

LBA and CHS Format LBA Mapping

LBA Format

LBA is the abbreviation for Logical Block Address. This simply means the sectors of a disk are sequentially numbered starting with LBA number 0. Every sector is identified by its unambiguous LBA number. The LBA format is supported only by a mainboard BIOS which is not too old.

CHS Format

In the CHS format a sector is identified by its Cylinder/Head/Sector number. Earlier these values meant the physical location of the sector on the disk. Today these values are only logical numbers. The (logical) number of cylinders, heads and sectors per track can be determined by the func. 08h resp. 48h of the BIOS interrupt 13h. The CHS format is supported by all the BIOS but it is limited to a disk size of 8 GB (see below).

The CHS format has the following restrictions:

| | | |
|------------------------|-----------------|-----------------|
| cylinder number | 0 - 1023 | (10 Bit) |
| head number | 0 - 254 | (8 Bit) |
| sector number | 1 - 63 | (6 Bit) |

Due to a problem in the DOS operating system a maximum head number 255 leads to a crash although the BIOS would allow this number. Therefore a maximum head number 255 is not used in general.

Maximum Disk Size

For the CHS format in the partition table and for calling BIOS functions there are in general only 24 bits available. With 24 bits and a sector size of 512 bytes it is possible to address all sectors of a disk up to a maximum disk size of 8 GB. For the LBA addressing scheme there are 32 bits reserved in the partition table. At the same sector size of 512 bytes all sectors of a disk up to a maximum size of 2048 GB (2 TB) can be addressed. The extended INT 13h even uses 64 bits for storing the LBA number. Due to its simpler concept and also the possibility to support larger disks the LBA format is used internally by all modern operating systems for the direct disk access.

Conversion Between CHS and LBA

It is possible to convert the LBA format to CHS and vice versa. Conceptually both forms are equivalent. A sector C/H/S in the CHS format has the following LBA number:

$$\text{LBA} = C \times \text{Num_Head} \times \text{Num_Sec} + H \times \text{Num_Sec} + (S - 1)$$

Here Num_Sec means the (logical) number of sectors per track and Num_Head the (logical) number of heads. Only these two (logical) geometry parameters of the disk are relevant for the conversion. The number of cylinders is unimportant for the conversion.

LBA Mapping

The two conversion parameters Num_Head and Num_Sec are summarized as LBA mapping. The LBA mapping determines the conversion between CHS and LBA numbers of a sector. These two parameters are obtained from the function AH=08h of the standard BIOS interrupt 13h. Even if the extended interrupt 13h is supported, the LBA mapping is obtained from the standard INT 13h. The disk parameters which are returned from the extended INT 13h are useful only to compute the total disk size.

The total disk size is simply the product of the total number of sectors (number of cylinders x number of heads x number of sectors/track) with 512 (the sector size).