SpeedTools ATA Hi-Cap Support

Device driver (kernel extension) to enable over 128 GB addressing of ATA hard disk drives on G3 and Pre-Mirrored Door G4 Macintosh computers running MacOS X 10.2 and higher. Includes Partition Map Extender application for single hard drive installations.

User's Guide

intech

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For One Computer

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1 Guide Introduction

About This Guide

The instructions and explanations in this guide assume that you understand how to operate your Macintosh computer. You should, for example, know how to choose, select, launch, and drag by using your mouse. In addition, you should also understand how the desktop, windows, dialog boxes, buttons and file/folders work within the Macintosh environment. For more information about these items, please refer to your Macintosh User's Guide.

Conventions Used In This Guide

Note: This symbol calls your attention to important information about the adjacent text. A note will always appear in standard print.

Warning: This symbol calls your attention to procedures in the adjacent text which can cause harm to you, your data or computer system. A warning will always appear in bold print.

User Registration

Please take a moment to register your copy of the SpeedTools™ software on-line via the Intech Software World Wide Web page at http://www.SpeedTools.com.

Technical Information

If you received this software with the purchase of a drive subsystem and you require technical support, Intech as made special arrangements with your drive manufacturer to support this software directly via their technical support department. For customers who have purchased this software product as stand-alone, Intech provides technical information and other late-breaking information via its web site at http://www.SpeedTools.com.

2 About This Driver

About the Intech ATA Hi-Capacity Driver (KExt)

The ATA Hi-Cap Support Driver (file name: IntechATA6.kext) software was created to allow the use of extended capacity ATA drives (drives greater than 128 Gigabytes in size) on older (Pre-Mirrored Door) G4 and all G3 Macintoshes running MacOS X versions 10.2 and later. Without this software installed, any extended capacity drive which is connected to the native ATA bus on older Macintosh models will be limited to only 128 Gigabytes. Later model G4's and all G5's do not suffer from this limitation. The IntechATA6.kext ("kext" is short for "kernel extension") driver has no user interface of its own. Rather, it is installed and/or removed via the included installation software program.

Note: Unlike classic MacOS drivers (MacOS 9.2.2 and earlier) the MacOS X ATA Hi-Cap driver is a file which loads during the OS X booting process. Therefore, it must be installed on EVERY bootable MacOS X volume on your computer. In other words, the driver is tied to individual OS installations, not any specific drive.

Installation Instructions:

1) Run the ATA Hi-Cap Installer utility
2) Install the Hi-Cap driver onto ALL bootable OS X volumes
3) Reboot
4) Run Applications->Utilities->Disk Utility.app
5) Partition ATA Hi-Capacity drive according to one of the Safe Partitioning instructions and samples beginnng on Page 3.

Removal Instructions:

1) Run the ATA Hi-Cap Installer utility
2) Click the "Remove" Tab
3) Select volume(s) from which you wish the driver to be removed
4) Click "Remove" button

Checking Driver Status:

1) Run the ATA Hi-Cap Installer utility
2) Click the "Boot Volume Status" Tab
3) Check "Installed" info to see if driver is installed on your current boot volume
4) Check "Loaded" info to see if driver is currently active
5) Both 3) and 4) must be true to get the full capacity of your internal ATA drive(s).

Safe Partitioning: What is it and do I need to do it?

Without the Intech ATA Hi-Capacity driver running, your Macintosh will only be able to address the first 128 GB. So what happens if your drive is formatted for, say, 200 GB and for some reason the Intech ATA Hi-Capacity driver fails to load? Let's just say the result would not be very good at all.

So why might the Intech ATA Hi-Capacity driver fail to load? There are a number of possibilities. If your drive crashes and you need to reboot your computer from the original MacOS X installation CD/DVD, the Intech ATA Hi-Capacity driver will not load since it was not included with MacOS X. Or maybe you need to boot your computer from your friend's iBook or Cube in target disk mode. In all these scenarios, and more, the Intech ATA Hi-Capacity driver will not be running when you boot your computer.

