

# Video Card Upgrade

## An Install Guide On How To Upgrade Your Own Video Card

The step-by-step instructions here show how I did a video card upgrade for my PC under Windows 98SE and Windows XP. Newer and better video cards are being produced more quickly than any other computer component. Upgrading the video card can make a huge difference in the performance of your computer.

A video card upgrade is not difficult. On the other hand, perhaps no other computer upgrade can be more error prone. Video card problems can be intermittent, perhaps occurring just often enough to be a nuisance. Yet when they do occur they can be show stoppers, literally bringing the computer to a halt, which is evidenced by the screen display "locking up", or dropping the application you're running suddenly back the desktop. As evidence of the myriad of video card problems that can result, just check out the humongous [GeForce FAQ](#) page from Tweak3D, or the massive [video card message board](#) at Guru3D. The internet world is fortunate to have such valuable resources available. Hopefully you won't need them.

But no computer upgrade is as rewarding as a video card upgrade. Stunningly realistic 3D images, seamlessly smooth animation, fantastic visual effects such as fog, smoke, and light haze, and real-world motion physics are some of the spectacular features gained through the use of state-of-the-art video card technology.

There are important steps that can be taken to minimize trouble. Such as buying a top-quality video card. Such as rigorously testing the video card after it's been upgraded to shake out and reveal lingering, intermittent problems. Such as using a hard drive restore utility like GoBack to ensure you can safely and accurately "get back to where you were" before all the troubles began, if necessary. And many other steps I detail on this site.

There's a great deal more to a video card upgrade than the typical video card upgrade user's guide describes. I've dealt with a number of different video card user's guides from different manufacturers and I would sum them up as "skimpy". At this site I provide something far more comprehensive. Nevertheless, you should consult the installation instructions that came with your video card and defer to them if they seem inconsistent with the steps I describe.

The video card upgrade I describe here is how I upgraded a computer running Windows 98SE to replace an existing AGP NVIDIA based video card (a GeForce3 Ti 200) with a more powerful and newer model AGP ATI based video card, namely the ATI All In Wonder 9600 Pro 128MB. These steps are written for my own video card upgrade, but the procedure varies little for any other type of video card upgrade or any

other type of Windows operating system. I've also upgraded my Windows XP computer to replace an existing NVIDIA based GeForce4 Ti 4200 video card with the All In Wonder 9600 Pro 128MB. The steps are very similar between the two operating systems. Where they differ significantly, I've included corresponding text specific to the Windows XP step, usually on a separate page.

New and improved video cards are produced frequently, so this type of upgrade can meaningfully be done at least once a year if you like. I would not recommend upgrading the video card on a computer that does not have an AGP slot. If your computer is that old then I suggest it's time to either perform the ultimate upgrade and build your own computer or purchase a new computer. Sorry, but, somebody had to tell you. I hope that's not bad news, because the good news is your new PC with AGP support will be quite something!

Now in case you didn't know, "AGP" stands for Advanced Graphics Port. It is a special expansion slot on the motherboard widely used in computers for some years that is specialized for accommodating a video card. Prior to the introduction of the AGP slot, add-on video cards were supported through the use of one of the PCI expansion slots on the motherboard. PCI stands for Peripheral Component Interface. While PCI expansion slots are quite useful and are still in common use for many types of add-on cards, such as sound boards, a PCI expansion slot leaves a great deal to be desired by today's standards in terms of providing video support. Video cards designed for the PCI expansion slot are quite the exception today.

## **What You Need - The Video Card**

The new video card for the upgrade. The two major sources of video card technology are NVIDIA and ATI. They continually come up with new models of video cards attempting to out-do each other in terms of performance and capabilities, as well as price.

Different manufacturers make and sell video cards based on the core models developed by NVIDIA and ATI. In general terms, the same model video card made by two different manufacturers is the "same", but there can be differences in the speed and quality of the components used, thus affecting performance and reliability. There can also be differences once outside the core model, such as cooling mechanisms provided for the video card and the included software bundle. For NVIDIA video cards, my own preference is models made by Gainward, ABIT or ASUS, although many are happy with their NVIDIA video cards made by other manufacturer's such as PNY, PowerColor, MSI and eVGA. For ATI video cards, my preference is for the ATI brand itself. A good source of reviews for the video card choices of today is this [set of video card reviews](#) from GamersDepot.

The new video card I'll be installing is the ATI All In Wonder 9600 Pro 128MB. The "All In Wonder" means this video card is enhanced over the ATI Radeon 9600 Pro 128MB to support video editing. The video card I'll be replacing is an NVIDIA based video card made by Gainward, namely a GeForce3 Ti 200. I purchased my ATI video

card from Amazon. I like using Amazon when I can since they are the lowest prices around, plus most things have no tax and free shipping. The only item needed from the retail box for the upgrade procedure is the video card itself. But all retail packages include a users manual and video card drivers. And most usually include utility software and one or more full-featured games.

Here is a picture of the ATI All In Wonder 9600 Pro 128MB retail box. Click on the picture to see it enlarged.



Here are the contents of the ATI All In Wonder 9600 Pro 128MB retail box. There's certainly nothing to be disappointed about in terms of what's included. Intimidated maybe, but not disappointed. Most of what's shown is not needed just to get the benefit of a more powerful video card. Many items only come into use once you take advantage of additional capabilities supported by the video card, such as video editing. Click on the picture to see it enlarged.



Here's a close-up of just the ATI All In Wonder 9600 Pro 128MB video card. Click on the picture to see it enlarged.



## Tools

An antistatic wrist strap. An antistatic wrist strap should be worn any time work is being done inside the computer. The alligator clip should be attached to a non-painted metal surface on the computer case. The antistatic wrist strap prevents static electricity from building up. Static electricity can electronically destroy many of the delicate components inside the computer. As an extra precaution, it's a good idea not to shuffle around while working inside the computer case. If you need to change position then let go of any electronic component, change your position, get comfortable again, then touch the non-painted metal surface of the computer case with your hand before touching anything else. Touching the non-painted metal surface of the computer case with your hand is another way to harmlessly release any static buildup. But this is an extra precautionary step - you should still always wear the antistatic wrist strap while working inside the case for any reason. Anti-static wrist straps are not expensive. Dealsonic carries them under Accessories.

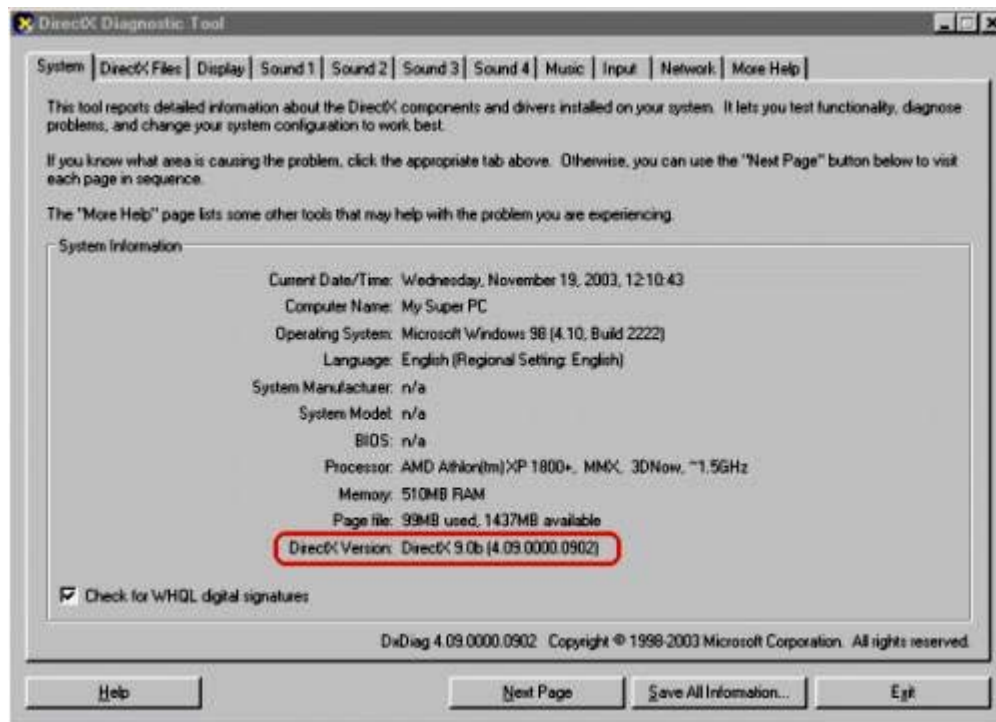


You'll need the right type and size of screwdriver(s), phillips, flathead or both, to get inside your computer case and work with the slot covers.

## What You Need - DirectX

The DirectX Diagnostic utility, called DXDIAG, can be used to see the version of DirectX installed on the computer. One way to check if it's installed on your computer is to search the C: drive for "dxdiag.exe" by clicking Start, then clicking on "Find", and then selecting "Files or Folders". Microsoft support includes [How to determine the version of DirectX using the DirectX diagnostic tool \(Q157730\)](#), which shows how to find DirectX and use it to determine the version number. The version number is shown on the first tab, the System tab, in DXDIAG. It looks like this on my computer before beginning the video card upgrade procedure with the DirectX

version circled in red. From within DXDIAG, clicking on the "Exit" button returns the computer to the desktop.

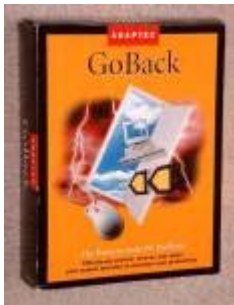


You can [download and install the latest version of DirectX](#) at this time if you like - before upgrading the video card, but, as usual, keep GoBack enabled during the upgrade just in case, and run the [DirectX Diagnostics and Tests](#) afterwards to be sure the upgrade of DirectX worked before continuing on with the video card upgrade.

## Hard Drive Restore Utility

A hard drive restore utility. I use GoBack. It's critical to have a hard drive restore utility so that you can completely restore your hard drive to the time prior to beginning the video card install should something go wrong. In a perfect world, you won't need it. But video card drivers are unpredictable. What works on one computer may not work at all on another computer. Even if you do everything exactly right, it might not work. One reason is because more than one driver package is always involved, so incompatibilities just between the video driver packages occurs. Throw in different motherboard chipsets, different video card vendors, different motherboard BIOS levels and settings, different video card BIOS levels and settings, and you can begin to see how hopeless it can be to try to fix it when it doesn't work. In most cases, you should be starting with a perfectly good computer. I have [GoBack which is available from Amazon.com](#), installed on for my video card upgrade. GoBack can be left enabled throughout the video card upgrade procedure. If something goes wrong

and you wish you could just get back to where you were - then you can with GoBack!



You should install and enable GoBack now, before starting the video card upgrade procedure and before making any changes to your computer.

A point about GoBack. GoBack makes it's disk restoral log when the PC is idle. So after 10 seconds of inactivity, you'll suddenly see the hard drive light spring to life while GoBack catches up with the disk changes. After making any disk change, such as downloading a file or installing a driver, wait and give GoBack a chance to catch up before proceeding.

There are a couple of precautions I like to follow when installing new software. One is that I only install one thing between computer re-boots, and the other is that I do an *extra* computer boot after each install to make sure I have an easy to find GoBack safe point. So, for example, if I install software that does not require a boot to complete the installation then after the install is complete I re-boot the computer before doing anything else. If the software install required a re-boot in order for the install to complete then I do a second boot after that one has completed. I don't point this out during later steps, but so you know.

## Video Card Upgrade Benchmark

A video card performance benchmark utility. This is a must-have in order to measure the performance of your video card so you can verify it is working as well as expected. The widely accepted and referenced standard is from Futuremark (formerly known as Madonion). I suggest getting at least [3DMark2001 Second Edition](#). 3DMark2001 Second Edition requires DirectX 8.1. Futuremark also has the more up-to-date [3DMark03](#) which can be used on computers with DirectX 9.0 installed.

They are available for free! That's the good news. They are huge downloads though, about 40MB for 3DMark2001 Second Edition and a whopping 170MB for 3DMark03. Dial-up users may find it difficult to download 3DMark2001 Second Edition and virtually impossible to download 3DMark03. It's very important to have at least one of these benchmarks so that you can verify the video card is performing up to expectations after the installation is complete.

The Futuremark benchmarks can be installed now by double-clicking on each downloaded file image. Optionally, they can be run against the existing video card already in the computer before the upgrade so you'll have an idea of how much performance has improved with the new video card. Note that 3DMark2001 Second Edition benchmark won't install unless you have at least DirectX 8.1 on your computer and that 3DMark03 won't install unless you have DirectX 9.

## Video Card Reference Drivers

Reference video card drivers. This is optional since any retail boxed video card will come with drivers on a CD-ROM that should work just fine. But it's widely practiced to use the reference drivers and that's what I do.

The latest ATI reference drivers (referred to as CATALYST drivers) can be downloaded from [directly from ATI](#). Once there, find the right drivers by first clicking on "Download Drivers". Then select your operating system in the first selection window ("Windows 98" in my case), then select "Graphic Driver" in the second selection windows, and then select "RADEON Family" in the third selection window. Since I have the "All In Wonder" version of the card, I'll include WDM Capture in my download as well as the Display Driver and the Control Panel.

The latest NVIDIA reference drivers can be downloaded [directly from NVIDIA](#). Once there, find the right drivers by first clicking on "Download Drivers". Then select "Graphics Driver" in the first selection window, "GeForce and TNT2" in the second selection window, and your operating system in the third selection window.

It's fine to retrieve additional, prior versions of the reference drivers in case the first one does not work out, meaning it won't install without errors or it doesn't pass muster when the tests are run. It's also true that some people enjoy trying different versions of the reference video drivers and comparing how well each one does against the Futuremark benchmark programs.

The CATALYST driver I retrieved is CATALYST 3.9. It consists of three files totaling over 25MB in size. The files are the WDM capture driver, the video card driver and the Control Panel. Again, make sure you retrieve the drivers corresponding to your operating system. For now, the three files can just be saved onto the computer. They will be used later during the installation process..

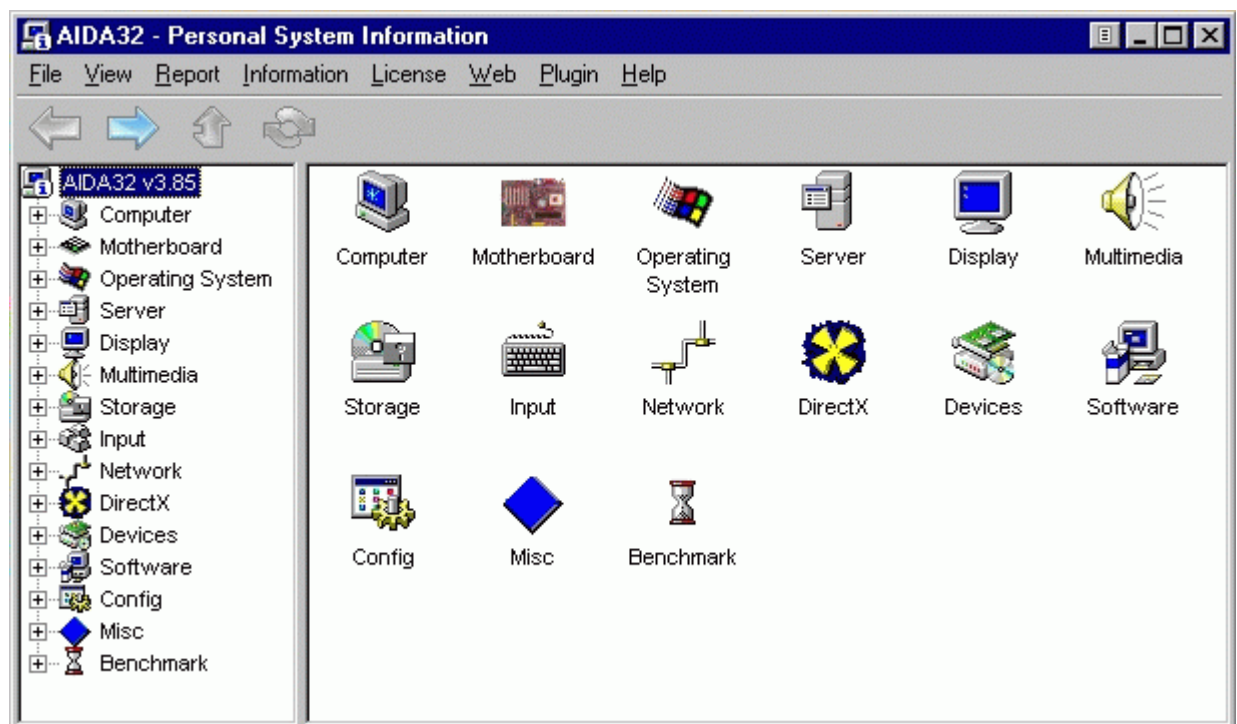
Driver Uninstaller. This utility ensures that the driver for the existing video card is completely removed. If the video card being removed from the computer is NVIDIA based then use [Driver Cleaner](#). If the video card being removed from the computer is ATI based then user [CATALYST Uninstaller](#). Download the file containing the appropriate utility, but do not execute it at this time. It will be executed later. The download for DriverCleaner is a "zip" file. If the video card being removed from the computer is NVIDIA based then double-click on it now to decompress the contents and extract the files within, one of which is named "Readme.txt". This file contains

the step-by-step instructions for using DriverCleaner. These steps will be done later.

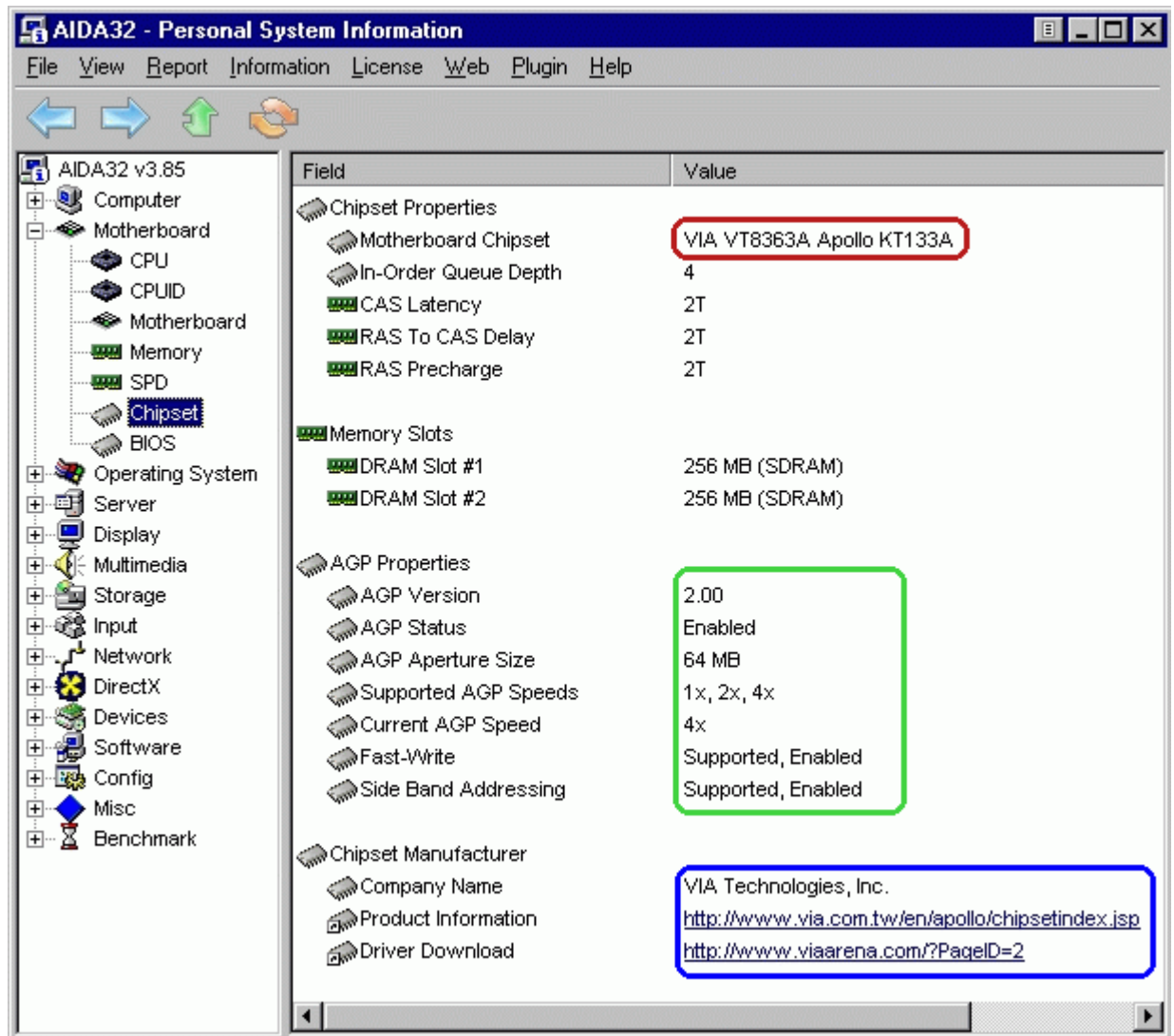
## What You Need - Motherboard/Chipset AGP Drivers

System Information Utility. I used AIDA32 to identify the AGP specification and motherboard specification within the computer. It's important to use it to verify that the AGP functionality is enabled. Without AGP enabled, everything can "look and feel" fine, at least for the most part or until you give the computer something really graphically challenging to do. But performance is dramatically reduced with AGP disabled. When it was available, AIDA32 Personal System Information was a free download. Nowadays, AIDA32 has been re-packaged as [EVEREST Home Edition](#). Fortunately it's still a free download. I also understand that it's look-and-feel has not changed much. I still refer to AIDA32 since that's what I used, but if you use EVEREST then you shouldn't have any trouble following along.

