A Combo drive reads CDs at a maximum speed of 52x and DVDs at a maximum speed of 16x. Moreover, it writes CD-R disks with a maximum speed of 52x and CD-RWs with a maximum speed of 32x.

A Combo drive has a large internal buffer (2 GB) that increases the speed of the data transfer, supports MultiRead functions, and consumes less power.

To use a Combo drive, ensure that your computer meets the following hardware and software requirements:

- A Pentium IV microprocessor or above with at least 512 MB of RAM
- A IDE host interface
- 1 GB hard disk drive space for installation
- Microsoft Windows XP/Windows Vista, or Windows 7

Let's now move to the next topic and learn how to decode optical media.

Decoding Optical Media

Optical media stores data in a compressed format. To use this data, you have to first decode it. The process of decompressing the compressed data is known as decoding. Usually, the computer decodes the data by using either hardware or software. Using hardware (such as a sound or graphic card) to decode data utilizes less computer memory and there is less burden on CPU. Hardware-based decoding is ideal

for slow or old computers. On the other hand, software-based decoding refers to the process of decoding the compressed data managed by CPU. Software-based decoding is possible when the computer has the latest hardware and software configurations. The popular software used to decode data from optical media is DirectX. With DirectX, you can play games, listen to music, and watch movies and access interactive Web sites without using graphic and sound cards.

Let's now learn how to maintain DVD and CD drives.

Maintaining a CD/DVD Drive

When gramophone records were used, handling of the records was quite a problem. Fingerprints, dust, and dirt adversely affected the performance of the record. CDs and DVDs are less prone to these problems, because they have a protective coating over the metallic aluminum alloy based data layer. While reading information, the laser beam ignores the protective coating and penetrates the data layer, therefore, the laser beam still operates even if a CD or DVD has dirt on its protective coating. There may be an exception in the condition when the surface material has reflective properties. The reflective property can reflect and deform the laser beam, which results in distortion or data corruption. Another exception occurs when dust or dirt results in complete closure of the laser beam. Heavy accumulation of dust and dirt increases the access time to read data from a CD or DVD as well as create scratches on its surface.



Special cleaning disks, cloths, and kits are available for cleaning CDs and DVDs. While cleaning the CD or DVD, wipe the disk from the inside (near the center hole) to the outside of the disk (not in circular motion). Proper handling of a disk helps in good performance. As with audio CDs used in stereos, handle the disk from its outside edge. Never touch the surface of a disk. Fingerprints, oil from hands, dust, and dirt on a disk can ruin a disk. Store a disk in a cool location.

Scratches occur on the surface of a disk can be fixed by using mild abrasives or special disk repair kits. While applying the abrasive, you must start rubbing from the innermost portion of the disk toward outwards.

The information from the disk is read by lens of the laser (known as objective lens). The laser lens is sensitised to dust and dirt accumulation. The CD/DVD-ROM drive report data or read errors, if the laser lens acquire dust, dirt, or moisture. Some CD/DVD-ROM drives have the lens enclosed in an compact enclosure and some have a self-cleaning laser lens. An air blower can be used to clean the lens of a CD/DVD-ROM drive. The process of cleaning the laser lens is similar to the cleaning the heads of a floppy disk drive. Some drive manufacturers comprise a special plate to keep dust away from the internal components. You should keep the disk compartment closed to protect laser lens and other CD/DVD-ROM drive parts from dust and dirt.

Let's now learn how to clean a CD/DVD-ROM drive

Cleaning a CD/DVD-ROM Drive

The tray of a CD/DVD-ROM drive is the main source from where dust and other foreign materials reach into the CD/DVD-ROM drive. The accumulation of dust results in the CD/DVD-ROM drive displaying a data reading error. However, you can avoid this problem with a few precautions:

- Avoid leaving the tray open. After using the CD/DVD-ROM drive, immediately push the button to put the tray back into the CD/DVD-ROM drive.
- Avoid touching the surface of the tray with oily and dirty hands. In case some liquid or food drops on the surface of the tray, clean the surface with some good cleaner.
- Use the CD cleaning kit regularly to clean the CD/DVD-ROM drive. You can purchase this kit from the market. It comes with a special CD. This CD contains a small brush on its surface. When the cleaning CD is inserted in the CD/DVD-ROM drive, the CD and the brush attached on its surface starts moving. The moving brush cleans dirt from the lens of the CD/DVD-ROM drive.

Let's now learn to write data on a CD/DVD with the Windows 7 wizard.

Writing Data on a CD/DVD with the Windows 7 Wizard

As a routine, you may need to transfer data or information from one place to another. For this, you need a device that can store data. One of the simple ways to store data is to write it on a CD/DVD. You need a

CD-RW or DVD-RW drive to burn (write) the CD/DVD in a computer and a blank, writable, or rewritable CD/DVD to store the data. Windows 7 provides the following types of formats to burn a CD/DVD:

- **Live File System:** Works similar to a pen drive or floppy disk drive. This means that you can use the Live File System format to directly paste files to a CD or DVD without any special writing software. The Live File System format is selected by default in your computer to burn CDs/DVDs.
- **Mastered:** Burns all files and folders to a CD/DVD at once and after that data (files and folders) cannot be erased from the CD/DVD.

Now, let's learn the procedure to write data on a CD/DVD.

