

Breaking the 8.4 GB Barrier with Support for Larger ATA/IDE Drives

An Ontrack Technical Paper

This paper outlines: the 8.4 GB limitation PCs have; describes methods for supporting hard drives with capacity beyond the 8.4 GB limitation within specific operating systems; and solutions that Ontrack provides for every operating system to overcome these barriers.

Contents:

Terms defines frequently used computer nomenclature.

Background focuses on the cause of the problem addressed in this document.

Situation is an overview of current circumstances related to the subject.

Solutions offers specific Ontrack options for breaking the 8.4 GB barrier for every operating system.

Terms:

BIOS: an acronym for Basic Input/Output System design – *the BIOS processes and redirects all data as it is being accessed and stored.*

FAT: an acronym for File Allocation Table – *the FAT tells the computer where data has been stored on the hard drive.*

CHS: an acronym for Cylinders Heads and Sectors – *which are the basic layout components of a hard drive.*

INT 13h & INT 13h extensions: protocols used for accessing data on hard drives.

Background: The first personal computer designers decided how many bits of data would be designated for addressing particular memory locations within the system, including hard drive capacity. The designers also had to specify how the computer would be instructed to access the bytes of memory that made up individual files. Originally, the data bits were divided into cylinder, head and sector (CHS) address locations that related directly to the physical layout of the hard drive. The File Allocation Table provided the “table of contents” the operating system used to retrieve the files.

Unfortunately, BIOS and hard drive designers did not set up the total bits used for addressing data in the same manner, nor did they define the same number of bits for the CHS addressing. The different CHS configurations required an address translation when data was sent from the system (using system BIOS) and the hard drive interface. These different configurations caused the first capacity restriction problems at 528 MB and similarly at 4.2 GB drive levels.

Current Situation: More recently, the system BIOS restricted total addressing space to an 8.4 GB limitation. Certain operating systems impose their own limitations, as well.

In most cases, for reading and writing data to the disk, the BIOS uses 24-bit addressing software and standard INT 13h drive access protocol which restricts drive capacity to 8.4 GB. Most current hard drive interfaces use 28-bit addressing. This mismatch of addressing further complicates access to drive capacity over 8.4 GB. Due to these factors, general consensus in the computer industry is that greater than 90% of PC's in use today have a hard drive limitation inherent in the operating system.

To address this limitation, system designers developed drive access protocol that goes beyond the standard INT 13h, and defined it as "INT 13h extensions." Only 5 percent of the systems built before 1998 properly support BIOS INT 13h extensions. Today, new desktop personal computers are supporting hard drives greater than 8.4 GB capacity to meet the explosive demand for access to much larger data storage facilities. Because most systems in use do not have built-in support, the computers will need to be enhanced to use drives greater than 8.4 GB. Ontrack was the first to break through the 8.4 GB barrier and support larger hard drives with its Disk Manager® software.

Solutions:

BIOS Upgrade: While it is possible to replace the BIOS in order to address the drive limitation barrier, it is quite impractical. Between the difficulty in finding the exact BIOS upgrade revision for a particular computer and the fact that success is not guaranteed even with the right upgrade, software has become the standard solution of choice.

Ontrack solutions that break the 8.4 GB barrier: ONTRACK Disk Manager DiskGo!; Disk Manager version 2.4, DiskWizard version 2.4 for Seagate drives, Disk Manager® for Windows version 3.4, and Disk Manager® DOS version 9.4.

Disk Manager Software can be applied with the following operating systems:

Windows 95 Rev B (OSR2) and Windows 98:

These operating systems are able to use the 12-, 16- and 32-bit FAT file systems and support drives greater than 8.4 GB provided the PC supports *INT 13h extensions*. They also support partitions greater than 2.1 GB.

If the computer's BIOS does not support *INT 13h extensions*, the ONTRACK BIOS overlay may be used to support *INT 13h extensions* and overcome limitations.

Partitions can be larger than 2.1 GB and up to total drive capacity if the operating system uses the 32-bit FAT file system. Systems using the 16-bit FAT file system are limited to 2.1 GB partitions.

Windows 95 Rev A:

Windows 95 Rev A, prior to the OSR2 release, uses a 12- and 16-bit FAT file system. This operating system supports drives greater than 8.4 GB provided the PC supports *INT 13h extensions*.

However, in instances where the computer's BIOS does not recognize *INT 13h extensions*, the ONTRACK BIOS overlay may be used to support *INT 13h extensions* and overcome limitations. Each partition is limited to a maximum size of 2.1 GB.

Windows 3.1x and DOS 5.x/6.x:

Windows 3.1x and DOS use a 12- and 16-bit FAT file system. These operating systems support partitions up to 2.1 GB each and drives up to 8.4 GB in total capacity. However, Ontrack provides a *BIOS overlay driver* that supports *INT 13h extensions* and enables the computer to realize its drive's full capacity. The Ontrack BIOS overlay eliminates the existing system's BIOS limitations.

To fully partition a drive greater than 8.4 GB within these operating systems, the Ontrack ONTRACKD.SYS device driver loads through a DOS file called CONFIG.SYS. This device driver reports to DOS the number of partitions that it will support. DOS assigns the drive letters, and ONTRACKD supports any volumes within a partition that exceed 8.4 GB. Each partition is limited to a maximum size of 2.1 GB.

Windows NT:

Windows NT 4.0 supports drives greater than 8.4 GB when Service Pack 3 is installed. However, it does not ship with this service pack and will limit the drive to 8.4 GB of storage space. Service Pack 3 is available from Microsoft.