When you run AIDA32, the first screen will look something like this:



Expand the motherboard section and click on "Chipset". This shows the chipset used on the motherboard. Mine is a Via chipset as you can see where I have circled it in red. AIDA32 is even so kind as to provide links to the chipset manufacturer and to where up-to-date drivers for the chipset can be located as you can see where I have circled it in blue. This page also identifies AGP information about the motherboard, shown where I've circled it in green, including whether or not AGP is enabled and the Current AGP Speed.



AGP Motherboard Chipset Drivers. For AGP to be enabled, your computer must have the chipset drivers for the motherboard. The file containing the chipset drivers should only be downloaded now. They are installed later. The drivers can be retrieved from the motherboard manufacturer or the motherboard chipset manufacturer. You can try the link provided by AIDA32 or use the [AGP Motherboard/Chipset Driver](#) page provided by ATI to track down the right drivers for your computer. The ATI page provides links to the various manufacturers. I downloaded mine from the motherboard chipset manufacturer.

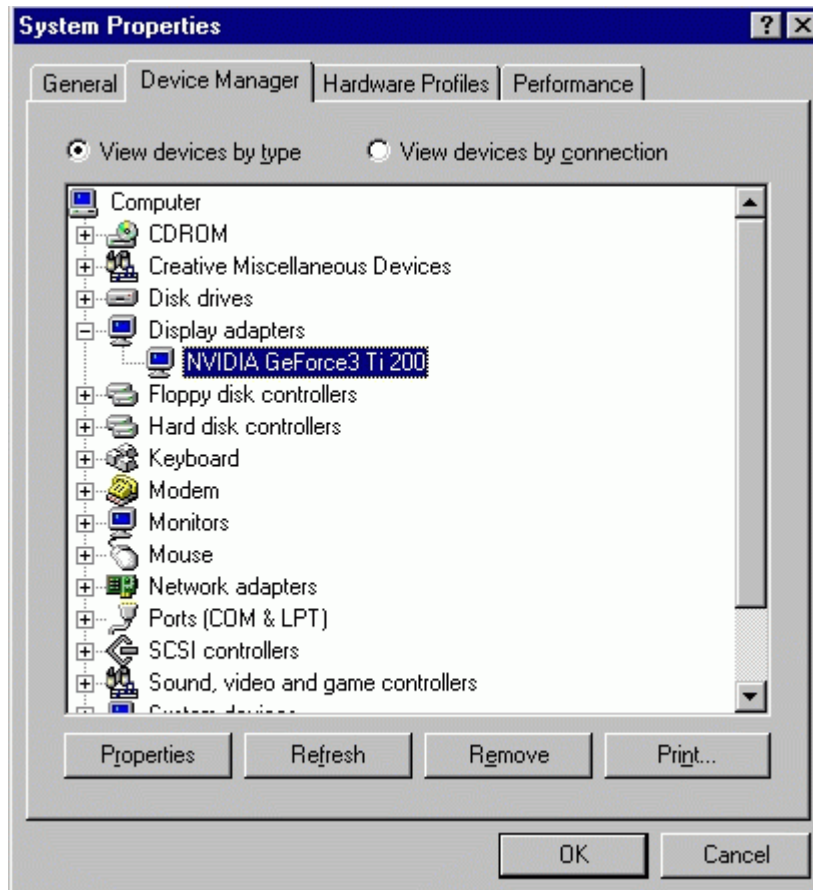
Some video card installs will prompt at some point during the install for the original Windows 98 CD, so you may as well have that handy, just in case.

## What You Need - Tour The Existing System Settings

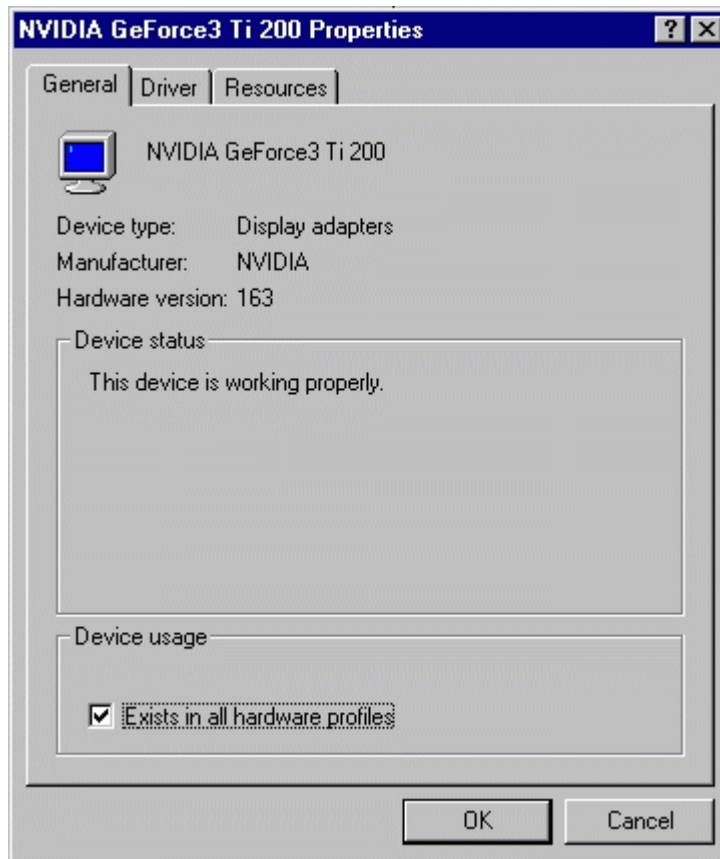
At the time of the video card upgrade, everything was just fine in my computer, but I wanted the extra performance and capabilities of the new video card. That's typically the case. Now, while everything is working and before any changes are made, is a good time to look around and just see how things look. Remember I'm running Windows 98 Second

Edition. Other versions of the Windows operating system may do some of these steps slightly differently.

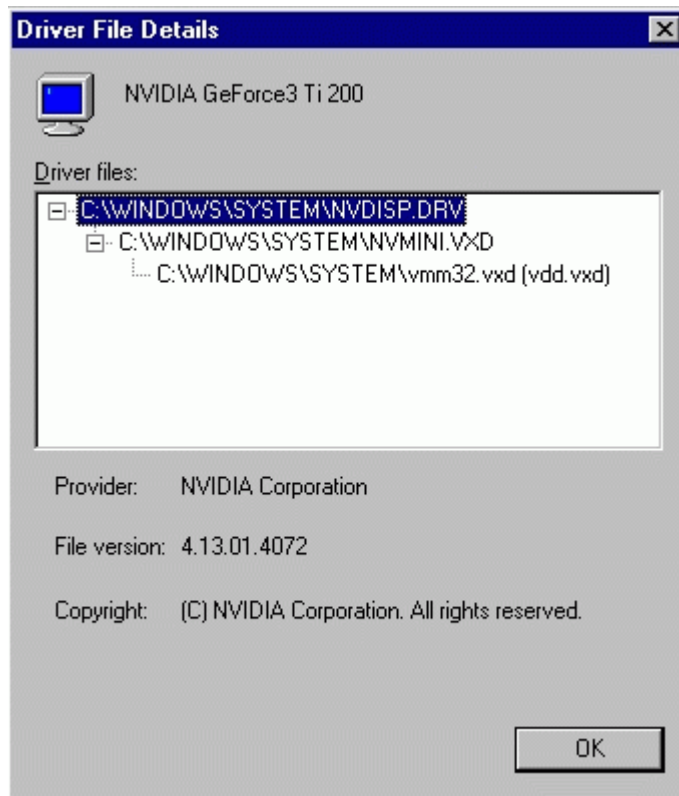
Right-click on the "My Computer" icon. On the pop-up window, click on Properties. The System Properties window opens. Click on the Device Manager tab to see the list of system devices. Clicking on the "+" sign next to Display Adapters shows I have a GeForce3 Ti 200 video card in my PC before the upgrade.



Right-clicking on the value shown under "Display Adapter", which is "NVIDIA GeForce3 Ti 200" in my case, brings up a pop-up window. Clicking on "Properties" in the pop-up window brings up this window.

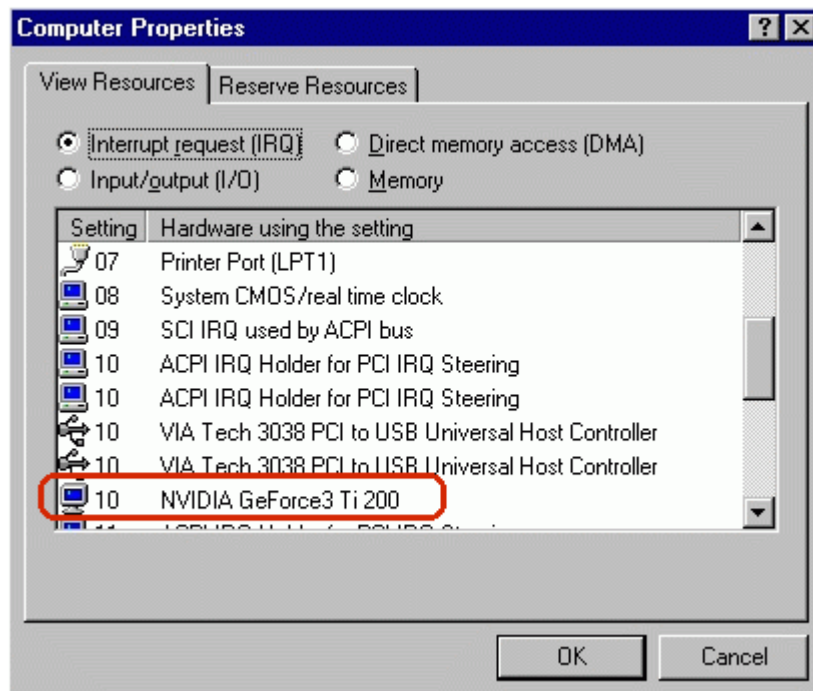


Clicking on the "Driver" tab and then clicking on the "Driver File Details" button shows which version of the NVIDIA reference drivers are currently in use. In this case, version 4.13.01.4072.

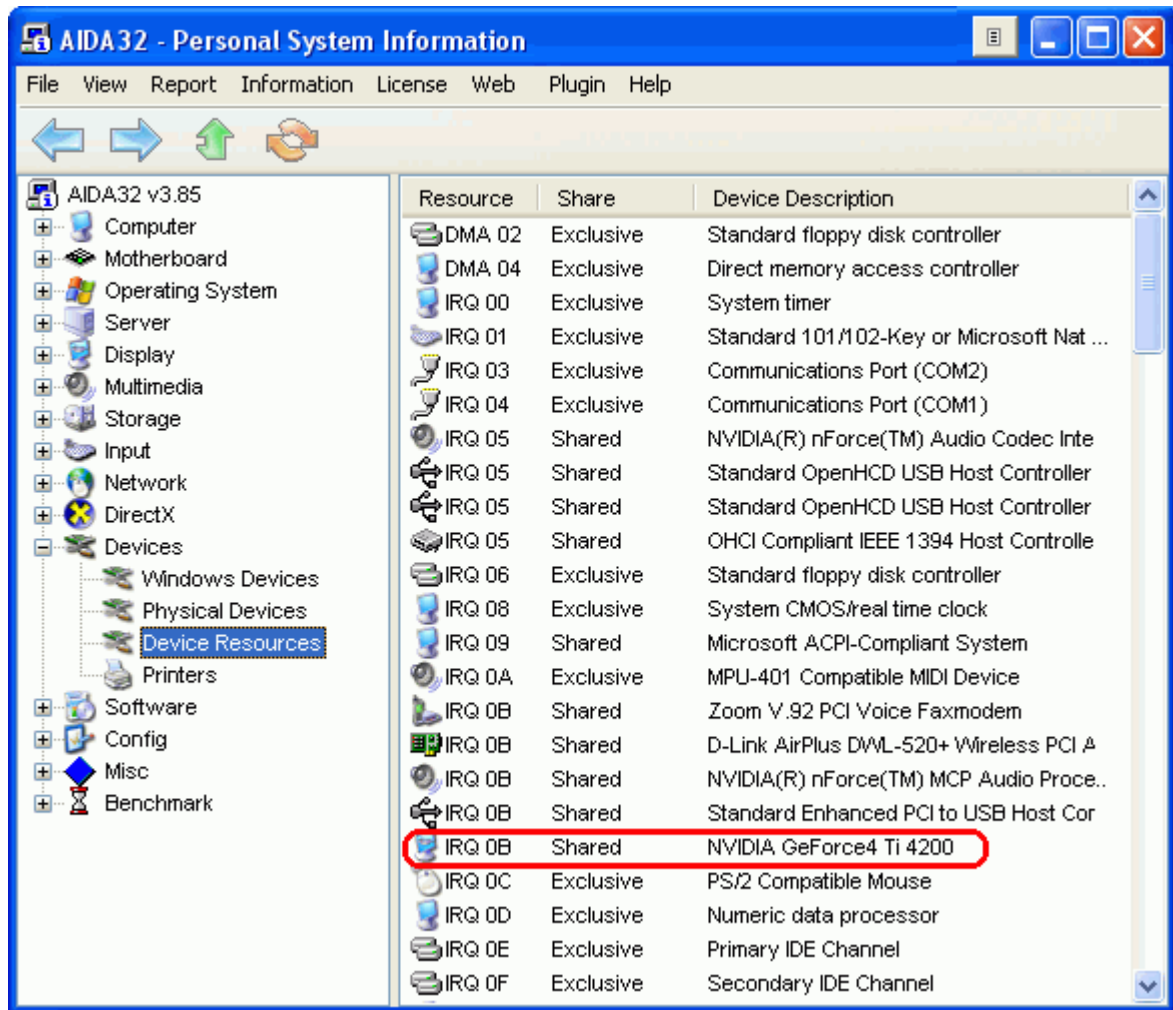


Clicking "OK" twice returns to the System Properties window.

Right-click on "Computer" at the top of the window to get a pop-up menu. Click on Properties in this menu to see the IRQ settings before the upgrade. Scrolling down a little finds the IRQ for the video card at IRQ 10, which I've circled in red. Looks like it's being shared with a few other things. Well as long as it works, that's ok by me.

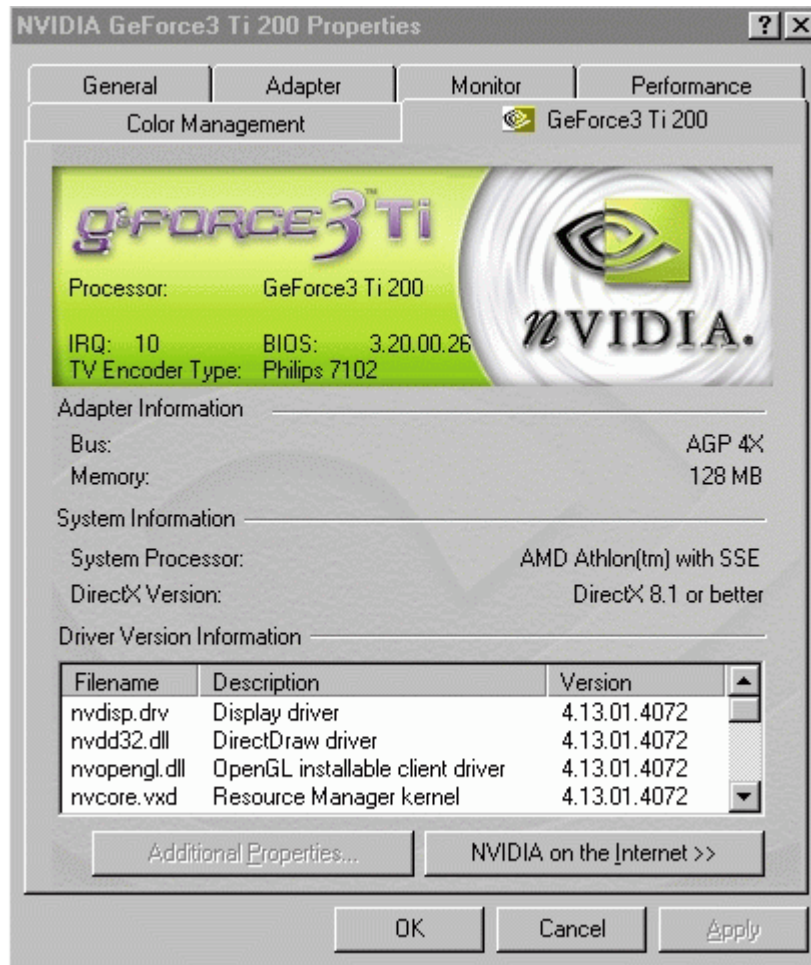


Or you can use AIDA32 to see the current IRQ setting . Here is an example where the old video card is a GeForce4 Ti 4200 video card in a computer running Windows XP. Using AIDA32 may be a little easier and it works for both Windows 98 and Windows XP. Again the IRQ is shared.



Ok, that's good to know. If all goes well then I expect to see corresponding values for the new video card. Clicking on Cancel buttons twice gets me back to the desktop.

Now let's see what else. Click on Start, then Settings, then Control Panel. Double-click the Display icon. This brings up the Display Properties window. Click on the Settings tab. On the Settings tab, click on the Advanced button. For the video card I have prior to the upgrade, this brings up the "NVIDIA GeForce3 Ti 200 Properties" window. Clicking on the "GeForce3 Ti 200" tab shows the information below. The sub-window titled "Driver Version Information" shows I have NVIDIA drivers version 4.13.01.4072 installed, which are the 40.72 drivers.



Clicking on "Cancel" twice returns the computer to the desktop.

## Things To Know Before You Start

You should now have everything you need at the ready and preparations can be made for starting the video card upgrade. Disable any anti-virus software that is running and disconnect your internet connection.

Now brace yourself for a little shock. There's a good chance that something will go wrong. I've done a video card upgrade many times and I'd say that at least half the time something went wrong. Could be anything, such as an video card reference driver won't install cleanly and "file not found" errors start occurring. Or it could that one of the tests I run fails in some way, such as by locking up the computer or not giving the expected results. It can be tricky, time-consuming business to diagnose the problem and identify the fix(es) that will get you back to where you were without resorting to GoBack. So if something does go wrong then pat yourself on the back for heeding my advice to include GoBack as part of the procedure.

## Enable AGP

The steps on this page update the motherboard chipset drivers with the most recent version and ensure AGP is set to enable. You can skip this page if you're satisfied with your motherboard chipset drivers and if you know for a fact that the AGP on your computer is enabled. It's extremely important to performance that AGP is enabled. Without AGP enabled, everything may appear to be working just fine, but in reality only a fraction of the computer's true performance is being realized.