Perform the following steps to write data on a CD/DVD:

1. Insert a blank CD/DVD in a CD/DVD drive of the computer. In our case, we have inserted a CD in the DVD drive. The AutoPlay window appears with different options (Fig.HD-8.6).
2. Select **Burn files to disc** in the AutoPlay window (Fig.HD-8.6). The Burn a Disc dialog box appears (Fig.HD-8.7).
3. Type a name in the text box beside the **Disc title** option in the Burn a Disc dialog box. In our case, we have typed **Backup data** (Fig.HD-8.7).
4. Select a radio button to define the file format of the CD in the Burn a Disc dialog box. In our case, we have selected the **With a CD/DVD player** radio button (Fig.HD-8.7).
5. Click the **Next** button in the Burn a Disc dialog box, as shown in Fig.HD-8.7:

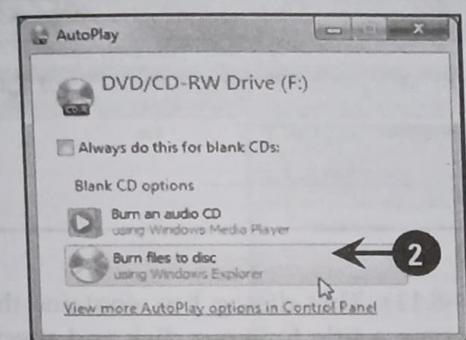


Fig.HD-8.6

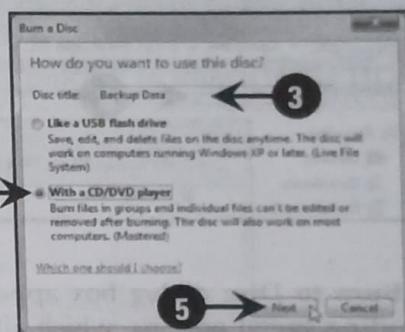


Fig.HD-8.7

The DVD/CD-RW Drive (F:) window opens with the Drag files to this folder to add them to the disc label, as shown in Fig.HD-8.8:

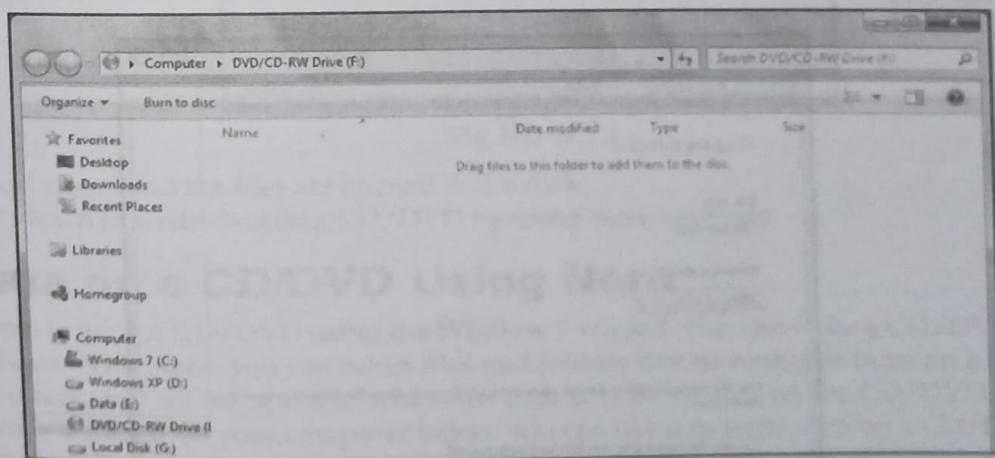


Fig.HD-8.8

6. Select the file or folder that you want to burn. In our case, we have selected the **Backup Data** folder from the **Windows XP (D:)** drive (Fig.HD-8.9).
7. Drag the **Backup Data** folder from the **Windows XP (D:)** drive and drop it in the **DVD/CD-RW Drive (F:)** window, as shown in Fig.HD-8.9:

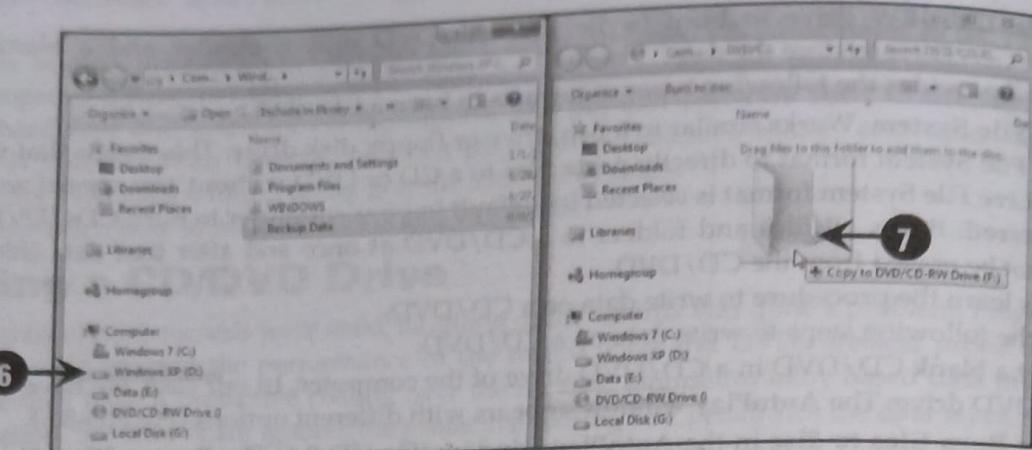


Fig.HD-8.9



You can also cut or copy the data from the source drive, which you want to write on the disk and then paste it to the CD/DVD drive window.

- Click the Burn to disc button on the Toolbar in the DVD/CD-RW Drive (F:) window, as shown in Fig.HD-8.10:

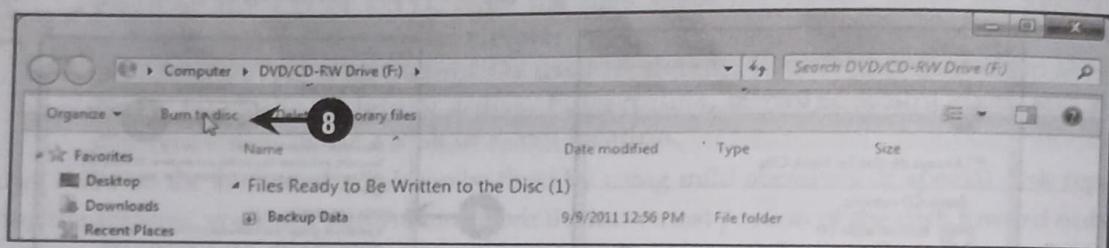


Fig.HD-8.10

The Burn to Disc dialog box appears (Fig.HD-8.11). This dialog box contains the Disc title and Recording speed options, which allows you to type a title for your disk and specify the recording speed, respectively (Fig.HD-8.11). In our case, we have selected Backup Data as the title of our disk and specified 40x as the recording speed.