There is also another possibility which is beyond our control: it is possbile that Apple Computer, Inc. releases a MacOS X update which prevents our driver from loading. Since the first release of our ATA Hi-Capacity driver, Apple has released two major updates and countless minor revisions to the MacOS (10.2, 10.3 and 10.4) without causing any compatibility problems. We fully expect ongoing MacOS compatibility with the Intech ATA Hi-Cap driver. But Intech simply cannot guarantee future MacOS compatibility. For up to date compatibility information, please visit our forums and check out the Topic we created which is dedicated exclusively to ATA Hi-Capacity support under MacOS X 10.2 and later.

Safe Partitioning for MacOS X use only (and we mean MacOS X only!):

If your machine is dedicated to running MacOS X exclusively, (running the MacOS 9 classic shell within MacOS X is not a problem), Intech recommends the following:

After installing the IntechATA6.kext and rebooting, run Disk Utility (from the “Applications->Utilities” folder). Create your bootable partition first. It can be up to 127.99 Gigabytes, but no larger. Allocate the remainder per your needs. If you need several partitions, we recommend partitioning the drive such that no single volume crosses the 128 Gigabyte boundary.

Here are two MacOS X only partitioning examples for a 250 Gig drive:

1) Simplest partition scheme - create a 127.99 Gigabyte volume and allocate the rest to a second volume.

2) A more complex sample scheme - create two 50 Gigabyte volumes, a 27.99 Gigabyte volume, and allocate the rest to one or more volumes.

The important point here is that no single volume spans the 128 Gigabyte barrier. Note that in our more complex example the first three volumes add up to exactly 127.99 Gigabytes (50 + 50 + 27.99).

Safe Partitioning for Hi-Cap support with MacOS 9 and MacOS X:

If you plan to boot your machine natively into both MacOS 9 and X, you will need to partition the drive under MacOS 9 using Intech's Hard Disk SpeedTools (a.k.a. HDST, sold seperately) product which supports extended capacity drives under MacOS 9. If you don't have this product, you can buy it directly from Intech's web site (http://www.speedtools.com). Once you have obtained HDST, boot your computer into MacOS 9 and do the following:

Run HDST. Create your MacOS X bootable partition first. It can be up to 131,071 Megabytes (about 127.99 Gigabytes), but no larger. Allocate the rest of the drive according to your needs. If you wish to have separate OS 9 and X partitions, make sure that both partitions are fully allocated BEFORE the 128 GB boundary.

Here are two HDST partitioning examples for a 250 GB drive for users of both MacOS 9 & X:

1) Simplest partition scheme - create a 131,071 Megabyte volume and allocate the rest to a second volume. Install both MacOS 9 and X onto the first partition.

2) A more complex sample scheme - create two 50,000 Megabyte volumes, a third 31,071 Megabyte volume, and allocate the rest to one or more volumes. You can install OS 9 and X onto any of the first three partitions.

The important point here is that no single volume spans the 128 Gigabyte barrier. Note that in our more complex example the first three volumes add up to exactly 131,071 (50,000 + 50,000 + 31,071).

Important Limitations of the Intech ATA Hi-Cap driver:

Once the IntechATA6.kext software has been installed using the included "ATA Hi-Cap Installer" program and you have rebooted your computer, your extended capacity drive will now show up at its true size and all sectors will be accessible. However, there are several points that must to be kept in mind.

1) If you already setup your extended capacity drive as a 128 Gig and you don't want to reformat the drive, you'll need run our ATA Hi-Cap Extender application (see Chapter 3) to get the full capacity. You will not be able to use Disk Utility without erasing all data on the drive.

2) If you boot from another source which does not have the Intech kext installed (such as an original OS X installation CD), the sectors which are located beyond the 128 Gigabyte boundary will not be accessible. This will result in i/o errors (see "Safe Partitioning" on page 3 to avoid such problems).