In the BIOS, there are several settings directly related to AGP that ensure it is enabled and running at optimal performance. I've listed my values in the table below. The BIOS of another computer may have somewhat different parameters for controlling AGP, or may call the parameters by a different name. This entry at the GeForce FAQ web site, [What are the recommended BIOS settings for a GeForce?](#) is a good reference and also applies to ATI based video cards. For more information and guidance, see [The Definitive BIOS Optimization Guide](#) at RojakPot and the [BIOS Tutorial](#) at ATI.

Parameter	Setting	Comments
AGP Aperture Size (MB)	64M	The BIOS guide at RojakPot provides a great description of how this should be set and why. A value of 64MB is best for most configurations.
AGP-4X Mode	Enabled	This setting controls the data transfer rate of the AGP video card. The AGP transfer rate can be from 1x (slowest) to 8x (fastest). The ATI All In Wonder 9600 Pro 128MB supports speeds up to 8x, but the motherboard I'm using only supports up to 4x. It's fine to use a video card and motherboard that do not support the same maximum AGP data transfer rate, but data will be transferred at the rate of the slower component. In my case, the transfer rate of 4x is used.
AGP Master 1 WS Write	Enabled	By default, the AGP busmastering device waits for at least 2 wait states before it starts a write transaction. This option sets the delay to 1 wait state. This setting works fine with the motherboard and video card I have. But if you see anything strange with your graphics then set back to Disable and see if it clears up.
AGP Master 1 WS Read	Enabled	Default is at least 2 wait states. The Comments under AGP Master 1 WS Write apply.

Init Display First	Onboard/AGP	This value is set since an AGP video card is being used.
Video BIOS Shadow	Disabled	Set to Disabled for best performance.

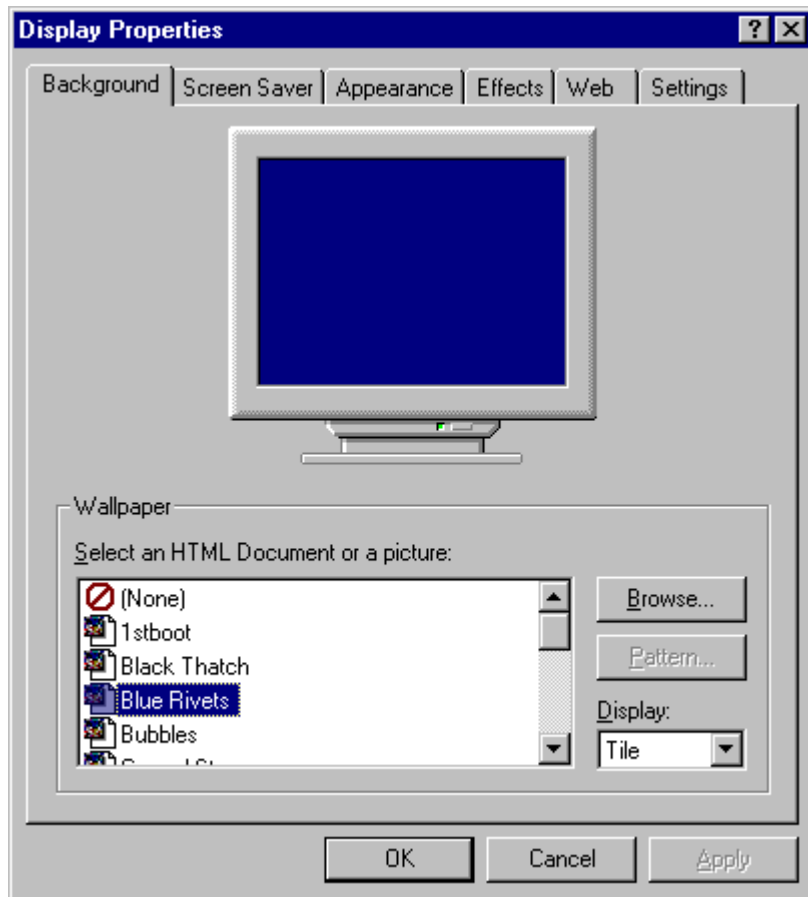
Besides configuring the BIOS, the other necessary step to ensure AGP is enabled and running at optimal performance is to install the latest motherboard chipset drivers which enable AGP functionality for the computer. My motherboard is the ABit KT7A which uses a Via chipset. The Via motherboard chipset drivers are called [Hyperion 4in1 Drivers](#). They are called 4in1 because there are actually 4 drivers in the one downloaded package, including the driver for the AGP. The new Hyperion 4in1 drivers are an easy install, just installing on top of and replacing the older drivers. The new drivers are fully activated when the PC is re-booted immediately afterwards. For more information about these particular drivers, see this [Via 4-in-1 article](#) from Anandtech.

Here are the options I elected for the installation of the new Via 4in1 Drivers on my computer.

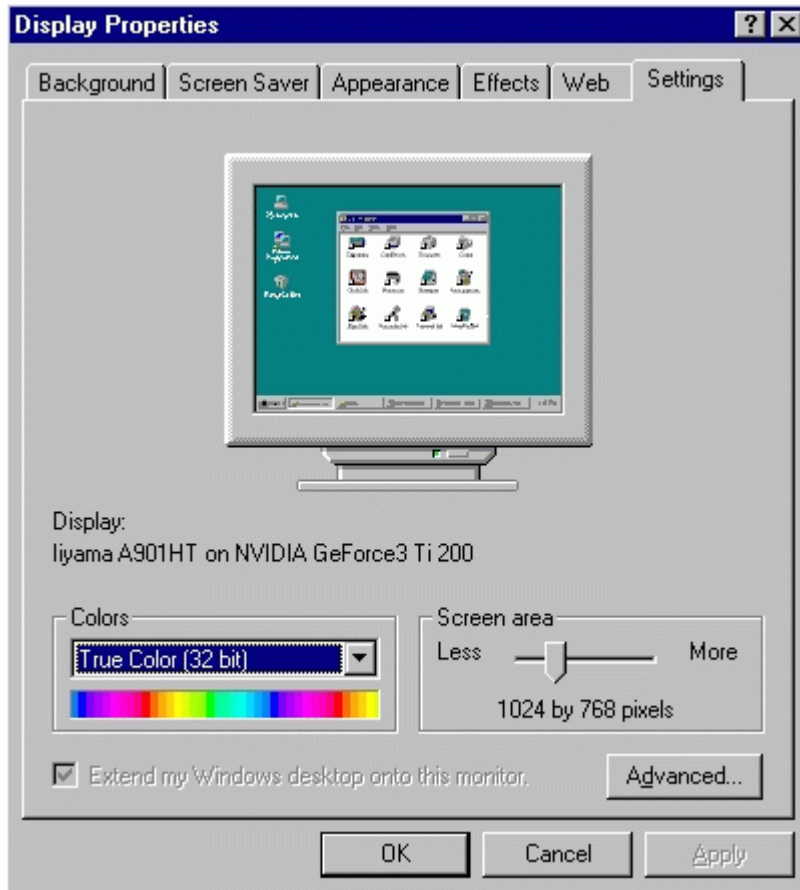
1. I installed all 4 drivers.
2. Under the ATAPI drivers, I selected to Enable DMA mode.
3. Under the AGP drivers, I selected to install in Turbo mode.

## **Change The Display Adapter In Use By The Old Video Card (Windows 98)**

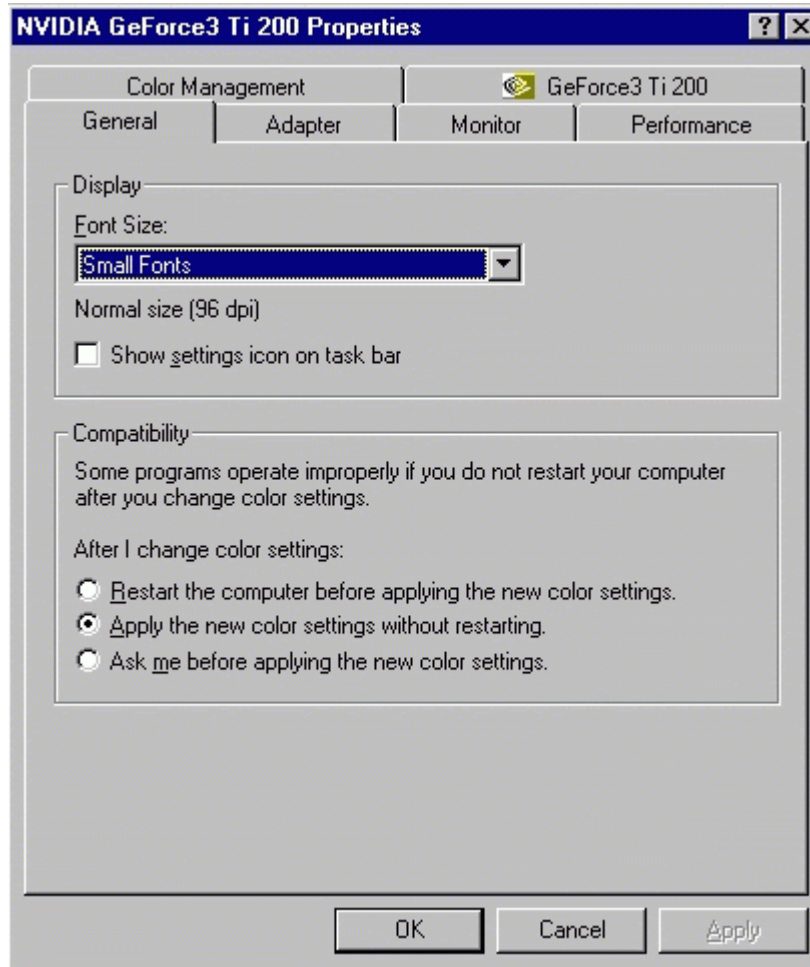
Installing the new video card begins by changing the video card driver that is currently in use by the existing video card to be the standard VGA video card driver. Click on Start, then Settings, then Control Panel, and the double-click the Display icon to get to this screen.



Clicking on the Settings tab brings up a screen like this. Click on the "Advanced" button.

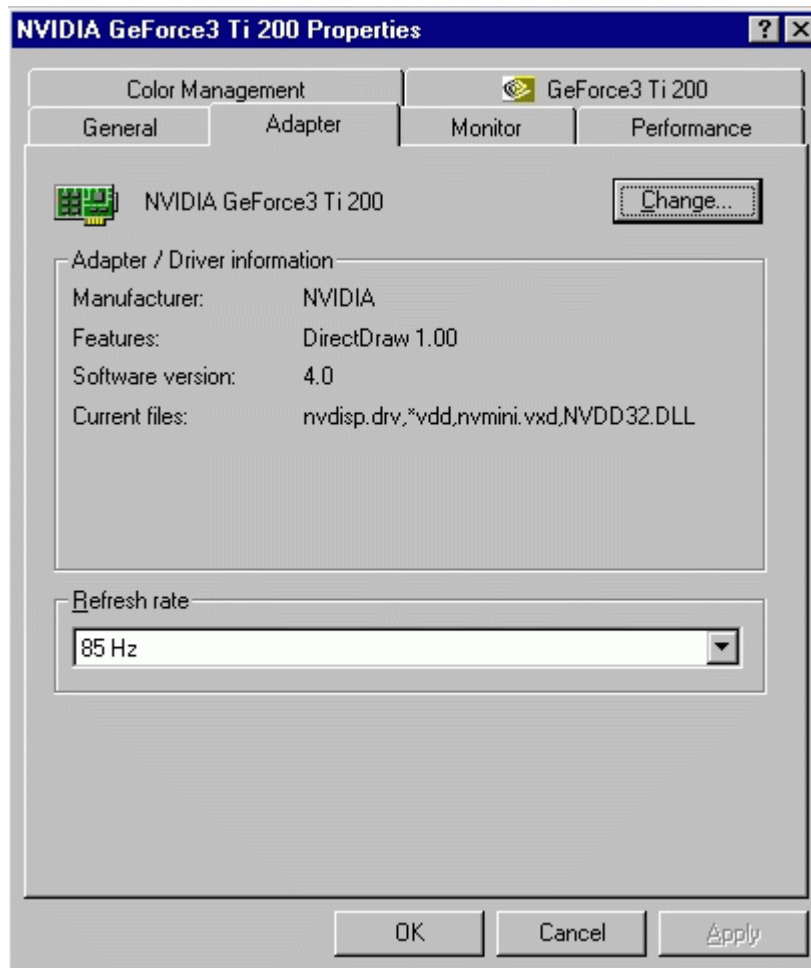


The window changes to look something like this. Click on the Adapter tab.

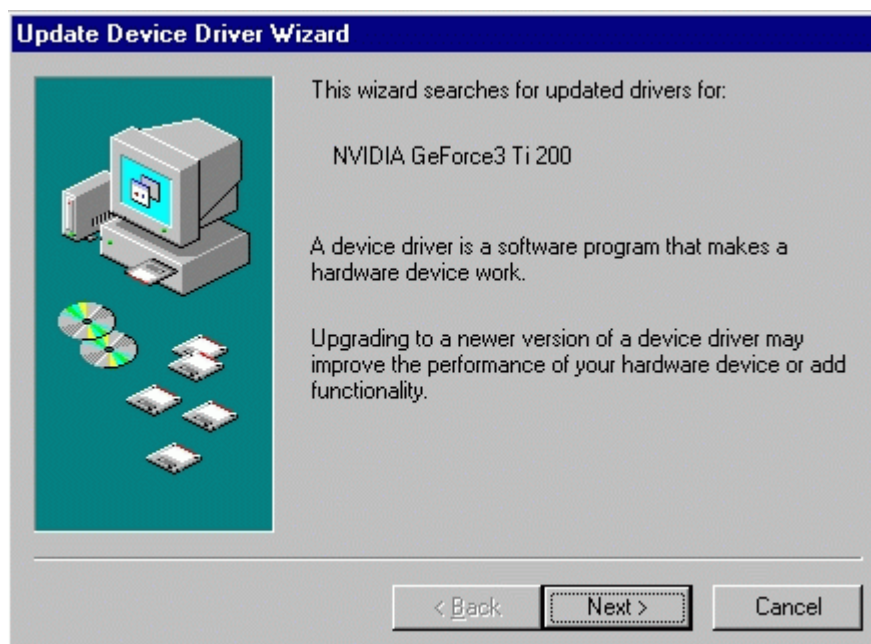


## Search For The Standard VGA Driver

The window changes to look something like this. Click on the "Change" button.



The window changes to look something like this. Click on the "Next" button.



The screen below appears. Select "Display a list of all the drivers in a specific location, so you can select the driver you want"...



... so that the window looks like this. Click the "Next button".

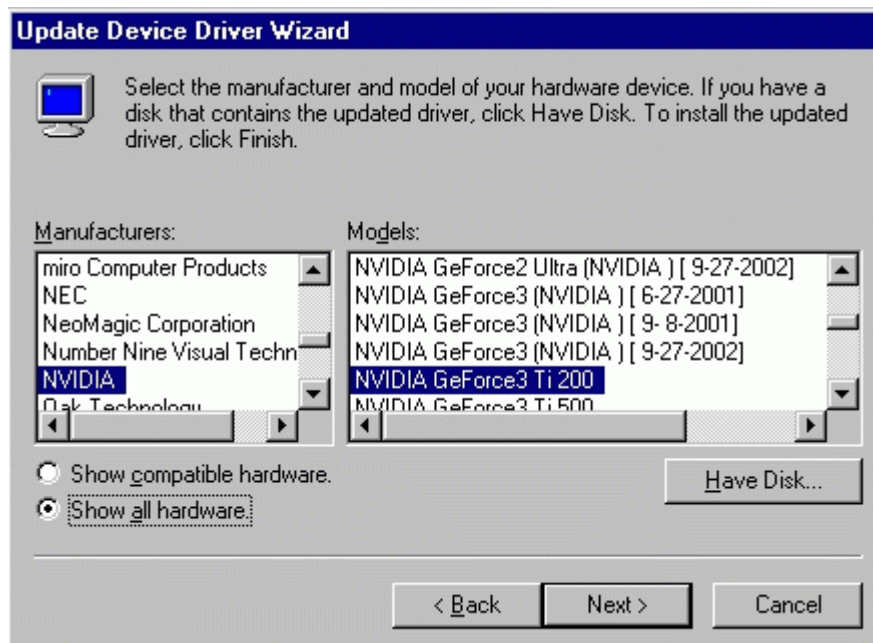


## Select The Standard VGA Driver

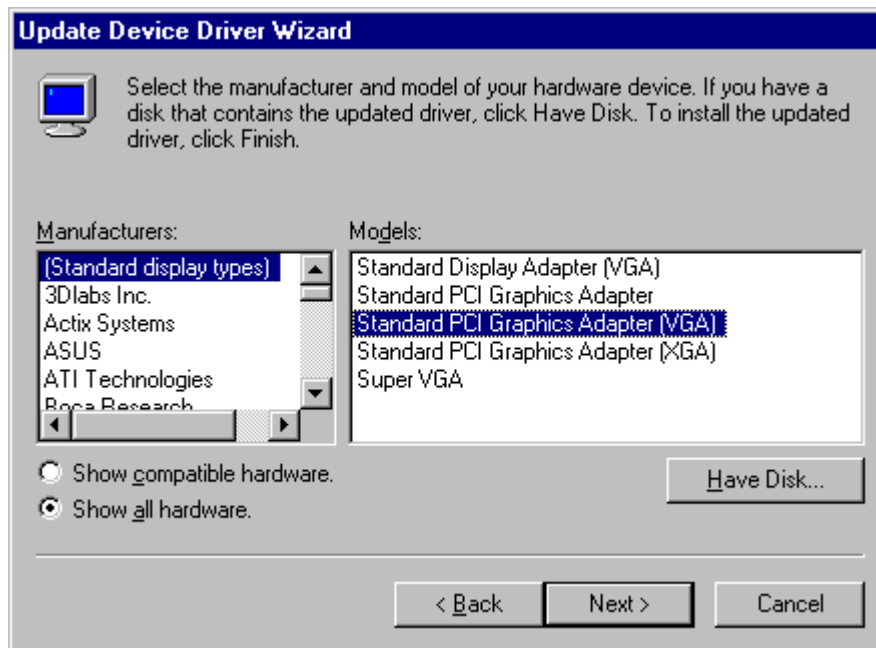
The screen below appears. Select "Show all hardware".



The window changes to look something like this. Scroll the left sub-window the top and select (by clicking on it) "(Standard display types)".



The window changes to look something like this. In the right sub-window, select (by clicking on it) "Standard PCI Graphics Adapter (VGA)". Click on the "Next" button.



## Installing The Standard VGA Driver

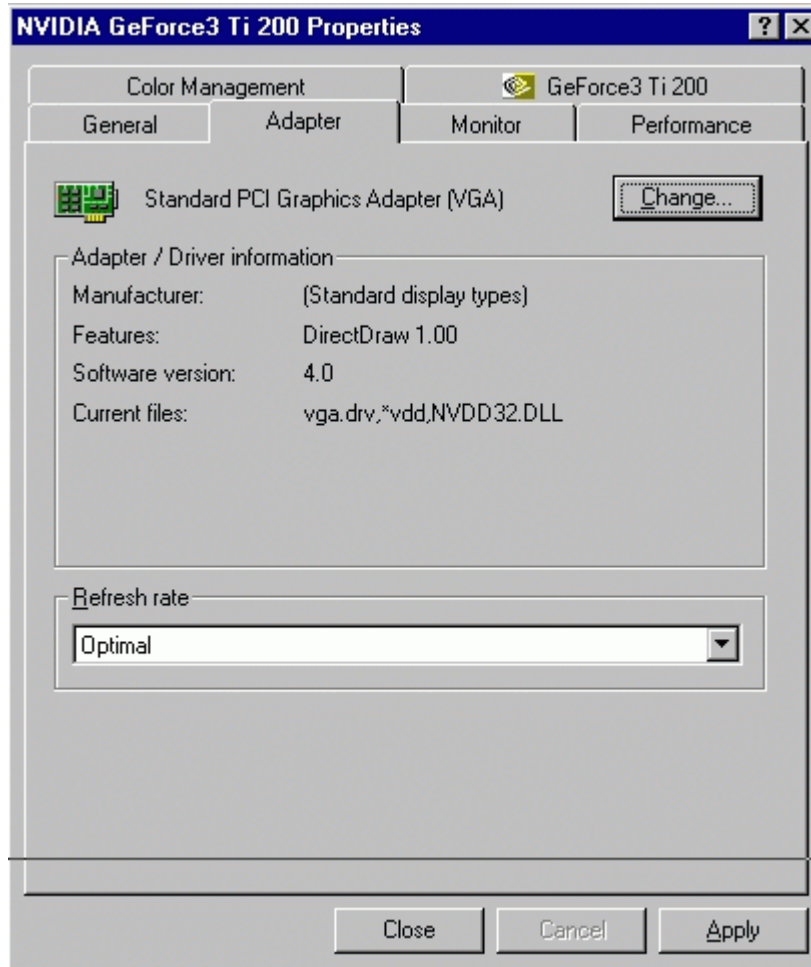
The window changes to look like this to indicate that Windows is ready to install the driver. Click on the "Next" button.