- Click the Next button in the Burn to Disc dialog box to start the burning process, as shown in Fig.HD-8.11:

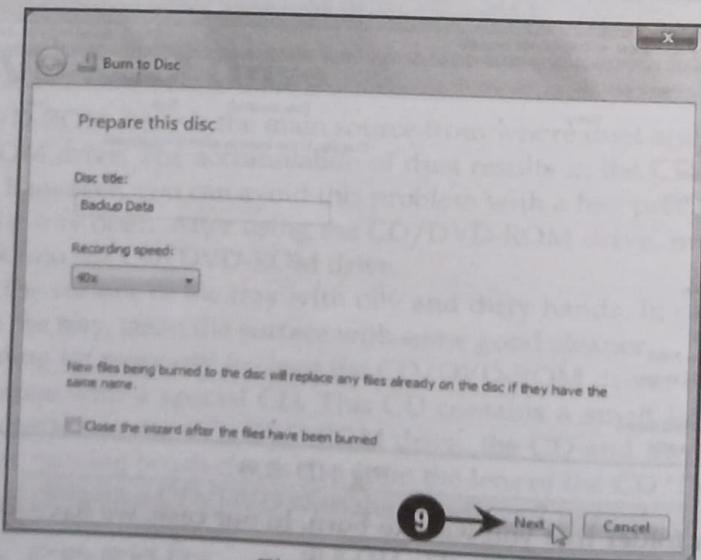


Fig.HD-8.11



You can select the check box beside Close the wizard after the files have been burned to close the writing wizard as soon as the burning process completes.

A progress bar appears, displaying the progress of the burning process, as shown in Fig.HD-8.12:

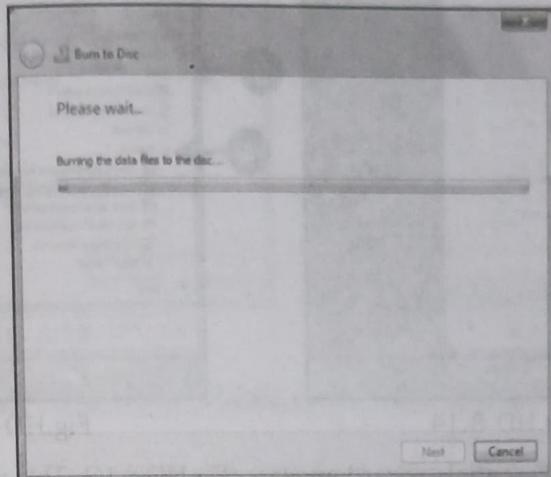


Fig.HD-8.12

When the burning process is complete, a confirmation message box appears, indicating successful completion of the burning process of files to the CD (Fig.HD-8.13).

10. Click the **Finish** button to complete the file burning process, as shown in Fig.HD-8.13:

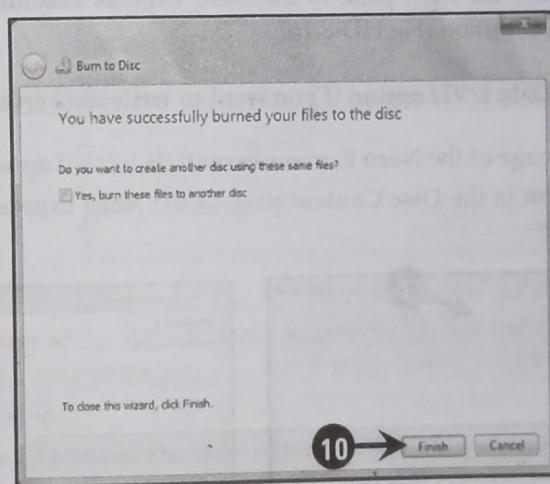


Fig.HD-8.13

The wizard closes and the files are burned to the disk.

Next, let's learn to write data on a CD/DVD by using Nero software.

Writing Data on a CD/DVD Using Nero

Apart from writing a CD/DVD using the Window 7 wizard, you can write a CD/DVD by using software named Nero. With Nero, you can select files and folders that to record or burn on a CD/DVD, check the data for errors, and set the speed at which the data is to be written on the CD/DVD. You need to ensure that Nero is installed on your computer before you can use it to write data on a CD/DVD.

Perform the following steps to write a CD/DVD using Nero:

1. Click the **Start** button on the Taskbar. The **Start** menu appears (Fig.HD-8.14).
2. Select **All Programs** from the **Start** menu. A list of options appears (Fig.HD-8.14).
3. Select **Nero** from the list (Fig.HD-8.15). A drop-down list appears (Fig.HD-8.15).
4. Select **Nero 9** from the drop-down list (Fig.HD-8.15). Another drop-down list under Nero 9 appears.
5. Select **Nero Express Essentials** from the drop-down list, as shown in Fig.HD-8.15;