3) While you can safely boot from a drive which is greater than 128 Gigabytes in size, you CAN NOT SAFELY boot from a volume if ANY of its sectors are located beyond the 128 Gigabyte boundary. So if you plan to boot from this drive, you need to follow one of the following procedures listed in “Safe Partitioning” on page 3.

4) Revision “A” Blue and White G3’s. Among the problems present in the Ultra-33 ATA controller on this Blue and White G3 computer is the inability to do 48-bit addressing with any type of DMA writes. If you have this machine, you will need to connect your extended capacity ATA drive to the Multi-Word DMA bus (which is the same bus your CD/DVD ROM is connected to). Do not connect an extended capacity drive to the Ultra DMA bus. It will cause your computer to hang the moment the Hi-Cap driver loads.

5) Because the Hi-Cap driver is a file which loads during the boot process (not before!), never try to install Mac OS X onto any partition which spans the 128 GB barrier or is located on the disk AFTER the 128 GB barrier. (Your Mac will not be able to read past the barrier until AFTER the Hi-Cap driver loads causing a potential fatal error during the boot process.)

Important Questions and Answers:

Q: If MacOS X 10.2 (and later) supports extended capacity drives, why do I need this software?:

A. Not all Macs take advantage of this support. When Apple released MacOS X 10.2, support for ATA drives over 128 Gigabytes in size was added. (See http://developer.apple.com/technotes/tn2002/tn2053.html#HW000319) Many people presumed that this would enable them to finally upgrade their internal ATA drives to something much bigger. Unfortunately, many would be sorely disappointed (See http://docs.info.apple.com/article.html?artnum=86178).

Intech surmises that the reason Apple has prevented 48-bit support in all of their G3’s and some of their G4’s has to do with the way MacOS X boots. To boot from an ATA drive under MacOS X, a minimal ATA driver must be loaded from the Computer’s boot ROM to begin reading the System files into memory and begin the booting process. At some point in this process, a newer, full-featured ATA driver will be loaded from a file off the disk and replace the driver which was used to begin the booting process. Since these older Macintoshes were manufactured prior to the widespread adoption of 48-bit capable drives, the Boot-ROM ATA driver does not support 48-bit addressing and, quite possibly, would not be able to access all the files necessary to boot the computer sufficiently to load the updated 48-bit capable driver. The IntechATA6.kext driver software does NOT solve this problem. See “Important Limitations” on page 4.

Q: What happens if my extended capacity hard disk crashes and I need to boot from a disk repair utility CD which does not have your driver software?

A. If you boot from any CD or any other source which does not have our software, your Macintosh will only be able to access the first 128 Gigabytes of the drive. For this reason

Intech strongly recommends you follow the “Safe Partitioning” guidelines above. If you do so, you will be able to boot from another source and retain every opportunity to repair your MacOS X boot volume.

Q: Why do some companies call it the “137 Gigabyte barrier” while Intech and others call it the “128 Gigabyte barrier”?

A. They are exactly the same barrier: 137,438,953,472 Bytes. It is simply based upon two alternative ways of defining “Gigabyte.” Intech stays with the more traditional notion of defining size categories (Kilobyte, Megabyte, Gigabyte etc.) as 1024 times the size of the lower category . Thus one KIlobyte is 1024 Bytes, which translates very easily to two sectors (512 bytes per sector * 2 sectors = 1024 Bytes or 1 Kilobyte). Others prefer category multiples of 1000. Thus one Kilobyte is defined as 1000 Bytes or 1.953125 sectors. Using Intech’s method 137,438,953,472 Bytes translates to 128 Gigabytes: 137,438,953,472 ÷ (1024 * 1024 * 1024). Using the other method, 137,438,953,472 Bytes translates to 137 Gigabytes: 137,438,953,472 ÷ (1000 * 1000 * 1000) = 137.44 Gigabytes. For detailed information on the math, see the “ATA Addressing Background” section.

Note: We at Intech realize that mulitples of 1024 are no longer the preferred nomenclature according to the U.S. National Institute of Standards and Technology. However, our rational to use this labeling system is simple: as long as Apple Computer, Inc. continues to use this nomenclature, so will Intech. We believe this strategy is the least confusing to Macintosh users.