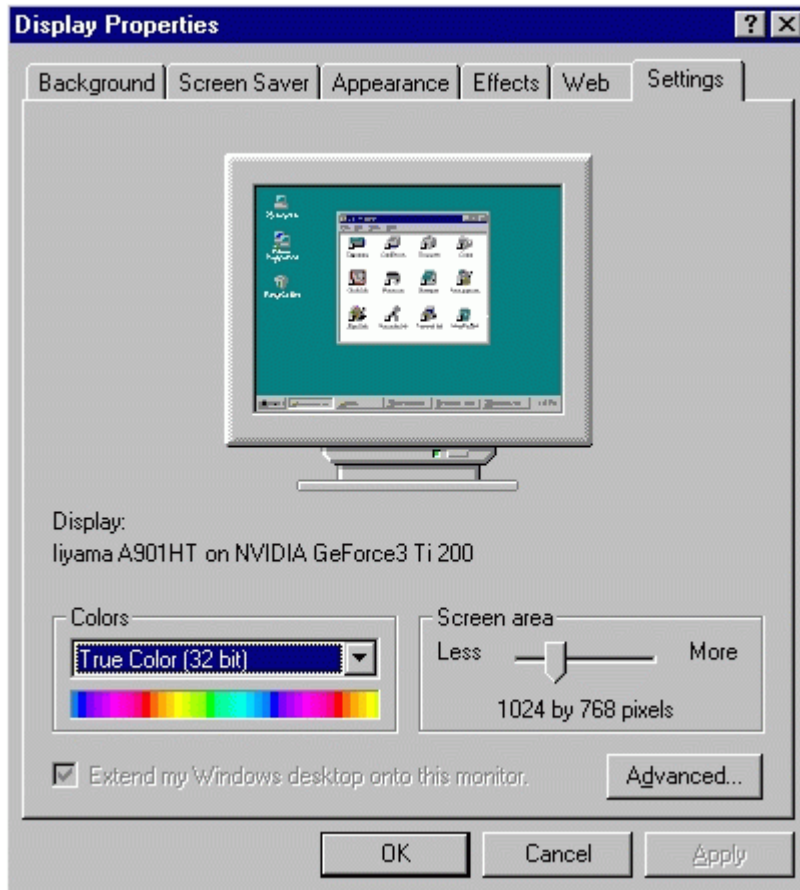
The window changes to look like this to announce that Windows has installed the driver. Windows has not really installed the driver yet. It's got the computer set up to do the install. Click on the "Finish" button.



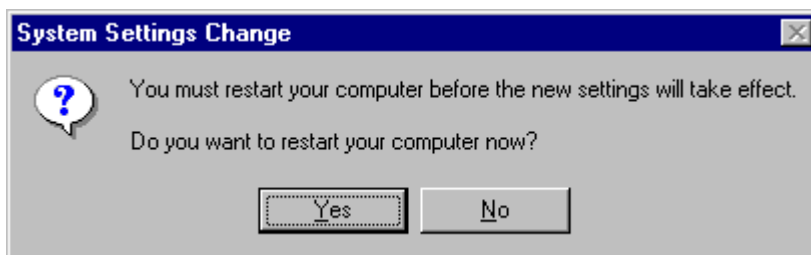
Click on the "Apply" button.



Click on the "Close" button.

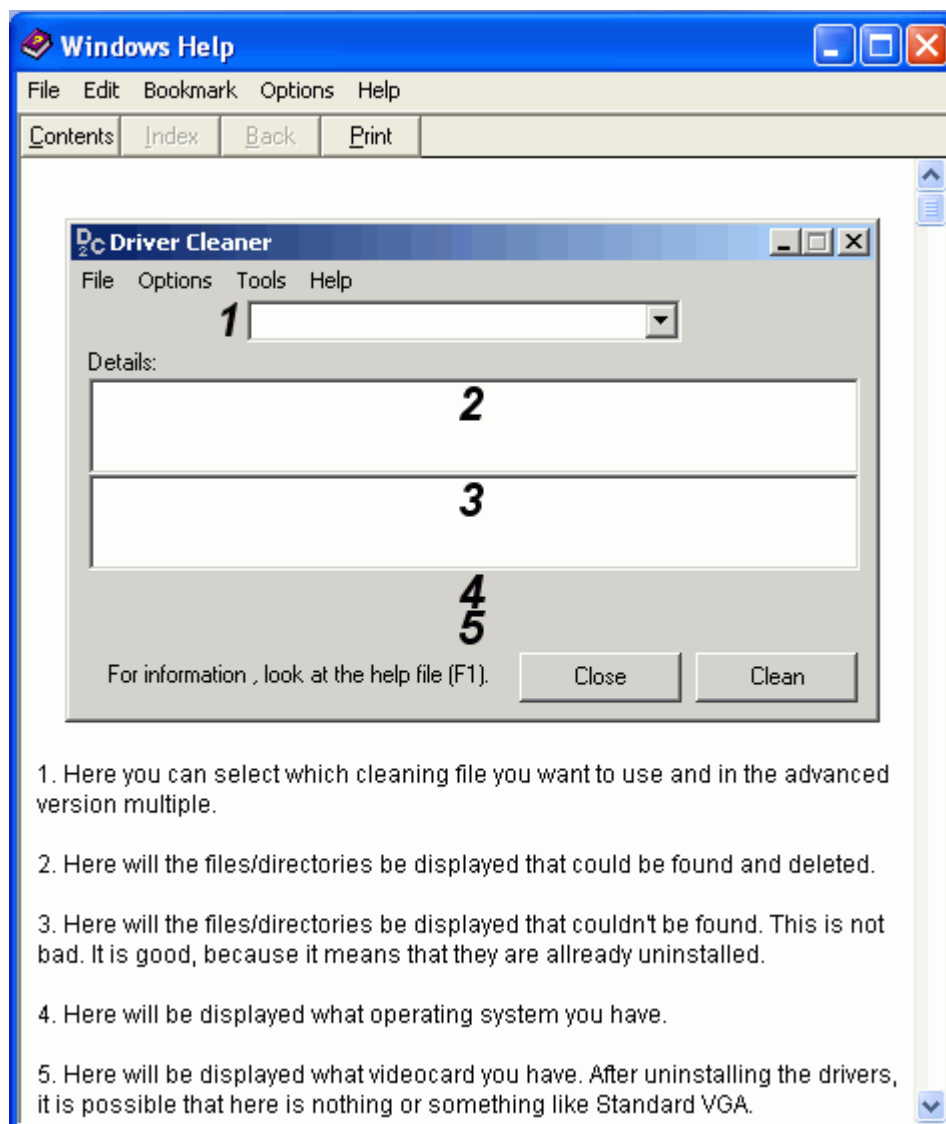


Click on the "Yes" button and the computer will restart to actually, really install the selected drivers.



The screen goes black and the message "Windows is now restarting..." is displayed. If, during this reboot, the Hardware Wizard gives a message to the effect that new hardware has been detected and prompts to install the drivers then once again select the "Standard PCI Graphics Adapter (VGA)". When the computer boots back to the desktop, the colors and the display probably look very different than they did before. That's because the computer is now using the standard VGA adapter, which is very basic. Let GoBack settle down.

For replacing an NVIDIA based video card like I did, read the Driver Cleaner ReadMe file and follow the steps. There are not many steps and the step are not difficult, but there's no point in repeating them here. On the other hand, I found the text shown below from the Driver Cleaner help file quite helpful, so I've mentioned it here to make sure you see it. Execute Driver Cleaner to remove any remaining remnants of the NVIDIA video card drivers. The steps for Driver Cleaner require that the computer be restarted in "Safe Mode". See this [How to Start a Windows 98-Based Computer in Safe Mode](#) article from Microsoft if you're not sure how to do that. If, during the reboot, the Hardware Wizard gives a message to the effect that new hardware has been detected and prompts to install the drivers then once again select the "Standard PCI Graphics Adapter (VGA)".



For replacing an ATI based video card, execute CATALYST Uninstaller (cat-uninstaller.exe). Follow the prompts and restart the computer when prompted. If,

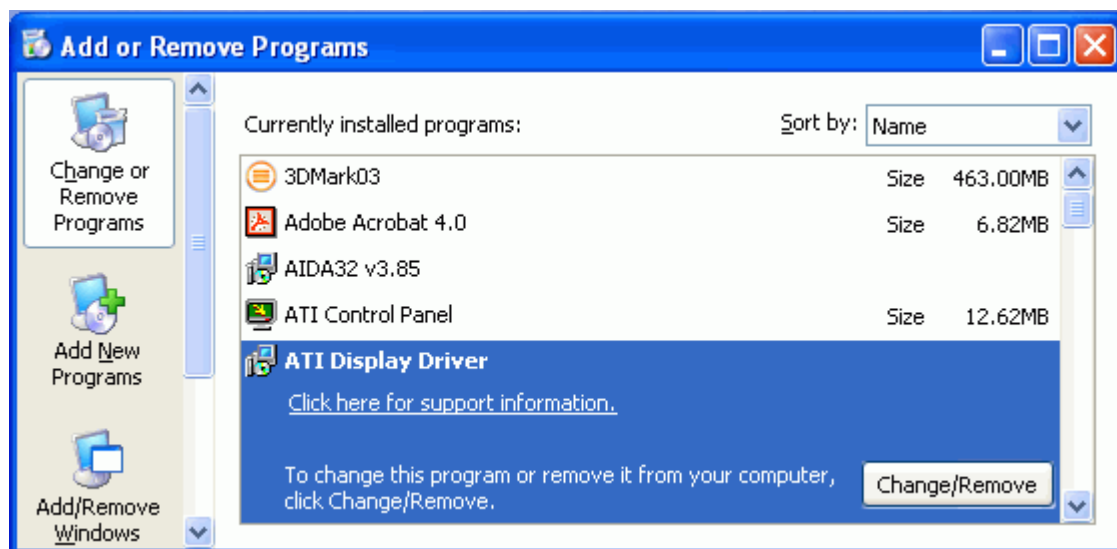
hardware has been detected and prompts to install the drivers then once again select the "Standard PCI Graphics Adapter (VGA)".

With the appropriate driver cleaner utility complete, if you used the System Configuration Utility to reach Safe Mode as the article describes (and like I did) then now is a fine to use it again to disable the startup menu since you'll no longer need the option of starting in Safe Mode.

If you're upgrading from an integrated graphics chipset, meaning a chipset built-into the motherboard, so that there is currently no video card in your computer then it's worth noting that some motherboards require a simple BIOS change in order for the installed video card to be recognized. Consult the documentation that came with your motherboard or computer for more information.

## How To Remove The Video Card Driver (Windows XP)

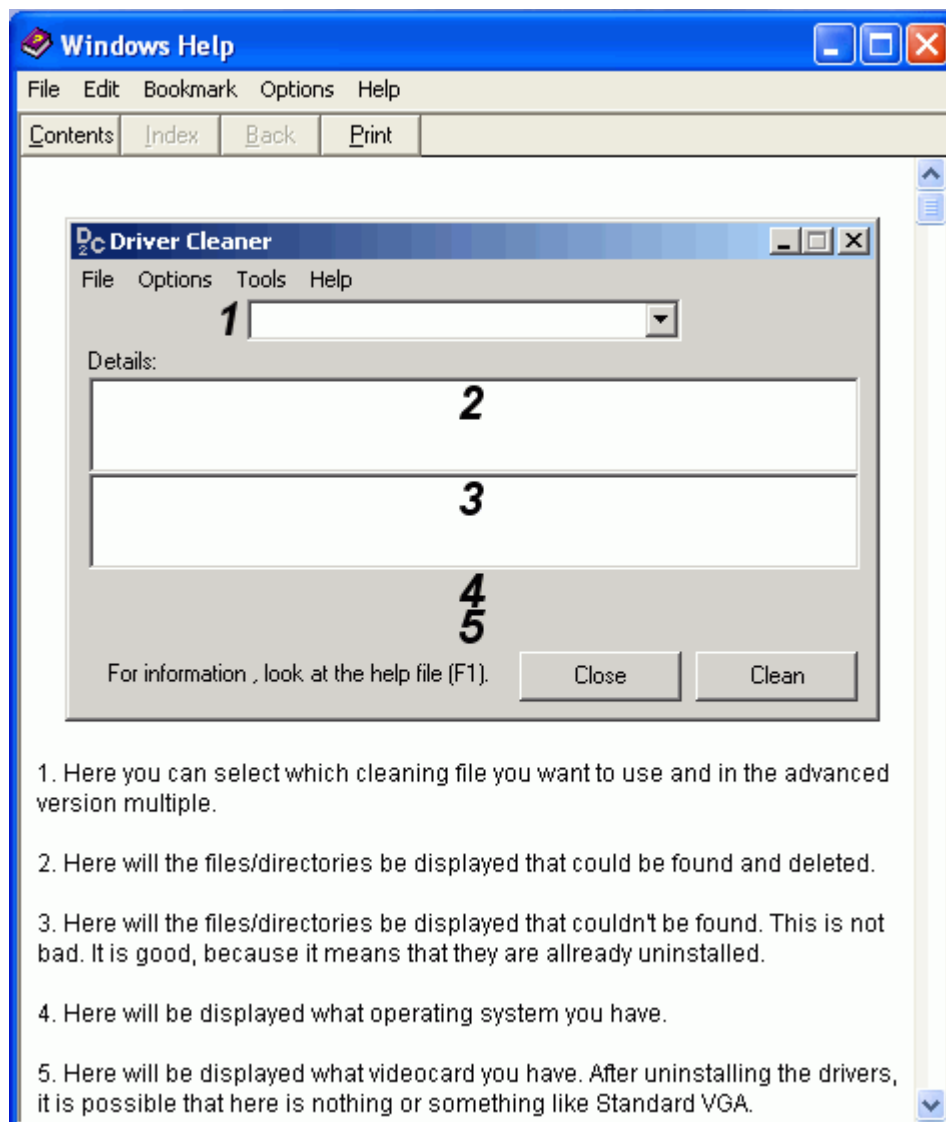
It's much simpler to remove the video card driver under Windows XP than under Windows 98. Click on *Start*, then click on *Control Panel*. Double-click on the *Add/Remove Programs* icon. Scroll through the list of programs installed on the computer and click on the current video card drivers. Highlighting an entry on this window brings up a *Change/Remove* button for the entry like the example shown below. If an NVIDIA video card is being removed then the entry would be named something like "NVIDIA Display Driver".



Remove the video card driver and restart the computer. When the computer boots back to the desktop, the colors and the display probably look very different than they did before. That's because the computer is now using the standard VGA adapter, which is

very basic. Let GoBack settle down.

For replacing an NVIDIA based video card like I did, read the Driver Cleaner ReadMe file and follow the steps. There are not many steps and the step are not difficult, but there's no point in repeating them here. On the other hand, I found the text shown below from the Driver Cleaner help file quite helpful, so I've mentioned it here to make sure you see it. Execute Driver Cleaner to remove any remaining remnants of the NVIDIA video card drivers. The steps for Driver Cleaner require that the computer be restarted in "Safe Mode". See my How to Start a Windows XP-Based Computer in Safe Mode page if you're not sure how to do that.



For replacing an ATI based video card, execute CATALYST Uninstaller (cat-uninstaller.exe). Follow the prompts and restart the computer when prompted.

With the appropriate driver cleaner utility complete, now is a fine to use the System

Configuration Utility (msconfig) to change startup such that the computer no longer restarts in Safe Mode.

If you're upgrading from an integrated graphics chipset, meaning a chipset built-into the motherboard, so that there is currently no video card in your computer then it's worth noting that some motherboards require a simple BIOS change in order for the installed video card to be recognized. Consult the documentation that came with your motherboard or computer for more information.

## **Installing The New Video Card (continued)**

Shut down the computer and it's time to install the new video card.

When working inside the computer, it should always be powered off. Furthermore, after the computer is powered off, disconnect all of the cables and other connections into the computer, including the telephone line connection for the modem, the printer connection, the monitor connection, and everything else. Also unplug the power connector from the PC. It's important that nothing external to the computer be connected while you are working inside so that nothing can provide any kind of electrical current to the computer. It's not getting electrocuted that's the concern, it's that some tiny electrical charge might come in at the wrong time and destroy a component. It's not uncommon for a computer to draw a little bit of electrical current while it is plugged in, even when it has been powered off, so that's why it's important to unplug the power connector, too.

If you're not used to disconnecting everything then you'll want to at least carefully note where each connection was attached. For example, until I learned my way around with the connections I used a short strip of masking tape to scribble a little note for each connection and then I wrapped the tape around the cord before I disconnected it. Each connection should only connect one way, so there's no need to remember how the connection was oriented before it was disconnected. But chances are you've got a nice little collection of connections into your computer, so you don't want to be looking at a confused pile of disconnected wires when you're ready to power it back on!

Set the computer in a nice comfortable work space (personally, I just use the middle of the floor) and remove the computer case cover.

Here's a shot of the motherboard in my computer with the old video card still installed. The video card is easy to pick out in the picture since it's red, which is unusual since typically video cards and other computer boards are green. The video card should be easy to find in any computer since it is the card into which the cable from the monitor connects. Click on the picture to see it enlarged.



It might help to have a look at the bare motherboard. The video card in my computer installs in the AGP slot. There is only one AGP slot and it is brown in color. In the picture, it is near the center and runs vertically. To the left of the AGP slot are 6 white PCI slots in a row. The PCI slots also run vertically. Click on the picture to see it enlarged.



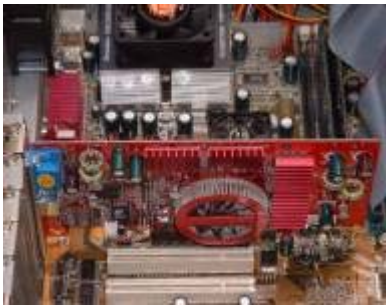
Here's a close-up of the AGP slot taken from the "east". Click on the picture to see it enlarged.



## Remove The Old Video Card

Here's an uncluttered view of the old video card still in my computer taken from the "west". For the purpose of taking unobstructed pictures of the video card, I've temporarily removed two other cards that were in the PCI slots. Click on the picture to

see it enlarged.



It's possible for the old video card to have internal connectors that need to be disconnected or an AGP locking clip that will need to be unlocked. For me using the ABIT KT7A motherboard and an ATI All In Wonder 9600 Pro 128MB video card, this was not the case. For reference, here's an example from a different motherboard of what an AGP locking clip looks like in the unlocked position, circled in blue on the AGP slot.



The video card is held in place with a slot screw. Remove the slot screw and keep it handy. It will be used with the new video card. Click on the picture to see it enlarged.



To remove the old video card from the AGP slot, grasp the video card firmly by the corner and upper edge lift straight up. It's normal to rock the video card a little side-to-side to help work it out of the AGP slot (i.e., to the left-and-right as viewed in the picture, but not rocked in-and-out of the picture), but while still holding the card straight up and while lifting the card straight up. Once the old video card is removed,

lay it aside, out of the way. Ideally it should be placed back in its original antistatic bag. Click on the picture to see it enlarged.



## Insert The New Video Card

Here's a picture of the new video card before it's installed. It's impossible to install the video card the wrong way around since the notches along the gold connectors key it with the AGP slot. Plus the new video card will face in the same direction as the old video card, and it's clear that the end of the video card with the slot bracket is the end that goes next to the back of the computer. Click on the picture to see it enlarged. The enlarged picture has a blue dot next to the notch that keys the video card for the AGP slot.