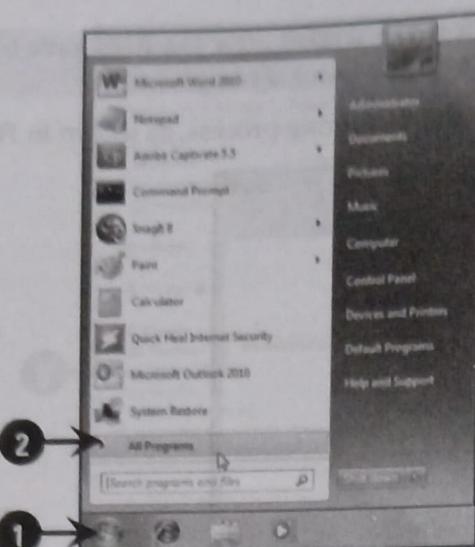


Fig.HD-8.14

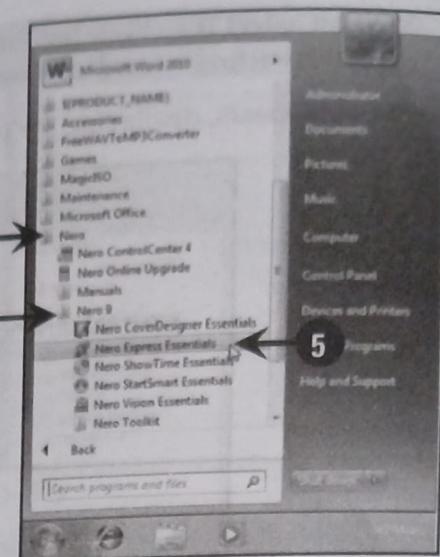


Fig.HD-8.15

The **Nero Express Essentials** wizard appears (Fig.HD-8.16). This wizard displays two panes. From the left pane, you can select a category, such as Data, Music, Video/Pictures, and Image, Project, Copy. The right pane displays options to write data either on a CD or a DVD.

6. Select a category from the left pane in the **Nero Express Essentials** wizard. In our case, we have selected the **Data** category (Fig.HD-8.16). A list of options appears on the right pane (Fig.HD-8.16).
7. Select an option from the right pane in the **Nero Express Essentials** wizard. In our case, we have selected the **Data CD** option (Fig.HD-8.16).



Select the Data DVD option if you want to write data on a DVD.

The Disc Content page of the **Nero Express Essentials** wizard appears (Fig.HD-8.17).

8. Click the **Add** button in the Disc Content page of the **Nero Express Essentials** wizard, as shown in Fig.HD-8.17:

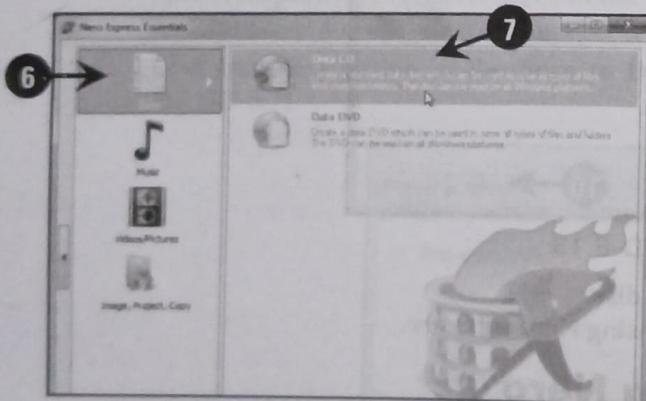


Fig.HD-8.16

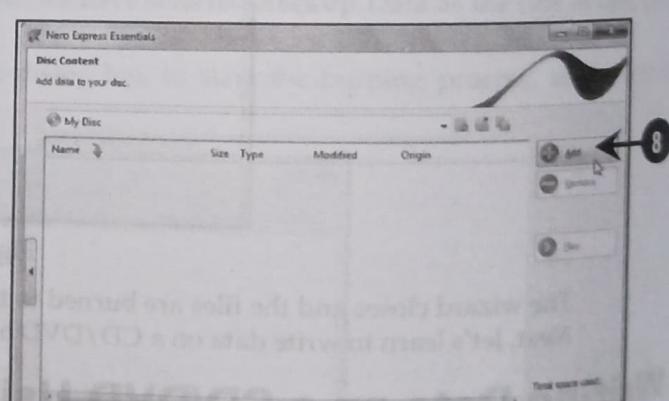


Fig.HD-8.17

The **Add files and folders** window appears (Fig.HD-8.18).

9. Select a drive to add files and folders in the **Add files and folders** window. In our case, we have selected the **Data (E:)** drive (Fig.HD-8.18). A list of files and folders present in the selected drive appears on the Content pane (Fig.HD-8.19).
10. Select a file or a folder from the list, which you want to add to your CD. In our case, we have selected the **Personal** folder (Fig.HD-8.19).
11. Click the **Add** button in the **Add files and folders** window, as shown in Fig.HD-8.19:

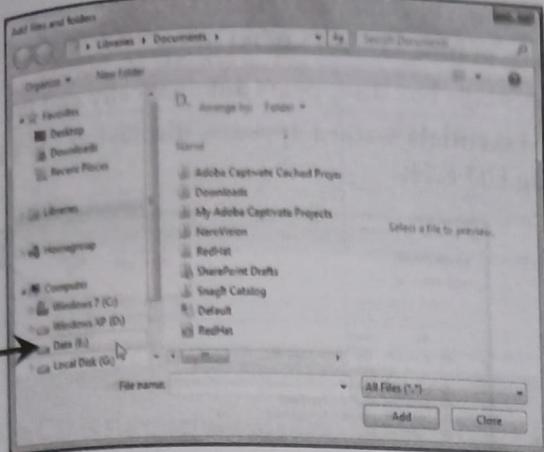


Fig.HD-8.18

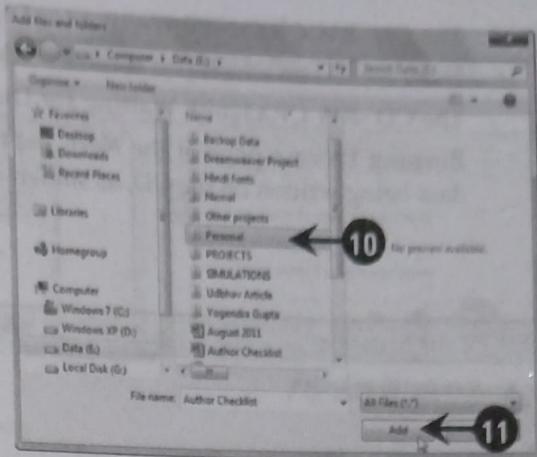


Fig.HD-8.19



You can repeat steps 9 to 11 to add more files and folders.

