

CD PLAYER: HOW IT WORKS

Get to know how a CD player works and how an audio CD player can be converted into a video CD player

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The CD player first appeared in the market in 1982. It plays the CD at the correct speed and accurately converts digital data of the CD back into the analogue form by means of a reflected laser beam.

The laser, an acronym for light amplification by stimulated emission of radiation, is a special light source that produces a concentrated light beam. The laser beam is used to reproduce the signals recorded on the disk surface. A number of servo systems are used to focus, track, and rotate the disk. The CD player operates in a specific order, with the sequence of operations controlled by a system built around integrated circuits (ICs).

CDs and their merits

A CD is a high-precision, compact, circular disk with a high storage capacity. On one side of the disk signals are recorded, and on the other side of the disk the label indicating the contents is printed. The CD surface (Fig. 1) is made of a continuous, fine spiral track going around the disk that originates from the centre of the disk.

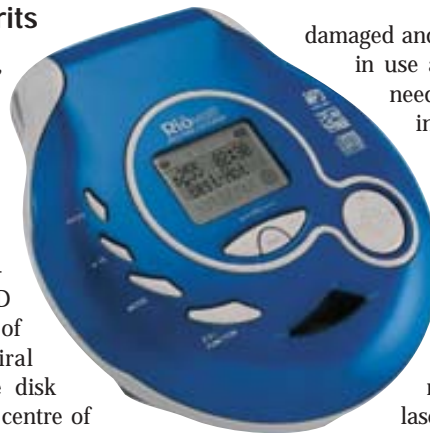
Signals are stored on the CD in the form of digital data comprising combinations of 'on' and 'off' signals (1's and 0's), recorded as pits and flat areas on the disk surface, commencing from the centre of the disk.

Signal recording on the CD in digital format offers greater advantage than in analogue format. When signals are stored in digital format, signal loss and disturbances are completely eliminated. The background hissing noise is negligible from a CD, which improves the sound quality. (Normally, the background hissing noise is audible from LP records and audiocassettes.)

On the CD, right- and left-channel signals are recorded separately one after the other in a fixed time interval. This helps to suppress cross-talk between the right and the left channels, reproducing stereophonic sound.

During playback the fine track is exposed to the laser beam. The playing of CD commences from the centre and continues towards the outer edge. The main advantage of using a CD is that its fine track is not easily

damaged and does not wear out in use as there is no hard needle or stylus touching the surface of the CD. There is no direct contact between the reading mechanism and the disk surface, the signals being read from the disk through a reflected beam of laser light.



The CD player system

The servo system. The CD player (Fig. 2) consists of a set of servo systems that make the laser beam accurately focus on the surface of the CD and track across the fine surface of the CD, when the CD is made to rotate at a correct speed. Motors perform simple mechanical operations to drive the CD, optical assembly, and the loading and unloading system. A pair of coils makes the lens within the optical assembly to move vertically and laterally.

Most CD players have four individual servo systems, namely, the focus, tracking, carriage, and spindle servos. CD players with radial optical assembly have only three servo systems, namely, the focus, radial, and spindle servos.

Focus servo. Focus servo makes the laser beam to focus on the playing surface of the CD by vertical movement of the objective lens. The photodiode array provides the initial focus information along with an amplifier and a control system.

Tracking servo. Tracking servo keeps the laser beam to track gradually across the CD playing surface area by sideways movement of the objective lens.

Carriage servo. Carriage servo makes the optical assembly to move when the objective lens reaches the surface limits of its operation. This servo works along with the tracking servo.