To insert the new video card into the AGP slot, line up the gold edge connector and notches on the video card with the AGP slot. Keep in mind the slot cover built onto the video card will lay flush against the back of the computer, so it should not be too hard to get the video card properly aligned into the slot. If the AGP slot has a locking clip then ensure the bottom edge of the video card is aligned into it. Grasp the video card firmly by the corner and upper edge and push straight down and fully into the slot. The AGP locking clip, if there is one, should click into place as the card is fully inserted. The AGP locking clip may only move partway into place, in which case you should be able to close it the rest of the way easily with your finger. Use the mounting screw to secure the card in the computer, but don't overtighten the screw as this can twist the card in the AGP slot and cause it to be not completely connected inside the

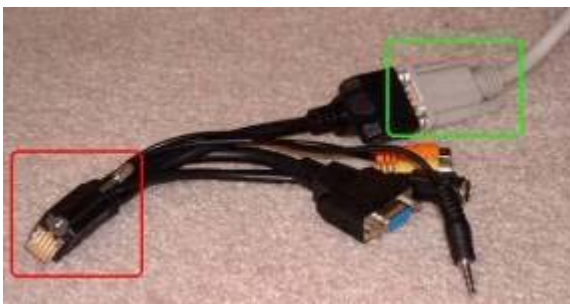
AGP slot.



Here's how the back of the computer looks with the new video card inserted (and with the PCI cards I temporarily removed re-inserted). I've circled the slot cover of the video card in blue. I've circled the connector for the monitor in red.



For many video cards, the connector from the monitor plugs directly to the video card. But the ATI All In Wonder 9600 Pro 128MB video card comes with different looking audio/video connection on the back of the card so that it can accommodate many types of connections. The connections are supported with the cable bundle as shown in the picture below. The connector circled in red plugs into the video card at the back of the computer. The cable from the monitor, shown circled in green, plugs into the cable bundle into the plug labeled "VGA 1".



Put the computer case back on. Reconnect all the connections, including the power cord. Turn on the monitor and let it warm up for 10 seconds or so. That way you'll be sure and see any messages that are displayed. Turn on the computer. The very first thing the computer displays is the video card BIOS header, but it lasts for just a moment before it's replaced by the motherboard BIOS header.

Alternatively, you can leave the computer case off and reconnect just the mouse, keyboard, monitor and power cord. This alternative allows you to keep back inside the computer quickly in case something goes wrong. But connections should only be made while the computer is powered off.

The problem that might be detected within the first seconds of the computer being turned on is that the computer will report it does not "see" a video card. What you will see and hear if this happens is this. You turn on the computer and you can tell it's getting power because you can hear the fans. But within seconds you hear a one-long-beep-two-short-beeps error code emitted from the computer's internal speaker. After the code is emitted nothing appears to be happening, the monitor is blank or showing text like "No Signal". The monitor LED indicator is either orange or blinking orange. If this happens then the first thing to try is to push the reset button on the computer and see if the computer recognizes the video card on reset. But if the problem persists then repeat the installation of the new video card into the AGP slot being careful to seat the new video card properly in the slot as described in the instructions. If the problem is a loose connection then reseating the video card may clear it up. It's reasonable to try reseating the video card to clear the problem several times.

But if the computer still does not recognize the new video card then your options are:

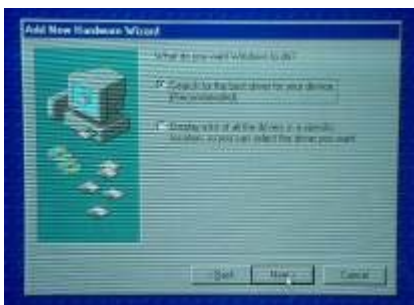
1. Try technical support for the maker of the video card.
2. Try technical support for the maker of the motherboard.
3. Replace the video card with a different make.
4. Replace the video card with a different model.

## **Windows 98 Steps To Add The New Video Card Driver**

The computer boots up to the wallpaper and then Windows announces it has found new hardware - the new video card. Then the "Add New Hardware Wizard" comes up with this window. Windows wants the driver for the video card. For now we'll give it the standard VGA video card driver. The next few pictures don't look that great, but the enlarged image looks better and you can at least make it out. Hit the "Next" button.



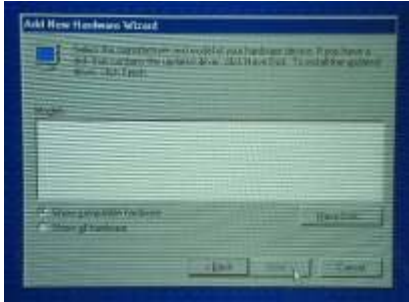
The window changes to look like this. Select the option to "Display a list of all the drivers in a specific location, so you can select the driver you want".



With the option selected, the window looks like this. Click the "Next" button.



The window changes to look something like this. Select the "Show all hardware" option.



The window changes to look something like this. The two sub-windows should already have the correct default selections. The left sub-window pane should show "(Standard display types)" selected. The right sub-window pane should show "Standard PCI Graphics Adapter (VGA)" selected. These are the correct values. Click on the "Next" button.



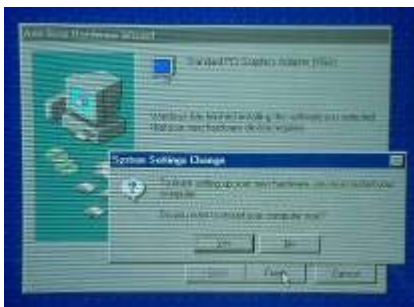
The window changes to look like this. Click on the "Next" button.



The window changes to look like this. Click on the "Finish" button.



Windows indicates it needs to restart your computer. Click on the "Yes" button.



When the computer re-boots this time Windows agains find new hardware, this time the monitor. But it will automatically find and install the drivers for it. It may happen so quickly you miss it. After the computer is finished, wait for GoBack to finish with the hard drive restoral log. Disable any Anti-Virus program which is running and shutdown any other background tasks that are not needed.

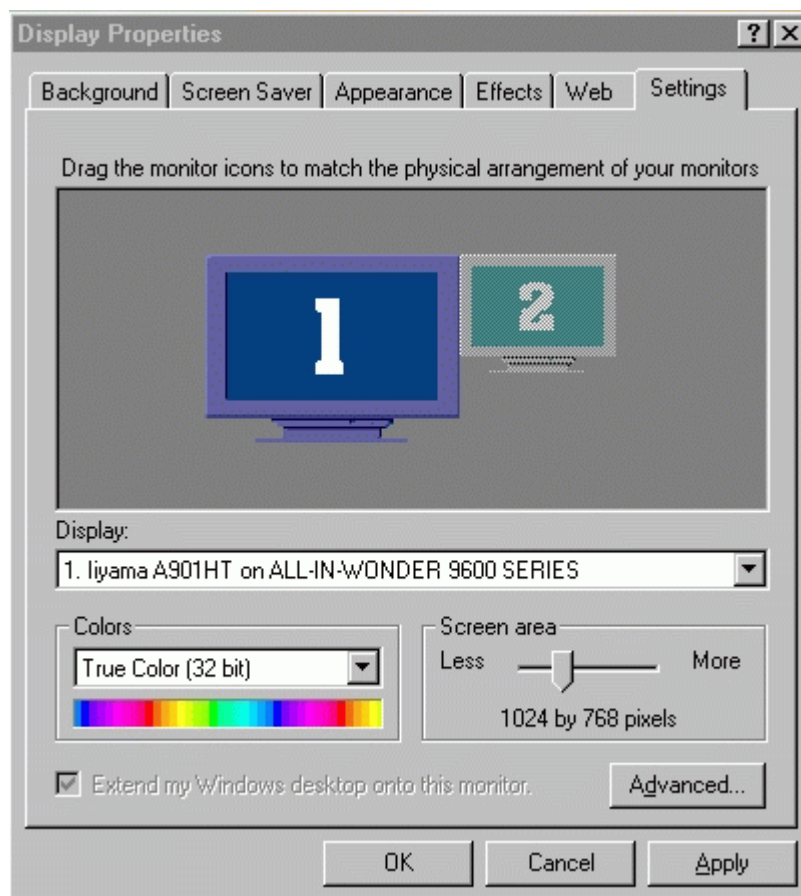
Now we're ready to install the reference drivers. This process is shorter for NVIDIA based video cards. Locate the NVIDIA reference drivers where you downloaded them and double-click on them. The NVIDIA reference drivers install automatically with just a few self-explanatory clicks. After they have installed, select the option to restart the computer. The computer should reboot back to the desktop with no errors and with no new hardware detected and with no new hardware installed. The new drivers are installed!

There are more steps for the ATI video card. If you have an All-In-Wonder type ATI video card like me then locate the WDM Capture driver where it was downloaded. Install the driver following the [Windows 98 WDM Capture driver installation steps](#) from ATI. Notice that the computer is not restarted after the capture driver is installed. Next, or first if you're not installing an All-In-Wonder type video card, locate the display driver where it was downloaded. Install the driver following the [Windows 98 Radeon Driver installation steps](#) from ATI, except that you don't need to restart the computer at the end of the steps. Because the next and last thing to install is the Control Panel. Locate the display driver where it was downloaded. Install the Control

end, restart the computer. On restarting, the computer may detect new hardware and ATI recommends not overwriting any files if asked. When the restart is complete, the new ATI video card drivers are installed.

As a reference for all Windows operating systems, here's a link to the [ATI Driver and Software Installation Instructions](#) and a link for NVIDIA reference drivers to [How do I install the NVIDIA Detonator drivers for Windows 95/98/ME/NT4/2000/XP](#).

Now do a little basic configuration to get the display looking the way you like. Click on "Start", then "Settings", then "Control Panel" and then double-click on the "Display" icon. Go to the "Settings" tab.



Move the slider underneath "Screen Area" to the screen area you desire. Select the color-depth you desire using the picklist options underneath "Colors". Click on the "Apply" button to put the changes into effect. Installation of both the new video card hardware and the video card drivers is complete! Now let's take a look around and see if all looks well.

## Windows XP Steps To Add The New Video Card

## Driver

The computer boots up to the wallpaper and then Windows announces it has found new hardware - the new video card. I've circled the "new hardware" in blue found by Windows XP. Cancel out of the hardware wizard without doing anything by clicking on the *Cancel* button.



Click on the *Cancel* button on this occurrence as well.



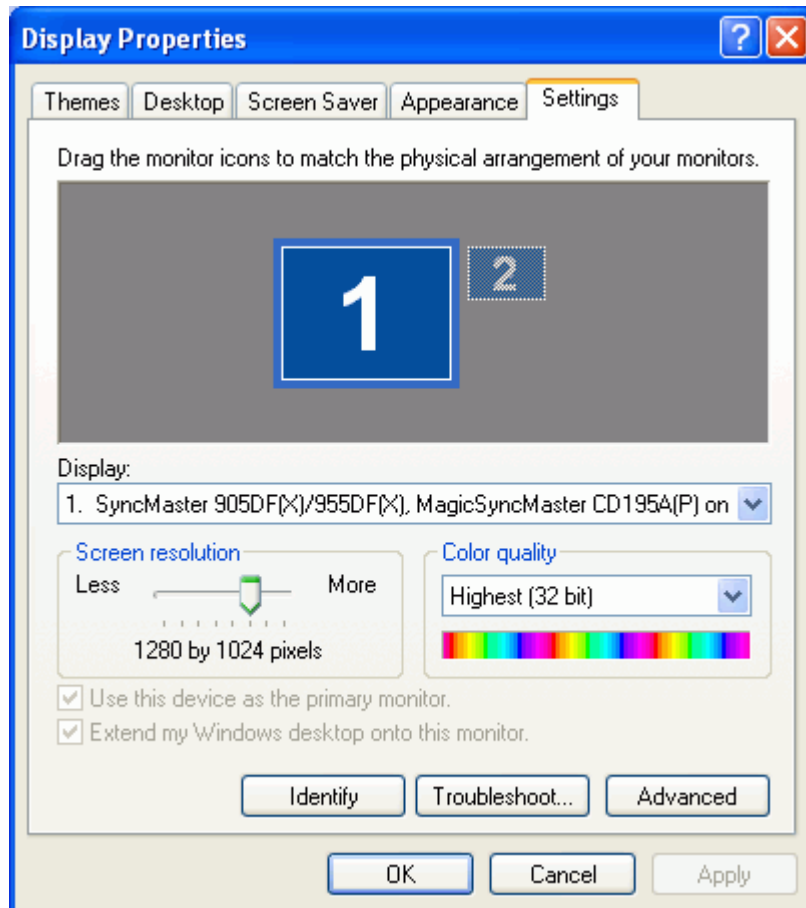
Wait for GoBack to finish with the hard drive restoral log. Disable any Anti-Virus program which is running and shutdown any other background tasks that are not needed.

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As a reference for all Windows operating systems, here's a link to the [ATI Driver and Software Installation Instructions](#) and a link for NVIDIA reference drivers to [How do I install the NVIDIA Detonator drivers for Windows 95/98/ME/NT4/2000/XP](#).

Now do a little basic configuration to get the display looking the way you like. Click on "Start", then "Settings", then "Control Panel" and then double-click on the "Display" icon. Go to the "Settings" tab.

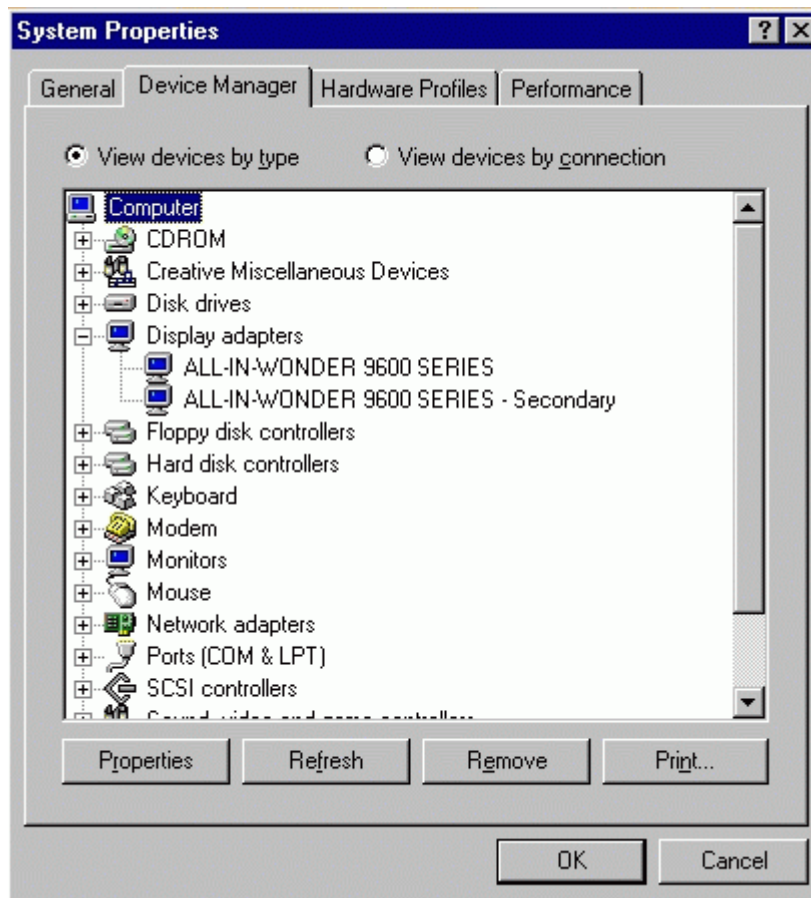


Move the slider underneath "Screen Area" to the screen area you desire. Select the color-depth you desire using the picklist options underneath "Colors". Click on the "Apply" button to put the changes into effect. Installation of both the new video card hardware and the video card drivers is complete! Now let's take a look around and see if all looks well.

## Tour The New System Settings

Right-click on the "My Computer" icon. On the pop-up window, click on Properties. The System Properties window opens. Click on the Device Manager tab to see the list of system devices. Clicking on the "+" sign next to Display Adapters shows I have an

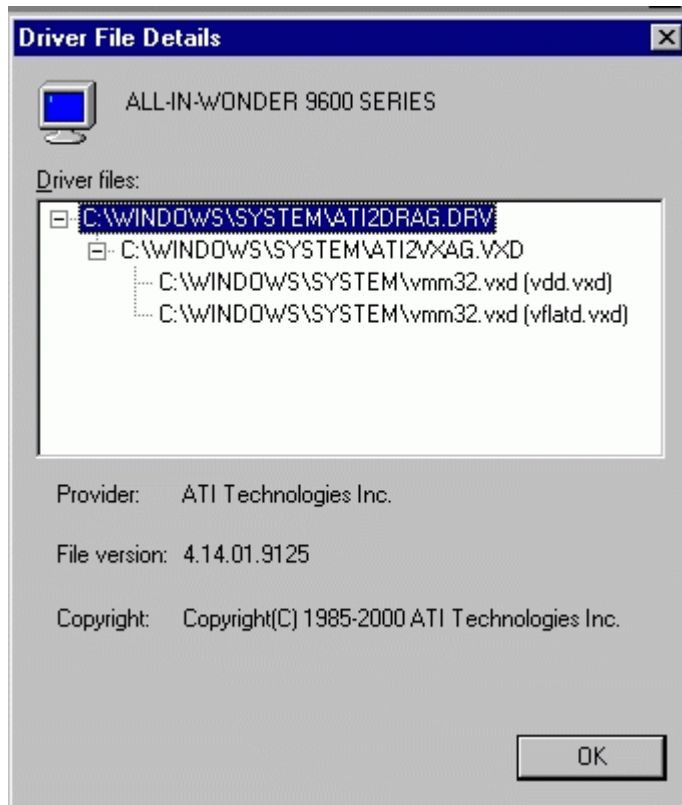
All-In-Wonder 9600 Series. Since the video card is the ATI All In Wonder 9600 Pro 128MB, that's exactly right. There are two entries shown because the ATI All In Wonder 9600 Pro is a dual monitor video card.



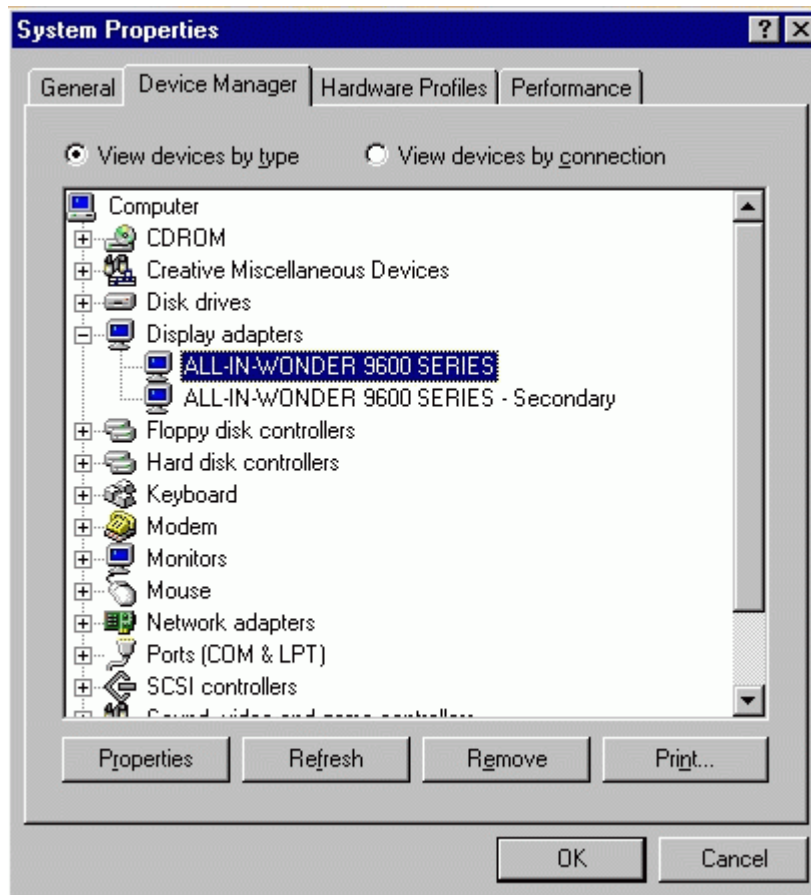
Right-clicking on the value shown under "Display Adapter", which is "ALL-IN-WONDER 9600 SERIES" now, brings up a pop-up window. Clicking on "Properties" in the pop-up window brings up this window.



