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Three Compact Disc Formats Described

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The AppleCD SC supports the following compact disc formats:

- the Red Book
- the Yellow Book
- High Sierra/ISO 9660
- HFS

Red Book

The first standard developed in the compact disc industry is known as the "Red Book" standard. It was proposed by Philips and Sony, and describes the CD hardware, form factors, and media specifications. Today, the Red Book is followed throughout the industry for CD-Audio. It also forms the basis for the Yellow Book and High Sierra standards discussed below.

The Red Book defines the way bit patterns are written to the compact disc, provides for synchronization bytes, and supports error correction within each "frame", or packet, of data. The overhead needed to accomplish this means that each frame, which represents 192 data bits (24 bytes), requires 588 channel bits on the compact disc.

The CD-Audio data correction algorithm is called the Cross Interleave Reed-Solomon Correction (CIRC) method and is intended to correct large runs of data that may be unreadable due to laser error or a defective or scratched disc. In this process, frames are interleaved and error checking is performed on the sum of this data. Error bursts of up to 450 data bytes in length can be corrected using this technique. CIRC recovery used on compact discs results in an observed error rate of less than one unrecoverable error in 2,000 discs.

CD-Audio reads digital sound samples at 44.1 KHz per second. With 16 bits per sample and two channels, the player reads 1,411,200 bits per second. Compact discs are capable of storing up to 75 minutes of sound per disc,

although 60 minutes is commonly quoted as CD-Audio's capacity.

Yellow Book

Philips and Sony also collaborated on the Yellow Book standard, which defines CD-ROM data addressing, and supplies a richer error detection and correction algorithm than is found on CD-Audio.

CD-ROM data is organized into blocks with 98 24-byte frames in each. Of the 2352 data bytes in each block, 2048 bytes, or 2 Kbytes, is user data. The compact disc player reads 75 blocks each second. At 75 minutes of playing time (the same as CD-Audio), the CD-ROM can hold 660 Mbytes of data. However, 60 minutes is generally used as the standard capacity, which equates to 550 Mbytes of CD-ROM data per disc.

Additional error detection and error correction (EDC/ECC) defined by the Yellow Book provide extra accuracy on CD-ROM discs. Each 2K data block is accompanied by 276 bytes used in a second layer of CIRC. Together with the Red Book's first layer of error correction, the algorithms result in an undetectable error rate of only 1 bit in 2 quadrillion discs.

High Sierra

In 1986, Apple was one of a number of interested parties that gathered at the High Sierra hotel, near Lake Tahoe, to come to a agreement on CD-ROM file formats. The result was a proposal, known as the High Sierra standard, which defines a hierarchical file system to be used on a CD-ROM.

The High Sierra file system is written with compact disc characteristics in mind. For example, it does not include instructions to delete or write to files, since compact discs are read-only media. High Sierra also addresses the relatively slow seek time of the compact disc by specifying a path table on each volume. When a host computer requests a file from a High Sierra CD, a single seek will give the location of the disc's file, no matter how deeply it may be buried in nested folders. This directory may also be cached within the CPU, so that the host computer can immediately request the compact disc player to move to the file on the CD.

High Sierra is system-independent, so that a disk (pressed with information conforming to High Sierra) could be conveniently read on Apple II, Macintosh, IBM PC, and other computers. All essential file data is written in palindrome format -- data is written twice: once as "high byte, low byte", and again as "low byte, high byte".

High Sierra discs are limited to no more than eight levels of"folders", and file names of no more than 31 characters.

NOTE: Prior to being adopted by the ISO Committee, ISO 9660 was know as High Sierra. Although some minor changes were made to High Sierra during the ISO standardizing process, Apple's driver will enable you to read CD-ROM discs pressed in either format. The two format names are often used interchangeably.

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