Radial servo. Radial servo with the

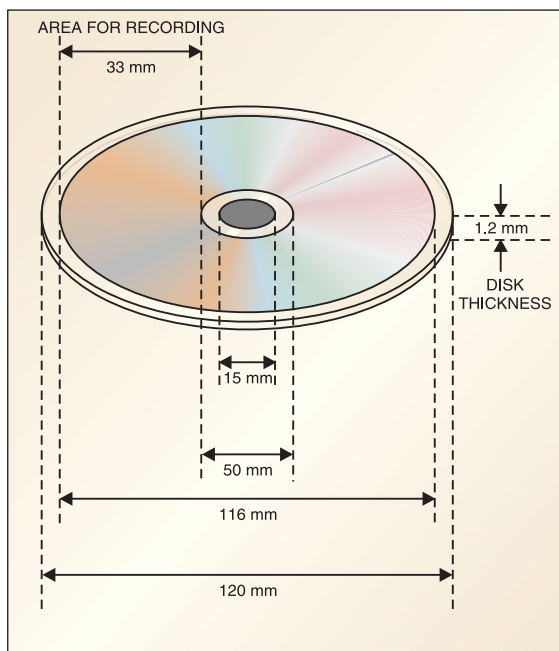


Fig. 1: The CD surface

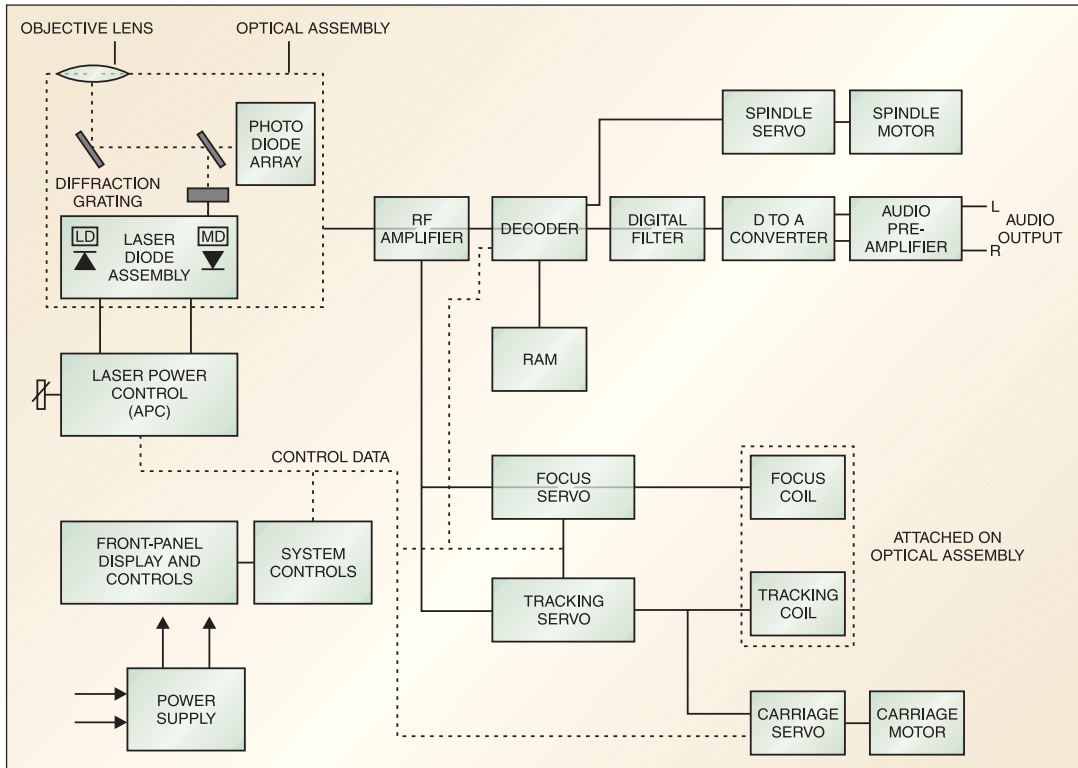


Fig. 2: Block diagram of an audio CD player

radial optical assembly does the functions of tracking and carriage servos. In the radial servo assembly the complete optical assembly is moved minutely (in fractions of a micrometre) to keep the objective lens on the proper track.

Spindle or disk motor servo. The spindle or disk motor rotates the CD at the correct speed (180-500 rpm). The data reproduced from the CD is compared with an internal reference circuit within the CD player to produce a control voltage. This voltage drives the disk motor accurately. The rotation speed of the CD is around 500 rpm at the centre, which slows down to around 180 rpm at the outer edge of the CD.

The optical block. The optical block (Fig. 3) reproduces the data or music information recorded on the CD. A low-power laser illuminates the CD track. A lens and prism assembly directs the laser beam towards the CD surface and the reflected beam towards the photodiode array. The photodiode array consists of four or six photodiodes to produce a range of signals that are, in fact, due to the variation of the reflected light on the playing surface of the CD. This, in turn, produces current variation from the photodiodes assembled in the photodiode ar-

ray. The current variation produces signals of data or music information from the CD. It also produces focus, tracking, spindle motor, or CD speed information, which makes the CD to play in a proper order.

The signals from the photodiode array are fed to the RF amplifier, where the necessary processing takes place to produce focus, tracking, data, or music information. This information is passed to the concerned operating sections and the other signals are passed to the signal processing and decoder circuit. After decoding and digital filtering, the music signals are passed to a digital-to-analogue converter in order to convert the signals back into the original form with greater accuracy.

Conversion of audio CD player into video CD player

In an audio CD audio signals are recorded, and in a video CD both audio and video signals are simultaneously recorded. An audio CD player can be converted into a video CD player by adding a video processor circuit to the audio CD player (see the article titled 'Conversion of Audio CD Player into Video CD Player' on page 45 of EFY's Jan. 2000 issue). This video processor circuit is known as the MPEG card.

The video processor circuit processes the video signals recorded on the CD the same way as the audio signals are processed by the audio CD player. The signals decoded by the video processor circuit are separated and converted from digital into analogue signals. Video and audio output signals are given to the television provided with video and audio input sockets. The television converts these signals into the original picture and sound. □

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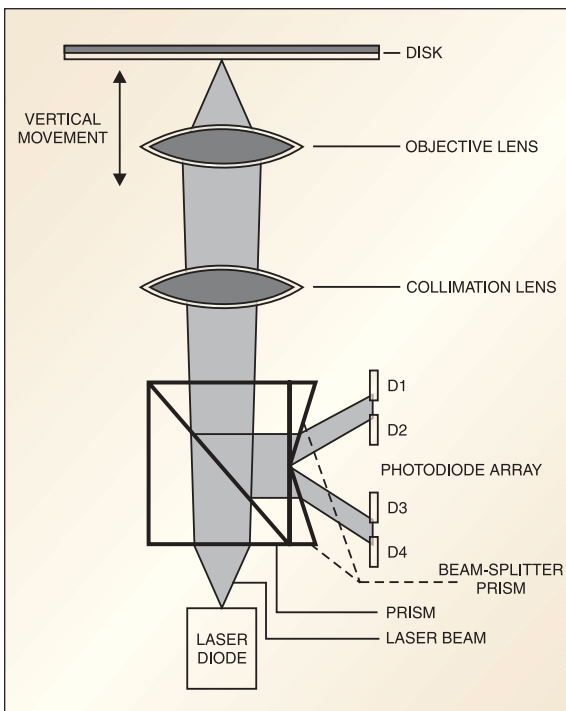


Fig. 3: Optical assembly