12. Click the Close button in the Add files and folders window, as shown in Fig.HD-8.20:

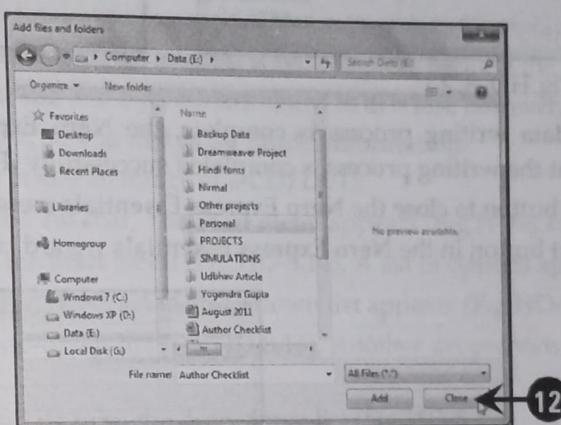


Fig.HD-8.20

The Disc Content page of the Nero Express Essentials wizard reappears (Fig.HD-8.21).

13. Click the Next button (Fig.HD-8.21). The Final Burn Setting page of the Nero Express Essentials wizard opens (Fig.HD-8.22).
14. Type a name for the CD beside the Disc name text box. In our case, we have typed Personal Data (Fig.HD-8.22).
15. Click the Burn button in the Nero Express Essentials wizard, as shown in Fig.HD-8.22:

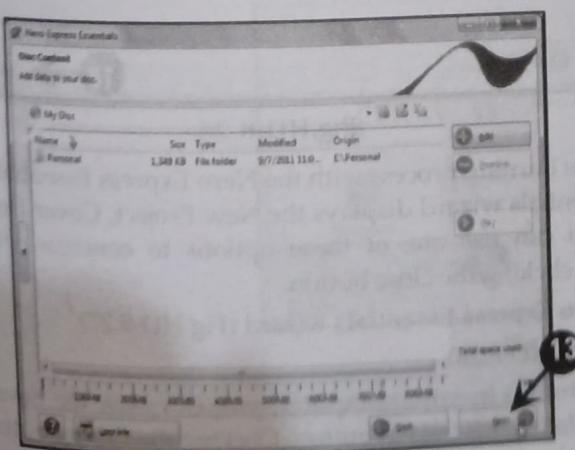


Fig.HD-8.21

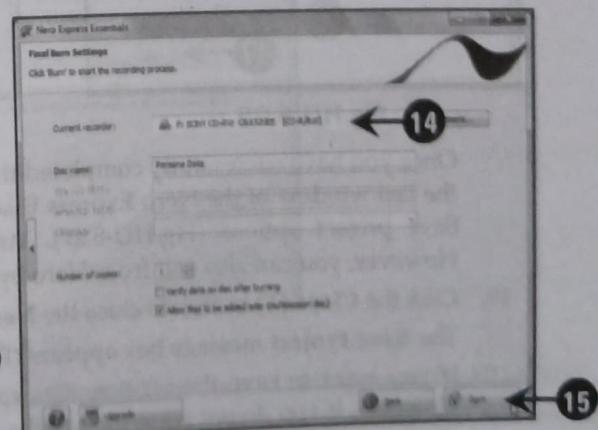


Fig.HD-8.22

The CD -RW CRX320EE Waiting for Disc message box appears (Fig.HD-8.23).

- Insert the CD on which you want to write data, in the CD/DVD-ROM drive.

The CD -RW CRX320EE Waiting for Disk message box disappears automatically and the

Burning Process page of the Nero Express Essentials wizard appears, displaying the status of the data being written on the CD, as shown in Fig.HD-8.24:

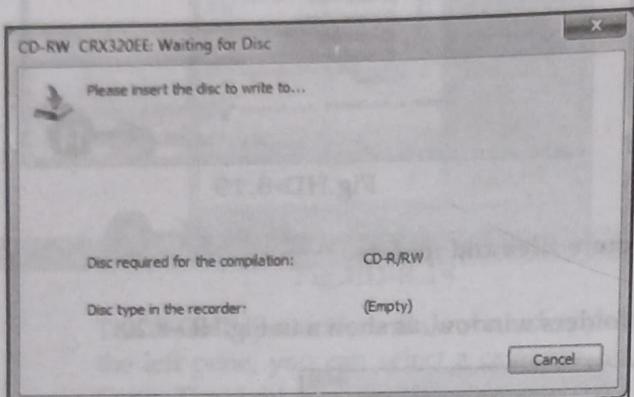


Fig.HD-8.23

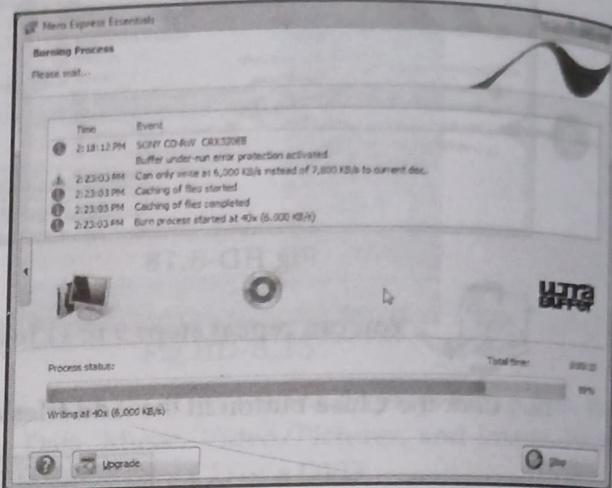


Fig.HD-8.24

When the data writing process is complete, the Nero Express Essentials message box appears, showing that the writing process is completed successfully (Fig.HD-8.25).