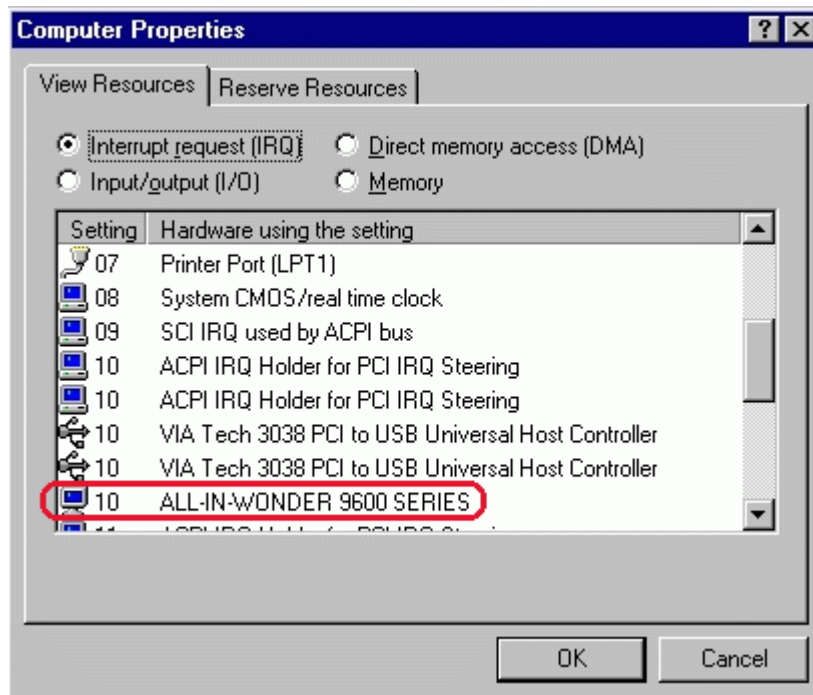
Clicking on the "Driver" tab and then clicking on the "Driver File Details" button shows which version of the ATI reference drivers are currently in use.



Clicking "OK" twice returns to the System Properties window as shown in this screenshot.



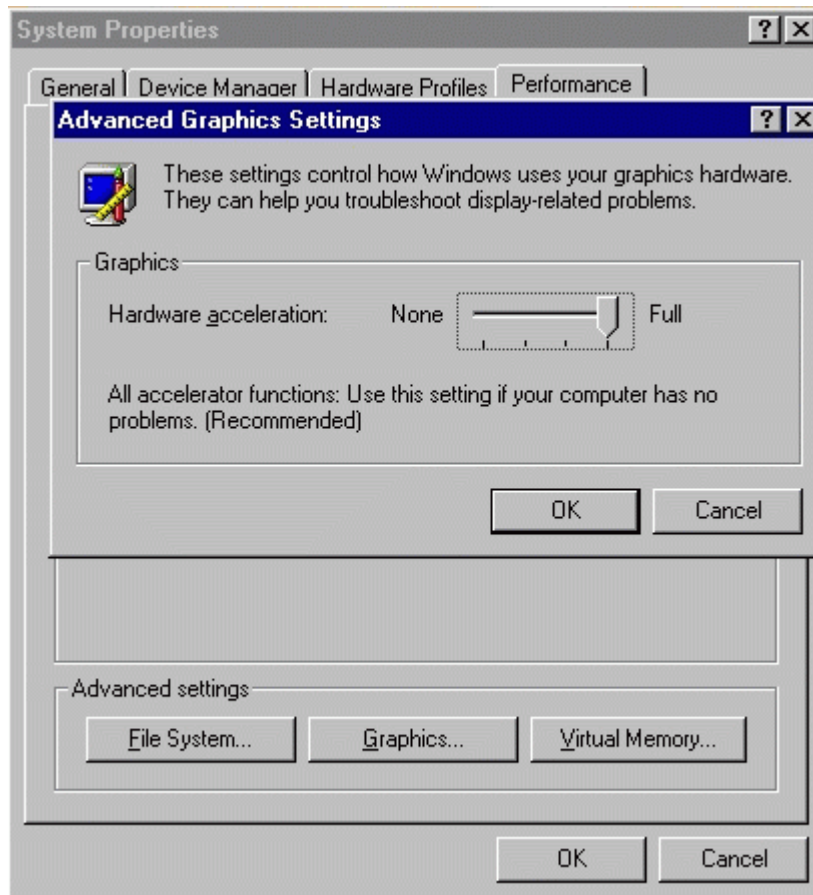
Right-click on "Computer" at the top of the window. A pop-up menu appears. Click on Properties in this menu to see the IRQ settings after the video card upgrade. The IRQ settings are shown. Scrolling down a little finds the IRQ for the video card at IRQ 10, same as it was before and still being shared with the same things as before. Ok, fine.



Click on the "Cancel" button and now select the "Performance" tab on the "System Properties" window to see the window change to look like this. On this window, push the "Graphics..." button.



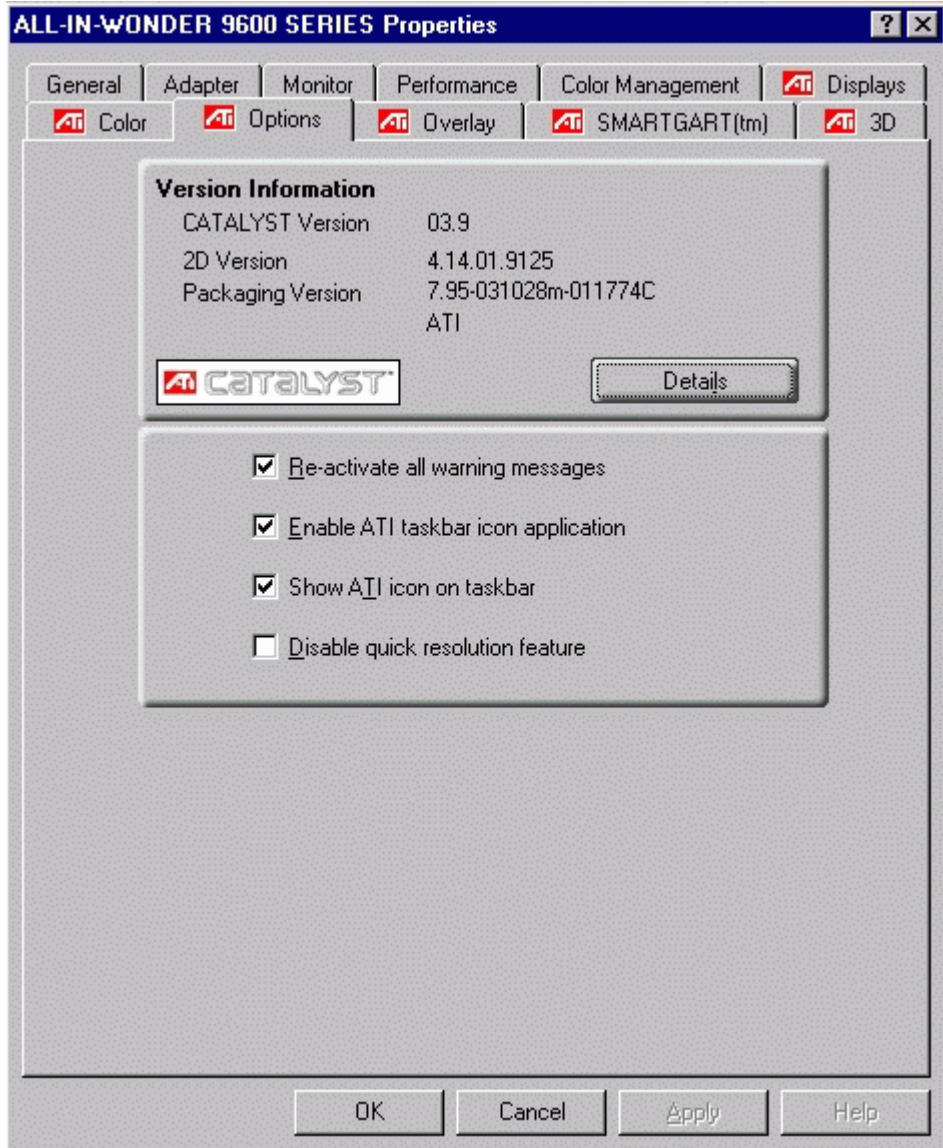
The "Advanced Graphics Settings" window appears. The slider next to "Hardware Acceleration:" should already be pushed to the far right "Full" setting. If it's not then you may want to carry-on and run the tests on the following pages while leaving it at whatever setting you have. If all the tests work then come back here and move the slider to "Full" and try the tests again.

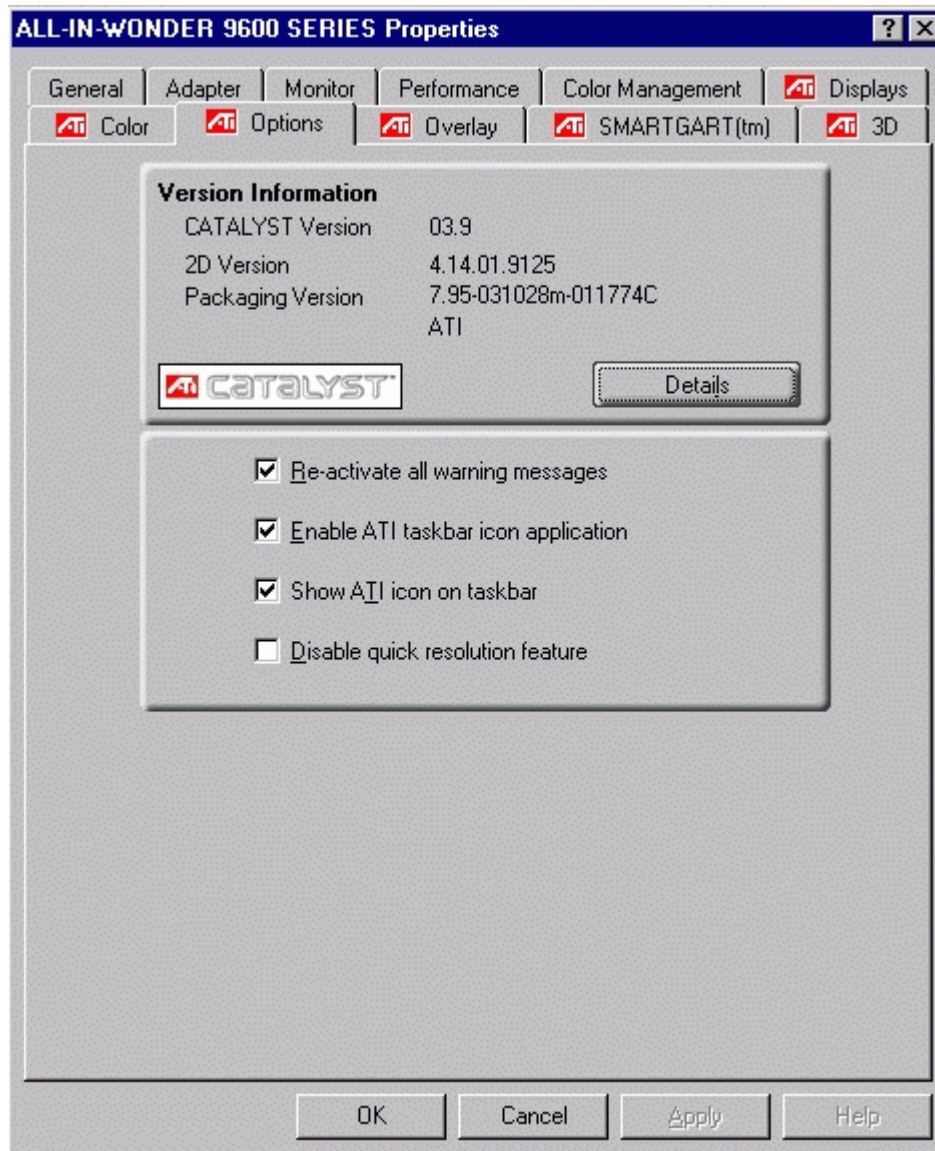


Clicking on "Ok" twice returns to the desktop.

## Control Panel Display Properties

Now let's verify the driver on the Control Panel. Click on Start, then Settings, then Control Panel. Double-click the Display icon. This brings up the Display Properties window. Click on the Settings tab. On the Settings tab, click on the Advanced button. For the new video card I have after the upgrade, this brings up the "ALL-IN-WONDER 9600 SERIES Properties" window. Clicking on the "Options" tab shows the information below. The sub-window titled "Version Information" shows I have CATALYST 3.9 drivers installed.





The Control Panel for an NVIDIA based card may look more like this example for a GeForce3 Ti 200 video card. The sub-window titled "Driver Version Information" shows the version number. In this example the NVIDIA driver version is 4.13.01.2183, which are the 21.83 drivers.


**NVIDIA GeForce3 Ti 200 Properties** [?] [X]

General | Adapter | Monitor | Performance | Color Management

GeForce3 Ti 200 | Device Selection | Color Correction

Display Adapter Information

Graphics Processor: GeForce3 Ti 200  
Bus Type: AGP  
BIOS Version: 3.20.00.26  
On-Board Memory: 128 MB  
IRQ: 10  
TV Encoder Type: Philips 7102



System Information

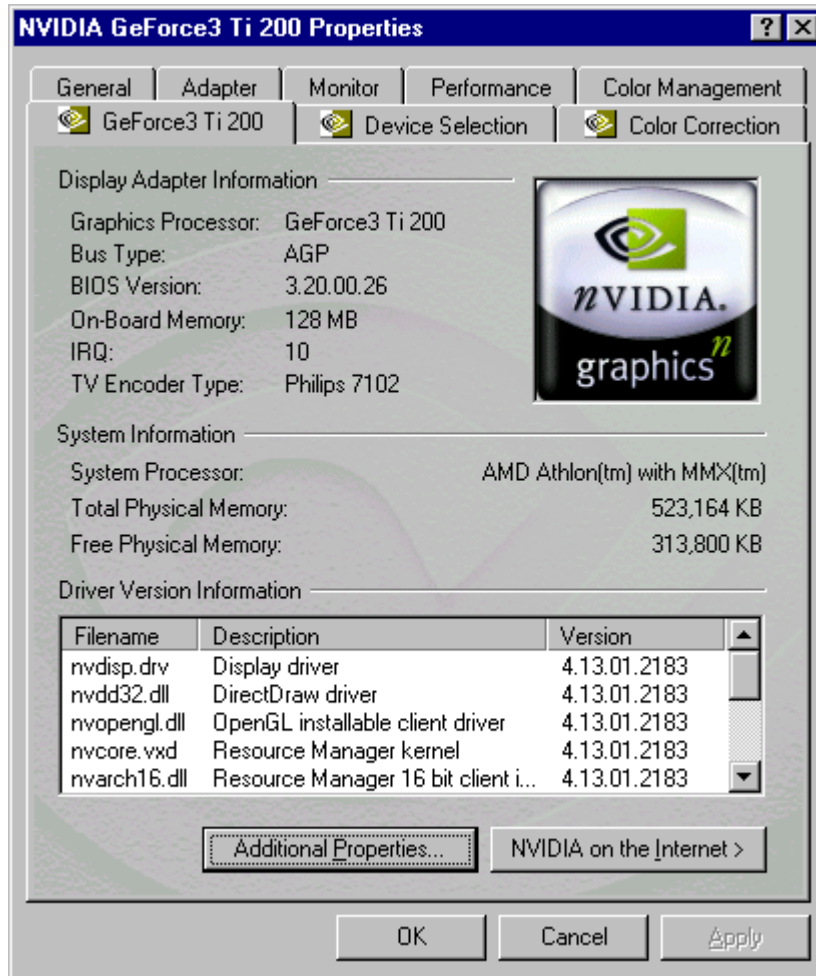
System Processor: AMD Athlon(tm) with MMX(tm)  
Total Physical Memory: 523,164 KB  
Free Physical Memory: 313,800 KB

Driver Version Information

Filename	Description	Version
nvdsp.drv	Display driver	4.13.01.2183
nvdd32.dll	DirectDraw driver	4.13.01.2183
nvopengl.dll	OpenGL installable client driver	4.13.01.2183
nvcore.vxd	Resource Manager kernel	4.13.01.2183
nvarch16.dll	Resource Manager 16 bit client i...	4.13.01.2183

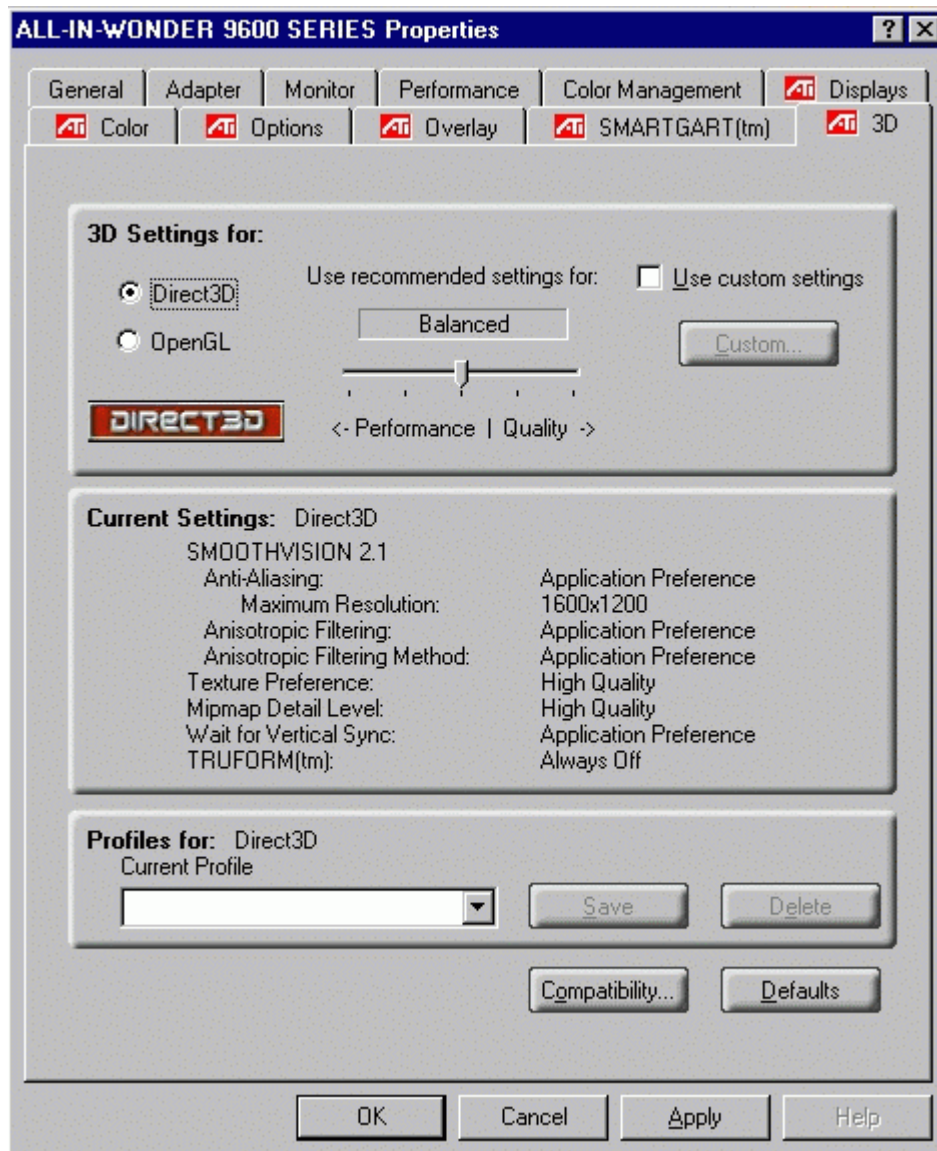
Additional Properties... | [NVIDIA on the Internet >](#)

OK | Cancel | Apply

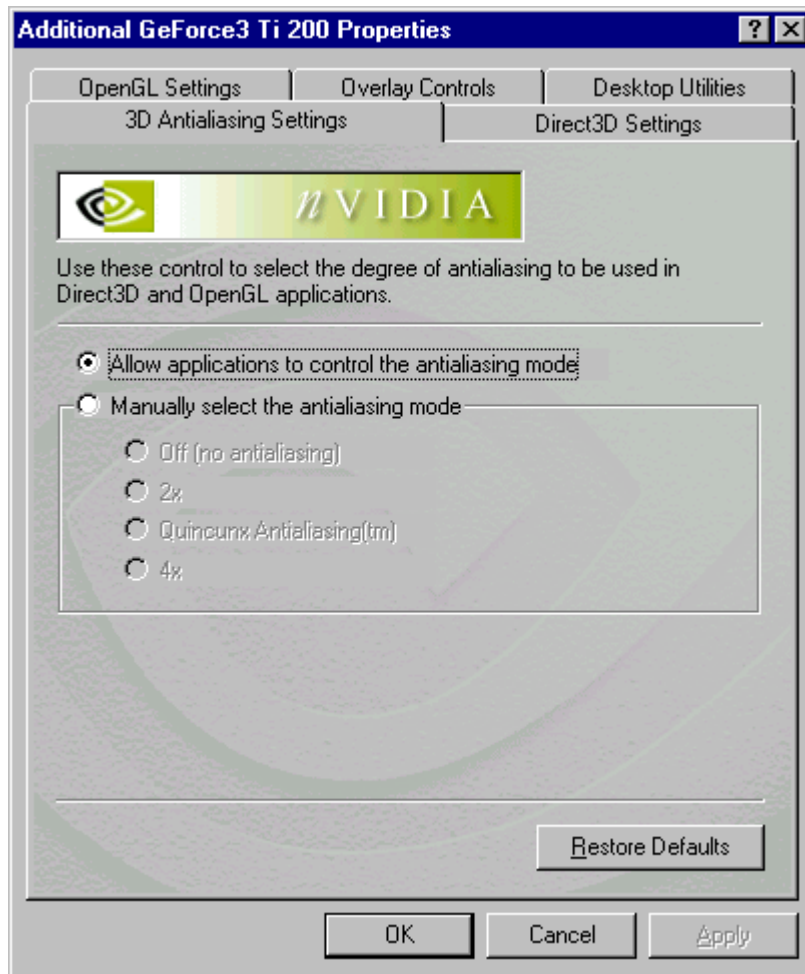


## Video Card Driver Settings

For the ATI based video card, clicking on the *3D* tab brings up the *Additional Properties* tab. This is where the video card settings controlling image quality and performance can be changed. It's fine to leave the values unchanged, as I did. They already provide a nice compromise between image quality and video card performance.

