Double-Density Versus High-Density Disks

This article has been archived and is no longer updated by Apple.
This article gives the specifications for the 800K floppy disks and the 1.4MB floppy disks. It also describes why you should not drill a hole in a double-density disk and format it as a high-density disk.

STARTDISCUSSThe table below compares the formatted capacity of the different media:

800K Disk 1.4MB Disk
1600 sectors 2880 sectors
--------- ----------
Bytes/Sector 512 512
Sectors/Track 8-12 18
Tracks/Side 80 80
Bytes/Side 409,600 737,280
Bytes/Disk 819,200 1,474,560

The Apple SuperDrive (formerly Apple FDHD) can read and write to any of the major 3.5-inch disk formats, including Macintosh (GCR 400K, 800K, and MFM 1.44MB), Apple II (800K), and MS-DOS and OS/2 (MFM 720 and 1.44MB). GCR stands for "Group Code Recording" and MFM stands for "Modified Frequency Modulation".

When the SuperDrive writes 400K/800K disks in GCR mode, the motor speed is variable, and the disk surface is divided into five zones to allow a constant recording density as the head moves from the outer edge to the center. When using high-density media, data is written in MFM mode, and the drive speed is constant for each track.

The table that follows compares the speed of the different disk structures:

Tracks 800K Disk 1.4MB Disk
------ --------- ----------
00-15 394/12 300/18
16-31 429/11 300/18
32-47 472/10 300/18
48-63 525/9 300/18
64-79 590/8 300/18

Revolutions Per Minute/Sectors Per Track

GCR and MFM only affect how the data is written to the disk. GCR and MFM do not care how the tracks and sectors are laid out on the disk. They also have no effect on the directory structure. GCR and MFM deal with how the bits are recorded on the surface of the media.

The MFM Method

MFM was originally recommended by Shugart Associates for double-density, floppy drives and was used in a small number of systems. IBM was the first major vendor to use MFM, and now Apple also provides MFM support for the Apple SuperDrive. MFM uses a transition pulse to write data to drive media. There are two locations for the transition pulse: the data boundary or the cell boundary. A transition occurs at a cell boundary only when two zero bits occur next to each other. This encoding method guarantees that no more than two-bit cells can occur without a transition and is, thus, self-clocking.

The GCR Method

GCR is a method that Apple has used to record information since the Apple II Disk Controller. Each group of four bits is translated into a 5-bit code (the Run-Length code). A translation table is used to find this 5-bit

code. This 5-bit code seems to increase data bits by 20%. However, the 5-bit codes never contain more than two consecutive zeros, and GCR writes the data in NRZI format. When a 1 occurs in the data stream, a transition occurs on the data boundary. Thus, GCR is guaranteed to be self-clocking. You also save the cell boundary transitions required for MFM. Thus, GCR is more efficient than MFM and is widely used in high-density disks and tape recordings. The disadvantage of GCR is the relatively high complexity of the encoding and decoding logic.

High-Density vs Double-Density Disks

High-density disks are physically different and tested to a different specification than double-density disks. In this case, high-density disks are of higher quality than double-density disks. The high-density disks have a special, thin, recording surface that allows the higher data rates used in MFM. The 800K or 400K disk may not be sensitive enough to properly pick up and align the magnetic particles when the SuperDrive writes in MFM. This could cause corruption of the stored data and may result in errors. Thus, it is unreliable, unsupported, and not suggested.

Published Date: Feb 18, 2012