- Click the OK button to close the Nero Express Essentials message box (Fig.HD-8.25).
- Click the Next button in the Nero Express Essentials wizard, as shown in Fig.HD-8.26:

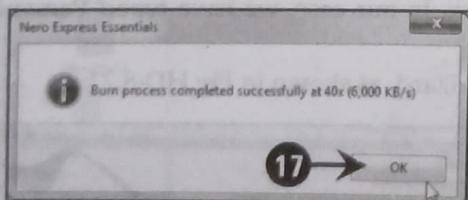


Fig.HD-8.25

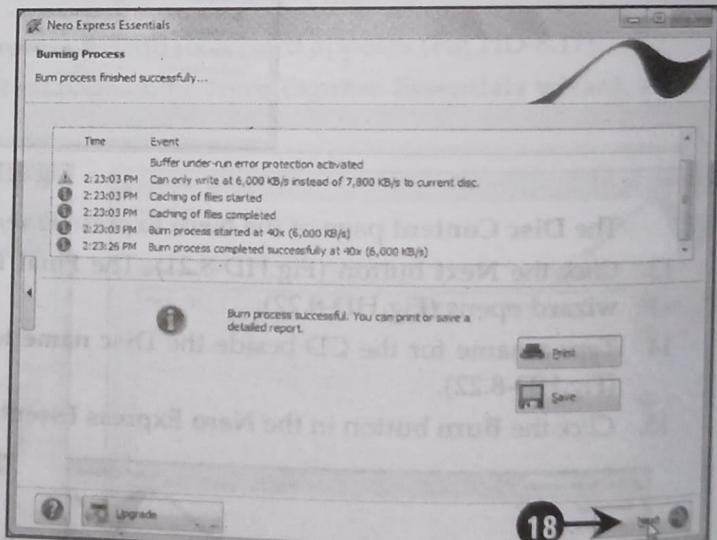


Fig.HD-8.26

Once you have successfully completed the burning process with the Nero Express Essentials wizard, the last window of the Nero Express Essentials wizard displays the New Project, Cover Design, and Save project options (Fig.HD-8.27). You can use one of these options to continue with Nero. However, you can also exit from Nero by clicking the close button.

- Click the Close (X) button to close the Nero Express Essentials wizard (Fig.HD-8.27). The Save Project message box appears (Fig.HD-8.28).

If you want to save the written data (project) in your computer, you can click the Save button. However, if you do not want to save the data, click the No button. Clicking the Cancel button closes the Save Project message box with saving the data.

20. Click the desired button in the Save Project message box. In our case, we have selected the No button, as shown in Fig.HD-8.28:

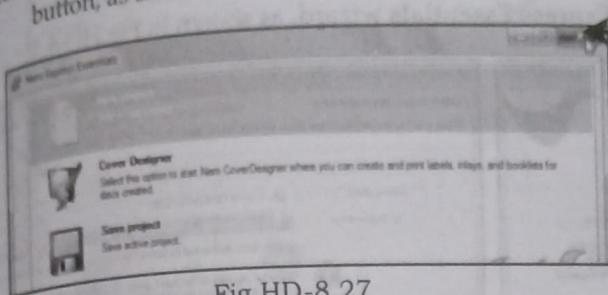


Fig.HD-8.27

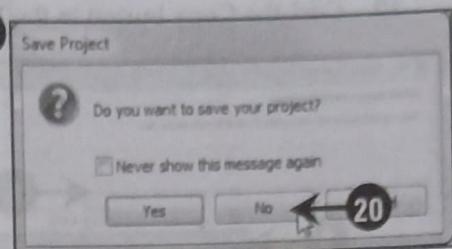


Fig.HD-8.28

The CD is successfully written with the help of Nero.

After learning how to write a CD/DVD, let's now learn the procedure to create an image of a CD/DVD.

Creating an Image of a CD/DVD

An image of a CD/DVD is a file that contains the exact replica of the data stored in the CD/DVD. You can create an image of a CD or DVD using various CD/DVD burning software, such as Nero and Ashampoo Burning Studio. You can use this replica as a backup for the original data. Generally, when you copy data from a CD/DVD to local drive on your computer, the data is not complete, because the header information (that is, the difference between CD sector size and data content stored in it) is lost; however, the image of the CD/DVD includes the complete information, data as well as the header information.

Perform the following steps to create an image of a CD/DVD:

1. Click the Start button on the Taskbar. The Start menu appears (Fig.HD-8.14).
2. Select All Programs from the Start menu (Fig.HD-8.14). A list of options appears.
3. Select Nero from the list (Fig.HD-8.15). A drop-down list appears (Fig.HD-8.15).
4. Select Nero 9 from the drop-down list (Fig.HD-8.15). Another drop-down list under Nero 9 appears (Fig.HD-8.15).
5. Select Nero Express Essentials from the drop-down list (Fig.HD-8.15).

The Nero Express Essentials wizard appears (Fig.HD-8.29).