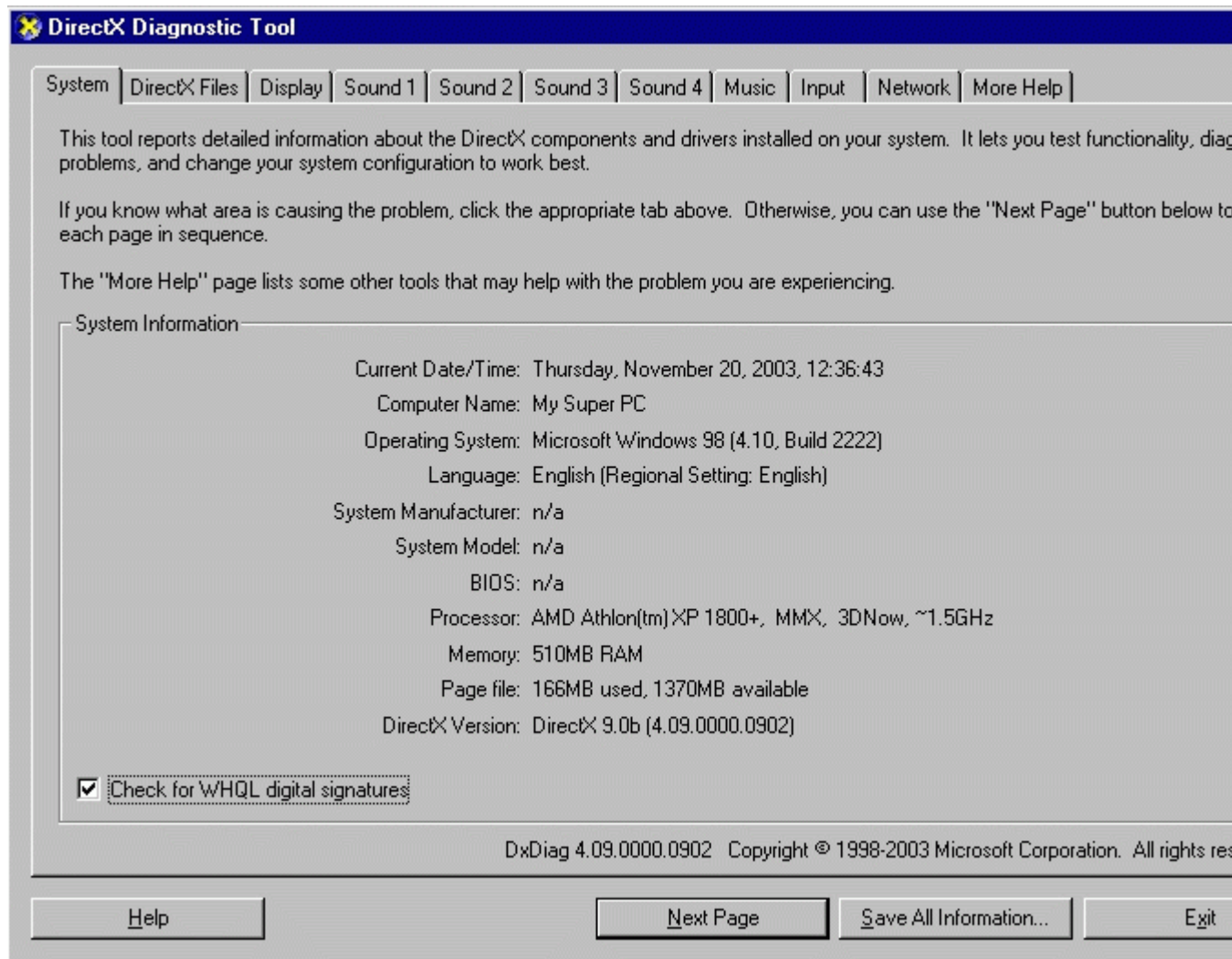


For NVIDIA based video cards, clicking on the *Additional Properties* button shown on the previous page brings up the *Additional Properties* tab like this example for the GeForce3 Ti 200. There are separate tabs to control settings having to do with image quality and video card performance. But again, it's fine to leave the values unchanged, as I did. They already provide a nice compromise between image quality and video card performance.

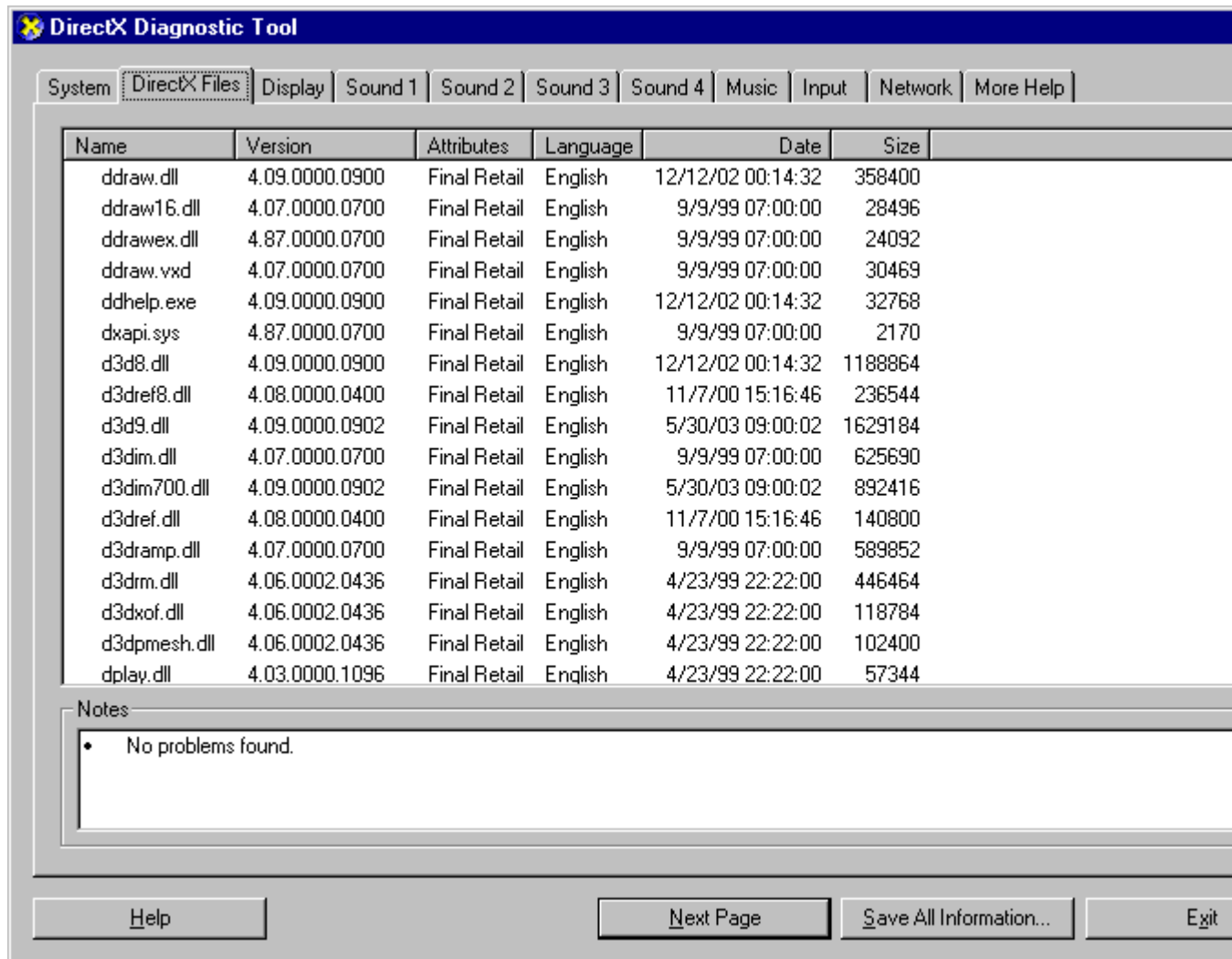


## Video Card Tests - DXDIAG - DirectX Diagnostics And Tests

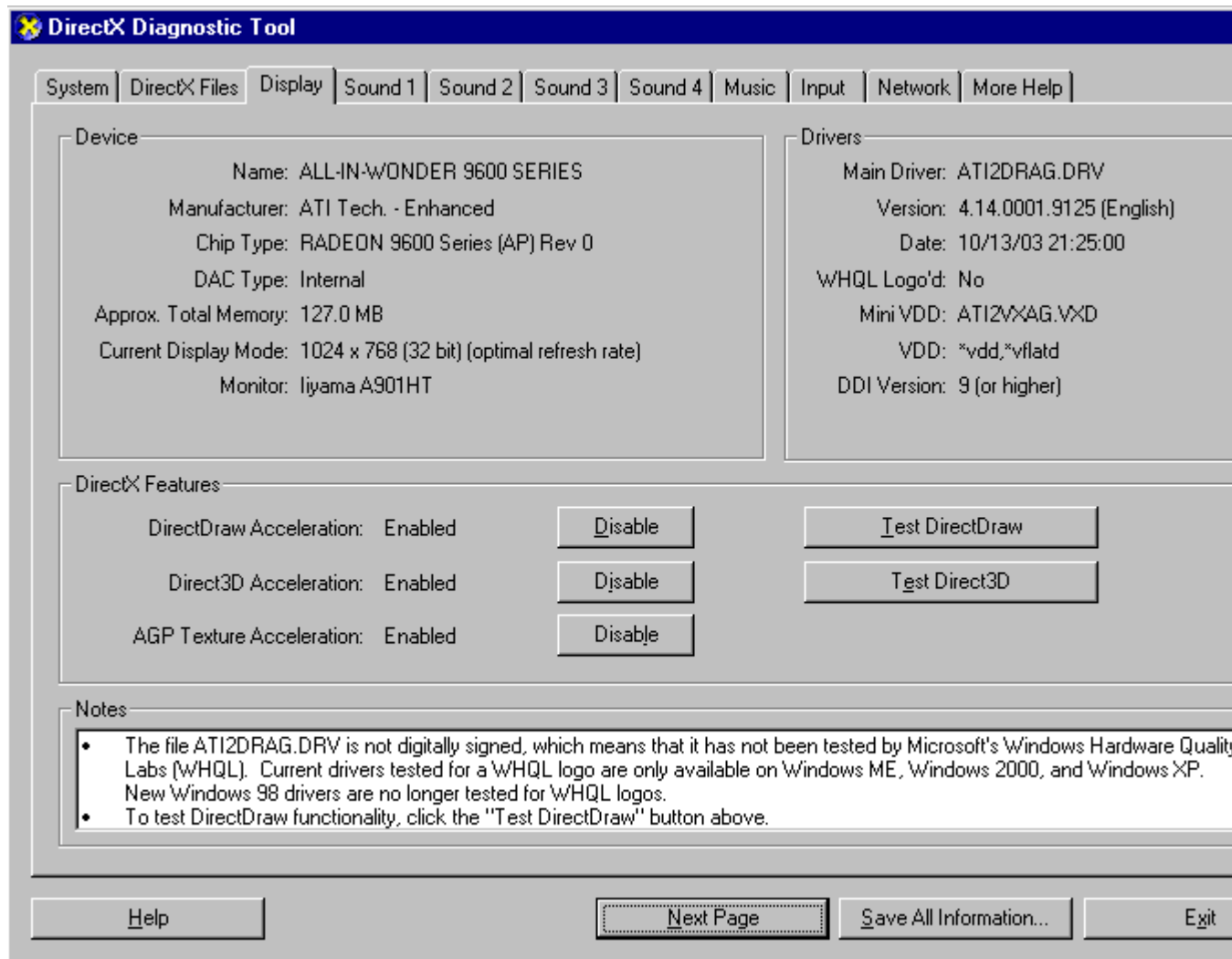
Now it's time to run some tests. Bring up DXDIAG. The *System* tab looks like this.



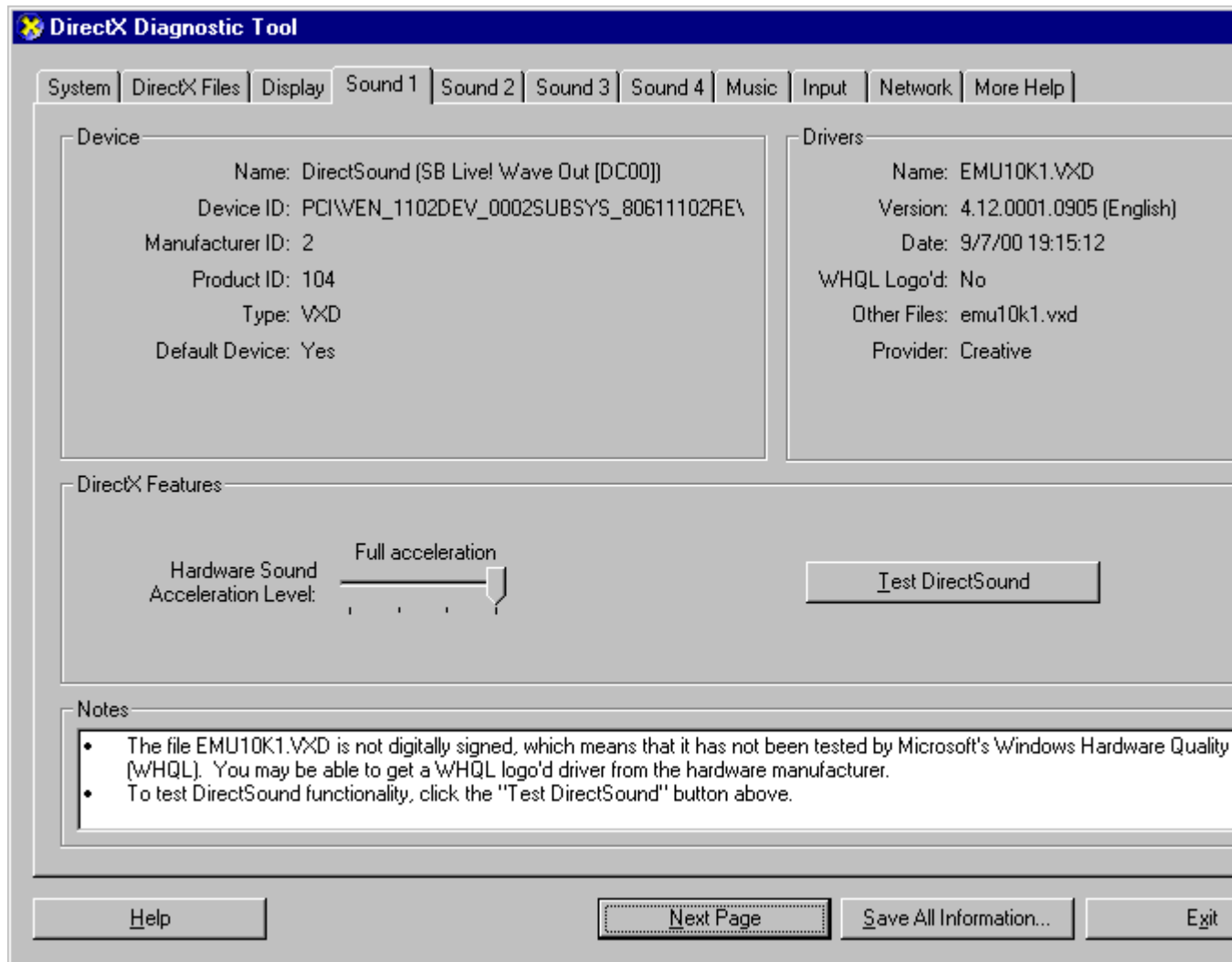
Click on the *DirectX Files* tab. The *Notes* pane at the bottom should look something like this indicating no problems.



Click on the *Display* tab. The middle pane labeled *DirectX Features* should show that DirectDraw Acceleration, Direct3D Acceleration and AGP Texture Acceleration are all Enabled. There are two tests that can be run on this tab, each with their own button in the middle pane. The buttons are labeled "Test DirectDraw" and "Test Direct3D". Run each test and verify you get the results described by DXDIAG. Notice the "Notes" pane is empty. The dxdiag file is not digitally signed. It's a non-issue.



Click on the *Sound 1* tab. The middle pane labeled *DirectX Features* should show that Hardware Sound Acceleration Level is set to Full Acceleration. There is one test that can be run under this tab, but the test has numerous parts to it. The test is run by pushing the button labeled "Test DirectSound" in the middle pane. Run the test and verify you get the results described by DXDIAG. Notice the "Notes" pane indicates a file is not digitally signed. It's a non-issue.



Continue in this manner with the rest of the Sound and Music tabs.

Clicking on the "Exit" button exits DXDIAG.

## Video Card Performance And Stress Testing - Benchmarks

The next test is to run the benchmarks downloaded free from Futuremark, namely 3DMark2001 Second Edition and 3DMark03. In addition to benchmarking performance, these demanding benchmarks are excellent for testing stability and for revealing graphics anomalies.

Performance is influenced by many factors besides the video card, the video card driver, and the video card driver settings. In my case, I'm using the ABIT KT7A

motherboard with 512MB PC133 CAS2 SDRAM and an Athlon XP 1800+. Other factors influencing performance include the BIOS settings and the version of the motherboard chipset drivers.

