Hitachi Deskstar 3TB Hard Drives
Frequently Asked Questions

1. **Why is there a limit of 2.2TB[1] on certain systems?**
   If you think back to when the PC was introduced, you will remember that capacity points were in the megabytes. Nobody dreamed that capacity points would ever reach 3TB or even 1TB. With that, some of the basic design decisions made in the original computer architecture left the industry with inherent limitations. One of those limitations is the ability to address hard drives that exceed capacities of 2.199TB, or approximately 2.2TB.

   This limitation is caused by 32-bit definitions, which have been used for partition sizes and logical block addresses (LBAs) since the 1980s, and affects the BIOS, the partition table, the operating system and drivers. These 32 bits are used to describe the size of a hard drive, which is made up of 512-byte sectors, resulting in 2.2TB being the largest size addressable with 32 bits (512-byte sectors x 2^{32} = 2.199TB).

2. **Is this a Hitachi GST issue or an industry-wide issue?**
   This is an industry-wide issue that affects all manufacturers delivering hard drive solutions greater than 2.2TB.

3. **What do customers need to take advantage of the full capacity of the 3TB Deskstar drive?**
   In order to take advantage of hard drives over 2.2TB, users must have some combination of a compatible operating system, BIOS, partition table, and file system. Combinations will vary depending on whether the customer will use the drive as a data drive or a boot drive.

4. **What systems can recognize 2.2TBs and above?**
   It depends on whether the user will use the hard drive as a data drive or a boot drive. A data drive requires an OS that supports long LBA addressing such as Windows® 7, Linux® Ubuntu® or Apple® Mac® OS X with a GUID partition table (GPT)[2]. For a Windows boot drive, the aforementioned are required, plus users will need a motherboard with a UnifiedExtensible Firmware Interface (UEFI[3]) BIOS and appropriate storage drivers. Microsoft only supports UEFI BIOS booting under Windows x64 operating systems (see chart below), therefore, you will also need a 64-bit version of your Windows OS. Intel based Macs (which have an EFI BIOS) and Linux users (using recent Linux Kernels) can boot a high capacity drive without needing a UEFI BIOS. The following table represents OSs that will support a drives greater than 2.2TBs.

Operating System	Boot Disk	Data Disk
Microsoft Windows XP (x32)	No	No
Microsoft Windows Vista SP1 or later x32	No	Yes
Microsoft Windows Vista SP1 or later x64	Yes, with UEFI	Yes

[1] 32 bit limitation : 512 byte sectors x 2^{32} bits = 2.199 TB
[2] GPT: GUID Partition Table. GUID = Globally Unique IDentifier
[3] The UEFI standard incorporates and supersedes Intel's EFI standard. Both EFI and UEFI systems meet the boot requirement.

Microsoft Windows 7 x32	No	Yes
Microsoft Windows 7 x64	Yes, with UEFI	Yes
Microsoft Server 2008	Yes, with UEFI	Yes
Intel based Mac OS X 10.6+	Yes	Yes
Linux Ubuntu 8.04+/SUSE x32, x64	Yes	Yes

5. **Are there any HDD device driver concerns?**
Yes, as of this posting (November, 2010) the native Intel HDD drivers to not support high capacity hard drives. However, Microsoft provides a driver within Windows Vista and Windows 7 that correctly supports high capacity hard drives. When using other HDD device drivers, please check with your vendor for high capacity support.

6. **What if I partition the 3TB drive? Will I be able to see and use the entire 3TB capacity?**
Yes; however, you must use the GUID partition table (GPT), and have an appropriate operating system that can recognize capacity greater than 2.2TB.

7. **What are the requirements for booting a 3TB drive?**
Windows Vista and Windows 7 support large drives. However, Windows requires a UEFI BIOS in order to boot off of a high capacity drive. Only 64-bit versions of Windows Vista and Windows 7 support UEFI BIOS. Therefore, booting off of a high capacity drive requires a 64-bit OS and a UEFI motherboard.

8. **How does the 2.2TB limit affect desktop RAID arrays? Can I build an internal RAID 0, RAID 1 or RAID 5 array and use the full capacities of the drives?**
Host bus adaptors (HBA) and RAID controllers typically take several drives and present them to the host as a single large drive. This can be accomplished by aggregating the drives (JBOD, Just a Bunch Of Disks), or creating a RAID system using the capacity of more than one drive.

In both cases, one can create a larger logical drive than the individual physical drives connected to the controller. For example, if two 2TB drives are connected to the HBA, then the HBA can present both drives as a single 4TB drive to the host PC. Most HBA vendors have already created firmware and host drivers that allow this configuration to work in current operating systems supported by the controller.

With the introduction of high capacity drives, the HBA controller must now be able to handle individual drives larger than 2.2TB. In this case, the firmware on the controller must be able to recognize the high-capacity drive. For example, if two 3TB drives are connected to the HBA, then the HBA could present both drives as a single 6TB drive.

Before using high-capacity hard drives with an HBA/RAID controller, please check with the controller vendor to determine if high-capacity hard drives are supported.

9. **Does the 2.2TB limit affect external storage drives?**
No. Suppliers of external storage drives will test and assure that it can be used as advertised in the systems they support. However, if you are placing a bare 3TB drive into an external USB or Firewire enclosure, you should first check with the enclosure manufacturer to ensure that the enclosure supports high capacity (>2.2TB) drives.

10. **How do external storage providers work around the 2.2TB limit?**
    To solve the 2.2TB limit, some external USB drives will present themselves with a sector size of 4K. By transferring 4K blocks, the USB drive effectively reduces the number of blocks that appear to the OS. Legacy USB drivers support 4K block sizes and will continue to work correctly. Although this implementation will work well for USB devices (which use USB drivers), it will not work for SATA devices, such as bare hard drives, since the SATA drivers only support 512-byte transfers.

11. **Where can I find the latest information about high capacity hard drives >2.2TB?**
    http://www.hitachigst.com/internal-drives/above-2tb/