6. Select the Image, Project, Copy option from the left pane in the Nero Express Essentials wizard (Fig.HD-8.29).
7. A list of options appears on the right pane in the Nero Express Essential wizard (Fig.HD-8.29).
7. Select the Copy Entire CD option in the Nero Express Essentials wizard to create an image of a CD, as shown in Fig.HD-8.29:

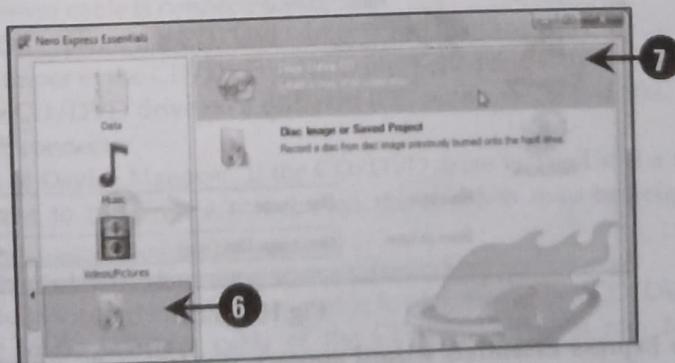


Fig.HD-8.29

8. The Select source and destination page of the Nero Express Essentials wizard appears (Fig.HD-8.30).
8. Select a source drive from the list box beside the Source drive option. In our case, we have selected F: SONY CD-RW CRX320EE [CD-R/RW] (Fig.HD-8.30).

9. Select a destination drive from the list box beside the Destination drive option. In our case, we have selected Image Recorder [CD-R/RW] (Fig.HD-8.30).
10. Click the Copy button in the Nero Express Essentials wizard, as shown in Fig.HD-8.31:

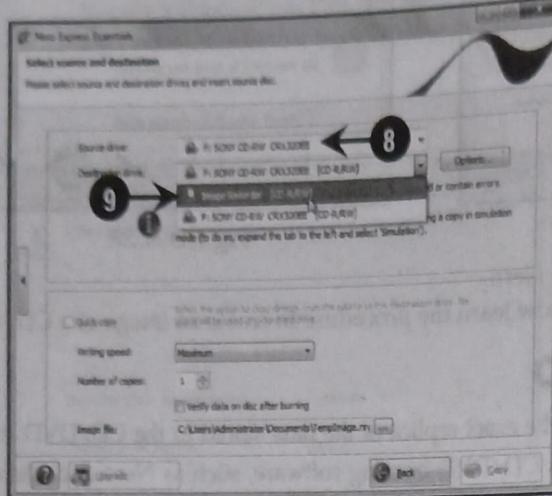


Fig.HD-8.30

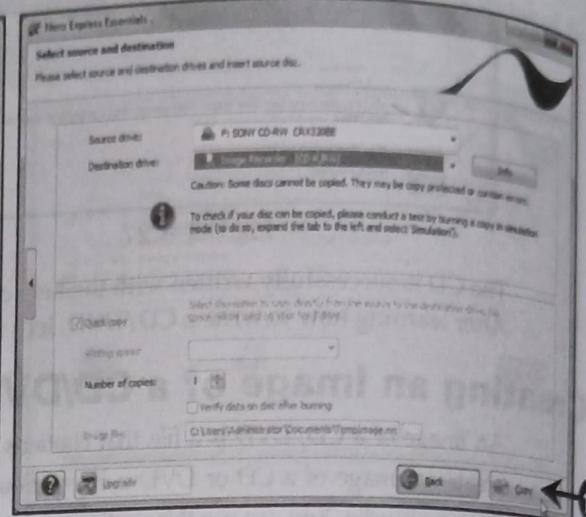


Fig.HD-8.31

The Save Image File dialog box appears (Fig.HD-8.32).

11. Select a location to save the image of the CD from the left side of the in the Save Image File dialog box. In our case, we have selected Desktop (Fig.HD-8.32).
12. Type a name of the image file that you want to save, in the text box beside the File name option. In our case, we have typed Disc_Image (Fig.HD-8.32).
13. Click the Save button in the Save Image File dialog box, as shown in Fig.HD-8.32:



Fig.HD-8.32

The Nero Express Essentials wizard appears, displaying the progress of the CD copying process (Fig.HD-8.33).

When the CD copying process is complete, the Nero Express Essentials dialog box appears, displaying the Burn process completed successfully message.

14. Click the OK button to close the Nero Express Essentials dialog box, as shown in Fig.HD-8.34:

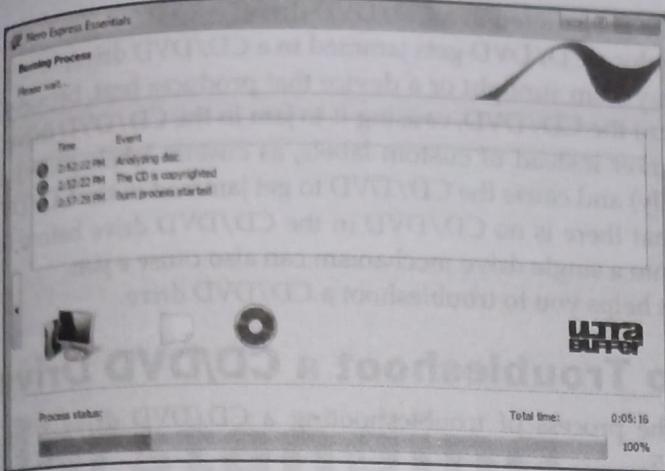


Fig.HD-8.33

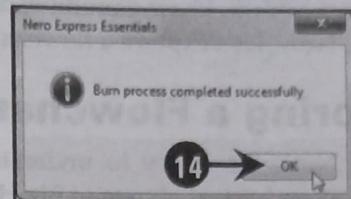


Fig.HD-8.34

15. Click the Next button. The Nero Express Essentials wizard reappears, displaying the Burn same project again, New project, and Cover design options. In our case, we do not select any option.

16. Click the Close button to close the Nero Express Essentials wizard.

The image of the CD is now created.

Let's now discuss some basic problems of optical media along with their solutions.

Troubleshooting Problems of Optical Media

You may encounter different types of problems while working with optical media. To avoid this, you must troubleshoot these problems, so that the optical media work properly.