Additional Technical Information:

ATA Addressing Background:

Every sector on a disk is accessed via a uniquely identified address, called a Logical Block Address (LBA for short). A “sector” is also called a “block” and the terms are used interchangably. Also, a sector on a fixed ATA hard disk always contains 512 bytes.

When the ATA (AT-Attachment) interface was being created back in the computer stone age, hard disk drives were much smaller than they are today. As a consequence, only 28 bits were reserved for identifying the beginning sector of data transfers in the reading and writing command data structures. This provided for an addressing capability up to 128 Gigabytes. (Actually, it goes back even farther, but it's not relevant to this discussion.)

For those of you interested in the gory details, the math breaks down as follows. (If you’re not interested in the math, please skip to the next paragraph.) The highest 28-bit number is hexadecimal FFFFFFF. This translates to 268,435,455 in decimal notation. Since zero is a valid LBA, this means there are 268,435,455 plus 1 or 268,435,456 maximum addressable sectors. Each sector contains 512 bytes so this means a total capacity of 137,438,953,472 bytes (268,435,456 * 512). Since there are 1024 bytes in a Kilobyte, 1024 Kilobytes in a Megabyte, and 1024 Megabytes in a Gigabyte you get the following 137,438,953,472 ÷ (1024 * 1024 * 1024) = 128 Gigabytes.

This original standard held through the first five major revisions of the ATA command set. This is a remarkable achievement, but, alas, even this forward looking standard has been overtaken by new disk drive technology. As a result, in early 2002, the sixth revision of the ATA standard (ATA-6) was adopted which contained a new addressing standard which allows up to 48 bits to be used for LBA addressing. This translates to a whopping 281,474,976,710,656 addressable sectors, or 128 Petabytes. (That's more than one million times bigger than the original 128 Gigabyte limit!) Note, however, that the ATA-6 specification required drives supporting 48-bit addressing to continue to support 28-bit addressing as well. There are important reasons for this, and of the resulting consequences on the Macintosh can be safely dealt with via our "Safe Partitioning" guidelines.

System Requirements

- MacOS X 10.2 or later
- All Macintosh G3's (except Rev "A" Blue & White G3)
- All Macintosh G4's which do not currently support extended capacity drives
- Internal ATA Hard Disk Drive greater than 128 Gigabytes in size

3 About The Extender

About the Intech ATA Hi-Capacity Partition Extender Application

The Intech ATA Hi-Cap Extender application is provided exclusively for use on Macintosh computers with only one bootable disk drive. The Extender application is designed to fix and extend a partition map which was created prior to the ATA hi-cap driver being installed (i.e. the drive's reported capacity was only 128 GB). When the only bootable disk drive is the ATA internal hard disk drive, it is not possible to use Disk Utility or any other third party partitioner software to adjust the partition map to the correct size after setting up your drive and installing MacOS X from the installation CD or DVD. The Intech Partition Extender application performs this one necessary function. It does nothing other than this.

The Extender will grow the partition map to the correct size and then add a second MacOS partition equal in size to the amount of remaining space (i.e. true drive capacity minus 128 GB). So if you have a 500 GB internal disk drive, your first partition will be about 128 GB in size, and your second partition will be approximately 350 GB in size. The Extender does not allow mulitple secondary partitions.

Note: An important limitation of single ATA Hi-Cap drive installations is that you will NOT be able to create a second partition volume which is case-sensitive. It is unlikely that this limitation will ever be resolved. If you need case-sensitivity, you MUST get access to another bootable disk drive (such as an external FireWire) and set up the your internal ATA Hi-Cap while booted from the other drive.