Problem 1: What should I do if my CD/DVD drive is not writing or reading a CD/DVD?

Solution: To solve the problem, you can do the following:

- ❑ Ensure that the CD/DVD is inserted in the CD/DVD drive.
- ❑ Ensure the CD/DVD is compatible with the drive. Certain types of drives can read certain types of disks. The standard formats are CD, CD-R, CD-RW, DVD-R, DVD+R, DVD-RW, and DVD+RW. If you have an old CD/DVD drive, ensure that it is able to read your high speed CD/DVD. Insert the CD/DVD into the drive and see if a LED lights up at the front of the drive. In addition, check whether the eject mechanism is working properly. If no light is visible, then check the power connection of the drive.

Problem 2: What should I do if my CD/DVD drive is not working after installation?

Solution: Installing a new hardware can be a complicated task. Check the following if a CD/DVD drive fails to work after installation:

- ❑ Ensure that the power cable is connected properly.
- ❑ Ensure that the IDE cable of the CD/DVD drive is installed correctly.
- ❑ Ensure that the jumper in the CD/DVD drive is positioned correctly.
- ❑ Try installing the CD/DVD drive on a different IDE connector. If it works, then you are more likely to have a bad IDE connector.
- ❑ Check the status of Device Manager. If the CD/DVD drive is listed and a question mark or a red X mark appears next to the drive's name, then the problem may be related to the driver of the CD/DVD drive.

Problem 3: Why am I not able to play music on my CD/DVD drive?

Solution: Check the following when you are not able to play music on a CD/DVD drive:

- ❑ Ensure that the audio interface cable of the CD/DVD drive is not damaged and is properly connected to the drive.
- ❑ Ensure that the speakers are connected correctly into an electrical outlet for proper power supply.
- ❑ Ensure that your computer has a sound card in it. Without a sound card, you cannot play music in your computer.
- ❑ Ensure that the sound driver is installed on your computer.

Problem 4: Why do the CDs/DVDs get jammed in a CD/DVD drive?

Solution: Here are a few reasons why a CD/DVD gets jammed in a CD/DVD drive:

- **Heat:** Keep the CD/DVD away from sunlight or a device that produces heat, because excessive heat can damage and warp (deform) the CD/DVD, causing it to jam in the CD/DVD drive.
- **Labels:** Use a permanent marker instead of custom labels, as custom labels pasted on a CD/DVD tend to come off (even partially) and cause the CD/DVD to get jammed in the CD/DVD drive.
- **Presence of a disk:** Ensure that there is no CD/DVD in the CD/DVD drive before inserting a new disk. Placing multiple disks into a single drive mechanism can also cause a jam.

Now, let's explore a flowchart that helps you to troubleshoot a CD/DVD drive.

Exploring a Flowchart to Troubleshoot a CD/DVD Drive

Now, let us try to understand the process of troubleshooting a CD/DVD drive with the help of a flowchart, as shown in Fig.HD-8.35:

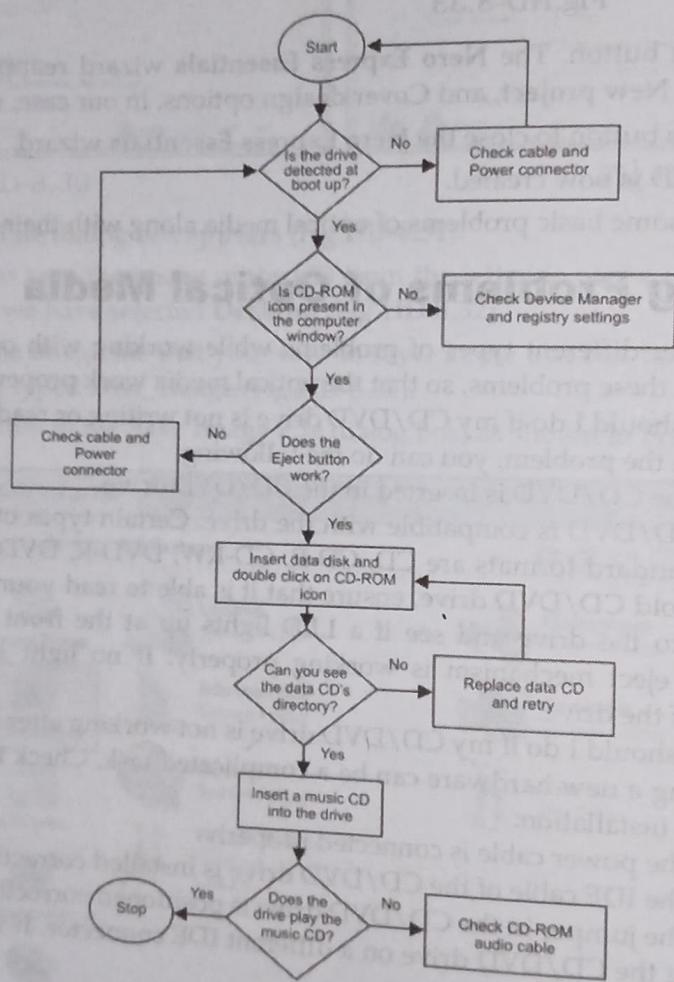


Fig.HD-8.35

With this, we come to the end of the chapter, let's summarize the key point discussed in the chapter.

Summary

The chapter has discussed important terms related to a CD/DVD-ROM drive. It has also discussed the different technologies used to read and write a CD or DVD, including the CD-ROM drive, the Magneto-optical drive, and Blu-ray. In addition, it has explored the Combo drive, and discussed how to decode optical media. Apart from this, you have learned how to maintain and clean a DVD/CD drive; write data on a CD/DVD using the Windows 7 wizard and Nero software; and create an image of a CD/DVD. Towards the end, the chapter has discussed common problems related to optical media along with their solutions and has explored a flowchart to troubleshoot these problems.