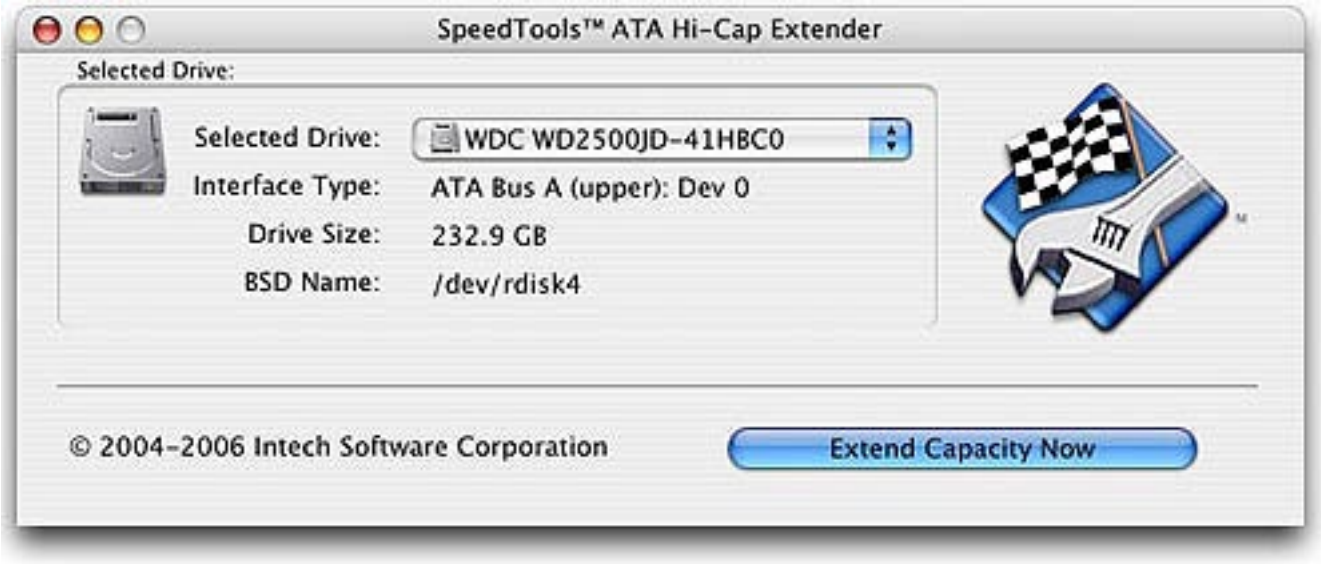

Figure 1: ATA Hi-Cap Extender

Instructions for New or Unformatted Hi-Capacity Disk Drives

1) Boot from the OS X installation CD
2) When you get to the part where the installer is ready to install the OS, run Disk Utility
3) Select the one partition option. (This will use all the currently available space for a single MacOS partition: approx 128 Gig).
4) Install MacOS X onto the new volume
5) Restart your Macintosh
6) Run the “Intech ATA Hi-Cap Extender” program, select your drive and click the "Extend Capacity Now" button. (This will create a new volume on your drive equal to the amount of recovered space)
7) Restart your Macintosh
8) Run “Disk Utility” from your Applications->Utilities folder
9) Select the newly created, unformatted volume in the list to the left (it will look something like “disk0s7” and the letters will be gray)
10) Select the “Erase” tab
11) Give it a name and click the “Erase” button and your new partition will be setup and ready for immediate use

Instructions for Already Partitioned Hi-Capacity Disk Drives

If your internal ATA Hi-Capacity disk drive has already been setup as a 128 GB drive and you would now like to recover all the additional space in a second partition you will need to:

1) Run the “ATA Hi-Cap Installer” program and install the ATA Hi-Cap Driver.
2) Restart your Macintosh
3) Run the “Intech ATA Hi-Cap Extender” program, select your drive and click the "Extend Capacity Now" button. (This will create a new volume on your drive equal to the amount of recovered space)
4) Restart your Macintosh
5) Run “Disk Utility” from your Applications->Utilities folder
6) Select the newly created, unformatted volume in the list to the left (it will look something like “disk0s7” and the letters will be gray)
7) Select the “Erase” tab
8) Give it a name and click the “Erase” button and your new partition will be setup and ready for immediate use