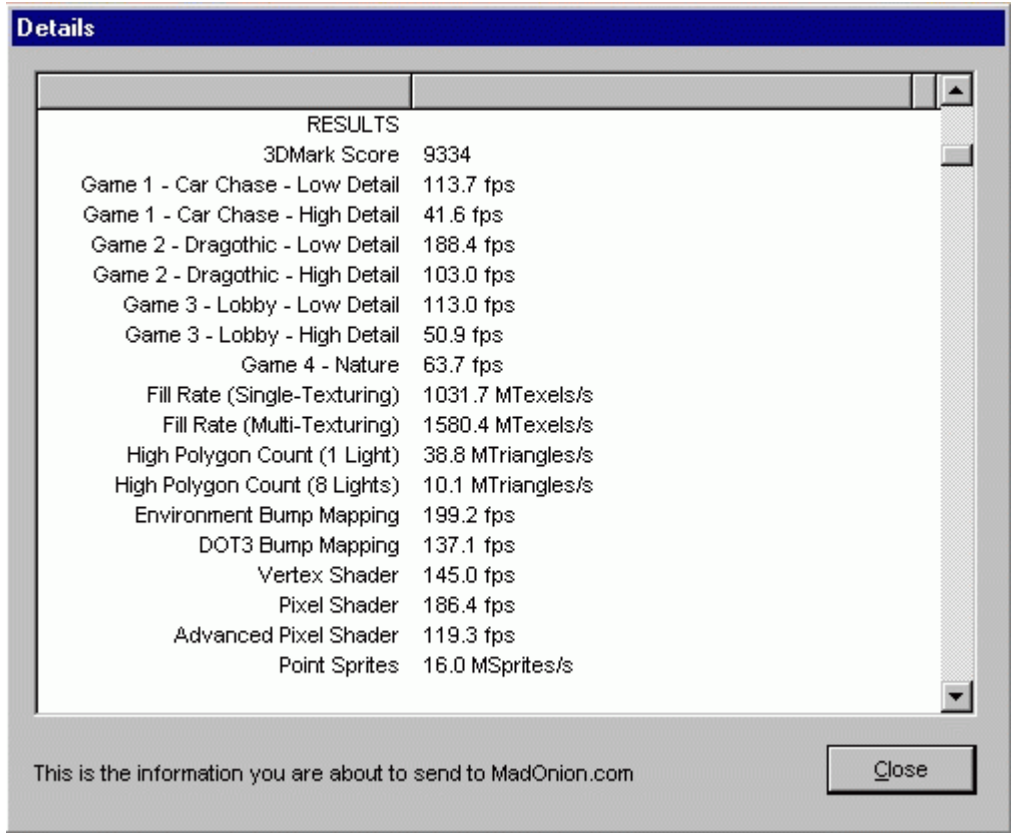
The benchmarks I used are Futuremark's 3DMark2001 Second Edition (build 330) and 3DMark03 (build 340). Keep in mind that the "Overall Score" values cannot be compared between 3DMark2001 and 3DMark03, they can only be compared to other 3DMark2001 or 3DMark03 scores, respectively. In any event, no two runs of a benchmarks will give identical results.

For each benchmark, run the Demo and perform the Benchmark. Observe them while they are running and check for anything unusual, such as cut images or pixel artifacts. If the computer locks up, that will be easy to see.

### 3DMark2001 Second Edition Overall Score



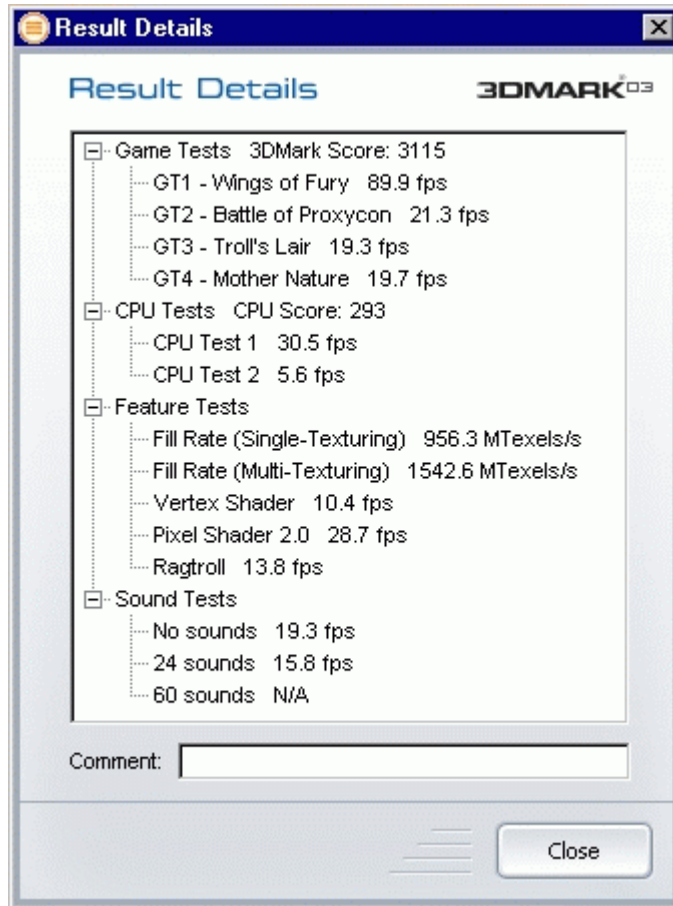
### 3DMark2001 Second Edition Frame Rates And Details



### 3DMark03 Overall Score



### 3DMark03 Frame Rates And Details



It takes at least 30 frames-per-second (fps) to have nice fluid movement. The rate of 30 fps must be maintained even under worst case conditions, such as when the screen is filled with moving objects and animations. It's therefore best to shoot for a higher value on benchmarks, such as 60 fps.

The computer configuration I have runs even the most demanding 3D applications and games smoothly. So I'm not surprised to see the results of the the 3DMark2001 SE which shows it surpasses the 60 fps mark on most tests. Each new edition of the Futuremark benchmarks raises the bar substantially, so it faired less well on the much more demanding 3DMark03 benchmark. That's nothing to worry about since the benchmarks are not meant to reflect real-world applications. But it is interesting and will no doubt give some motivation to pursuing even more powerful computer configurations in the future, one that emphasizes beefing up the processor and RAM bandwidth rather than the video card which is already quite powerful. The scores do look right for my computer configuration. In addition, the demos from both benchmarks ran smoothly and all tests completed successfully. All this gives a solid boost to the amount of confidence that can be taken in that the installation was done properly.

## Video Card Tests - Boot Problems

If all the tests done to this point with DXDIAG and the Futuremark benchmarks complete successfully then it's reasonable to conclude that the video card "works". However there are two boot tests you should do.

By this time, the computer should be physically warm. Shut down the computer. Wait for the fans to stop. Turn the computer back on again. The computer should boot normally. This test fails if the computer's internal speaker emits a "one long beep two short beeps" BIOS error code and the computer does not boot. This error code means the computer does not "see" the video card. See my Troubleshooting Video Card Problems for more information. If this occurs, the computer should boot after pressing the reset button.

The second boot test must be done when the computer is physically cold, say, after it's been sitting turned off for an hour or so. The test is the same. Turn the computer on and it should boot normally, or you may get the "video card not found" error. If the computer encounters the error then wait a few minutes for it to physically warm up and push the reset button. It should boot normally.

You may want to run your own favorite applications through their paces as a final verification that all is well.

## Troubleshooting Video Card Problems

For any NVIDIA video card question or problem, I suggest first hunting for it on the enormous [GeForce FAQ](#) page. It's very comprehensive and informative. Another excellent resource for NVIDIA based video cards is the [NVIDIA Frequently Asked Questions](#).

If the information I have here is insufficient for the problem you are experiencing then you can tap into a vast wealth of NVIDIA and ATI video card experts at the [Guru 3D Forums](#).

**Problem.** Just after turning on the computer, you get power and you can hear the fans but then these problem symptoms occur:

- The computer's internal speaker emits a "one long beep two short beeps" error code.
- The monitor is blank and the monitor indicator is orange or blinking orange.
- Nothing further appears to be happening. The computer just sits there.

This means that the computer does not "see" the new video card. This either means the video card is not installed properly or you have what I call the "video card boot problem".

If the computer never sees the video card, not when it is physically cold, not when it is physically warm, not when you first power on, not if you hit the reset button - never - then the video card is not installed properly. Reinstall the video card.

If the computer some times sees the video card but not always then you have the "video card boot problem". The "video card boot problem" should be consistent in one of two ways. The "warm video card boot problem" is when the computer consistently does not see the video card after the computer has become physically warm, but the computer always sees the video card when the computer is reset. The "cold video card boot problem" is when the computer consistently does not see the video card when the computer has cooled down, but the computer always sees the video card after the computer has warmed up by waiting five minutes or so and then pressing the reset button.

The "cold video card boot problem" is more common than the latter, but the fix for either one is the same. From my observation, the GeForce2 GTS video card is the type of card most frequently involved, but it has been known to happen with other video cards as well. The number of possible solutions is almost infinite, from changing BIOS settings to upgrading the power supply. The solution I recommend is to get a new video card, preferably an upgrade from the video card giving the trouble, but at least a different make of the same video card. It's also agreeable with some to just live with the problem, especially the "warm video card boot problem", since the computer boots on reset and occurs infrequently.

**Problem.** After the new video card and drivers are installed, the computer locks up running a test such as one of the Futuremark benchmarks. If this is happening when the video card is overclocked then use the default clock values. The number of possible solutions is almost infinite, from changing BIOS settings to installing new video drivers. The best bet is to try different video card drivers. Use GoBack to restore your hard drive to the time prior to any drivers being installed, swapping out the new video card and re-inserting the old video card if necessary. If the video card still locks up then I suggest returning the video card and getting a different make. See also:

[GeForce FAQ: My GeForce keeps on locking up or drops me back to the desktop during 3D applications. How can I fix it?](#)

[My system keeps crashing/locking up. How do I fix this?](#)

**Problem.** Artifacts are evident. For example, black text on a white screen can show some number of scattered black pixels that come and go as the screen is refreshed by scrolling up and down. This is a sign of overheating. Your computer should have an intake case fan and an exhaust case fan. If it does and the problem still occurs then is the video card being overclocked? If it is then use the default clock values. If the video card is not being overclocked then either add more cooling, such as a slot fan,

or return the video card and get a different make.

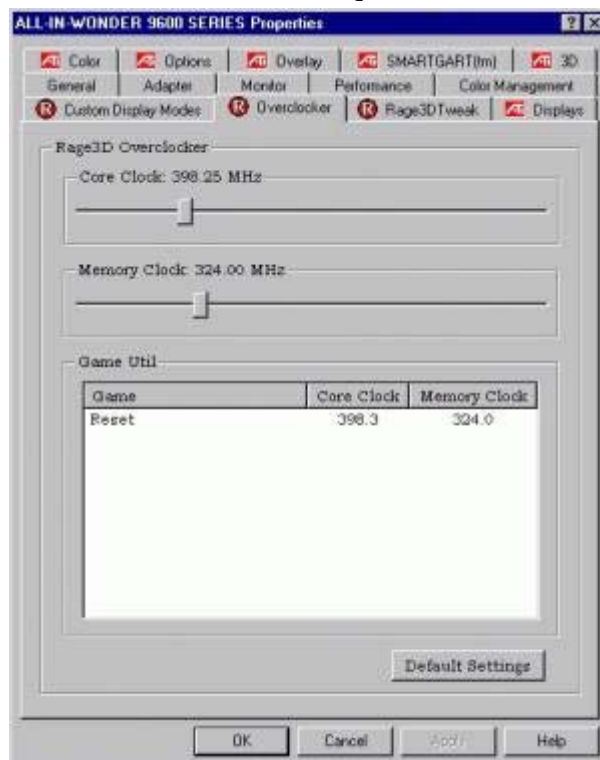
**Problem.** Under DXDIAG, on the Display tab, the tests run by pressing the "Test Direct3D" button do not all pass successfully. Try this: Run DXDIAG. Go to the Display tab. Click the "Disable" button for "Direct3D Acceleration". Exit DXDIAG. Rerun DXDIAG. Go to the Display tab. Click the "Enable" button for "Direct3D Acceleration". Retry running the Direct3D tests.

## Video Card Overclocking

For ATI based cards, it's possible to overclock the video card after installing a utility like Rage 3D Tweak. You can [download Rage 3D Tweak](#) from DriverHeaven.

After installing Rage 3D Tweak, additional tabs are available under Display Properties called *Custom Display Modes*, *Overclocker*, and *Rage 3D Tweak*. The *Overclocker* tabs allows the Core Clock Frequency and the Memory Clock Frequency of the video card to be changed from their default values. It looks something like this.

ATI Clock Frequencies



For NVIDIA based cards, it's possible to overclock the video card after using a utility called Coolbits. Coolbits is a very small utility to download and only needs to be executed once. For more information and a copy of Coolbits, see this article on [nVidia Video Card Overclocking with Coolbits](#).

Executing Coolbits allows access to an additional tab under Display Properties called *Clock Frequencies* that allow the Core Clock Frequency and the Memory Clock Frequency of the video card to be changed from their default values. Here's an example from a GeForce3 Ti 200 video card.

### NVIDIA Clock Frequencies



But what values should be used? There's no "safe" or "recommended" overclocking values and some people will push these settings as far as they can just to see how high a benchmark score they can reach. It's true that overclocking the graphics card is an effective way to increase overall system performance since it's the bottleneck (assuming you are doing graphics intensive operations, like most games), but if you push it too far then you will start to get graphics anomalies, such as shimmering pixels or artifacts - or maybe worse things can happen.

If you decide to modify these values then advance them slowly and test thoroughly as you go.

## Tweaking Video Card Driver Settings

Video card settings often involve a trade-off between performance and quality. Here are the video card settings which have the greatest impact on these two areas. Those with high-powered systems can get away with using the quality value for many or all of these settings and gameplay will remain smooth and responsive, even at higher resolutions. Those with lower powered systems may still enjoy smooth and responsive gameplay by giving up some image quality and by using a lower screen resolution.

Of course, altering these setting may reduce your benchmark scores. But that's fine. In fact, the point of having a high-powered system is not to generate 120 frames-per-second at average detail when you're eye cannot distinguish more than 60 frames-per-

second, and your monitor is set to say, 85 Hz, so it's only changing the screen 85 times per second in any event. No. The point of having a high-powered system is so you can have it all - the highly detailed, highly responsive, fully immersive, computing experience.

Note that it's possible that settings changes that "improve quality" may not yield pleasing results to you in general or in every game/application.

Depending on what you have used in order to be able to tweak the video card driver settings, the setting name you see may not have exactly the name shown in italics. But it probably does and, even if it doesn't, it should be close enough to tell it's the same.

A setting with a value of "By Application" or "Application Preference" allows the setting to be configured by the application, including being disabled altogether. The application/game itself often has an options page where video card driver settings can be tweaked just for the duration of the application/game.

To gain complete access to all of the video card driver settings, a utility is needed. For ATI based cards, the Rage 3D Tweak utility used on the video card overclocking page to gain access to the overclocking settings also adds a tab to the Control Panel called "Rage3D Tweak" to allow changes to the video card driver settings. For NVIDIA based cards, the utility of choice is Rivatuner. [Download Rivatuner here.](#)

## **Tweaks For Settings Common To Both Direct3D and OpenGL**

*# of Samples* - This setting controls FSAA (Full Scene Anti-Aliasing). It can significantly improve image quality by smoothing out angled edges, but is a significant performance hit. Values can be "Application Preference", "2 Samples" and on up. The higher the number, the better the image quality and the greater the performance hit. It's worthwhile using as high a value as performance will allow, but it's an easy quality improvement to give up to gain performance.

*FSAA Mode* - If a value is entered for the setting *# of Samples* (meaning it's not left as "Application Preference") then change this setting to a corresponding value, such as "Quality" or "Always On".

*Anisotropic Filtering* - This improves the quality and detail of textures as they extend from the viewer, such as improving how smoothly the ground surface detail transitions as the view recedes. Values can be "By Application", "2:1 Forced" on up to "16:1 Forced". The bigger the number, the greater the improvement. But it's a big hit to performance. While the improvement in quality is perceptible, it's an easy quality improvement to give up to gain performance.

*Anisotropic Mode* - Used in conjunction with Anisotropic Filtering. The values are Bilinear (Performance) and Trilinear (Quality). Trilinear should be used if it does make an improvement in the quality but the performance hit is small.

*Mipmap Detail Level* - This controls the level of detail used for textures. It can significantly improve the quality of the entire scene, but with a cost in performance.

It's worthwhile setting this to High Quality if your system can bear the performance penalty

*TRUFORM* - Should be set to "Application Preference" to improve quality without a significant hit to performance.

*Wait for VSync* - Setting this to "Application Preference" allows the application to treat this setting as enabled so it can match the rate at which scenes are being generated to the refresh rate of the monitor, improving quality. This is what most applications will do. But it also allows the application to generate the frame rates as fast as possible, even faster than the monitor refresh rate which is wasteful in the sense that the scene is rendered but never actually displayed on the monitor. Unless you're benchmarking, it's best to set this to "Always On" to improve quality and just change it to "Always Off" when you're benchmarking. A setting of "Always On" is also best for controller responsiveness since it helps keep the application from wasting computer power on needless scene processing.

### **Tweaks For Direct3D Only Settings**

*Bump Mapping* - Enabling this option makes a noticeable improvement in the amount of detail to objects, such as the surface of a wall. The impact to performance is measurable, so it should be set to disabled if needed to gain performance.

*Guard Band Clipping* - This value should be set to enabled for optimal performance with no loss in quality - probably. If display errors are observed the set this to disabled.

*Colorfill* - Setting this to enabled can make the display appear more vibrant with no loss of performance. But if you don't like what it does for the display then set it to disabled.

### **Tweaks For OpenGL Only Settings**

*3DNow!* - Should be enabled for systems using AMD processors to improve performance with no loss of quality.

*SSE* - This option should be enabled to improve performance with no loss of quality for systems with processors that support the Intel SSE instructions, such as the AMD Athlon XP, Pentium III and Intel IV. It should be disabled for other AMD processors and the Pentium II.

*SSE2* - This option should be enabled to improve performance with no loss of quality for systems with processors that support the Intel SSE2 instructions, such as the Pentium IV. It should be disabled for other processors.

*Texture Compression* - Should be set to enabled to improve performance with minimal impact to quality.

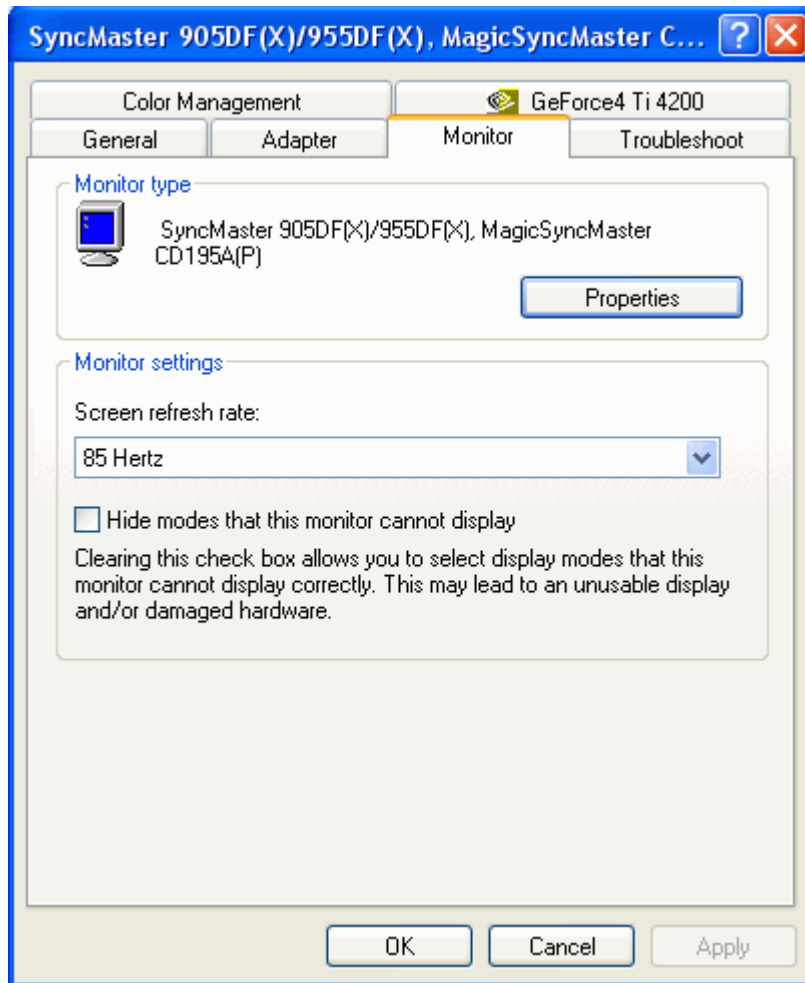
## Windows 2000/XP Monitor Refresh Rate Problem

This topic on this page is not strictly speaking a video card upgrade issue, but it does affect display quality.

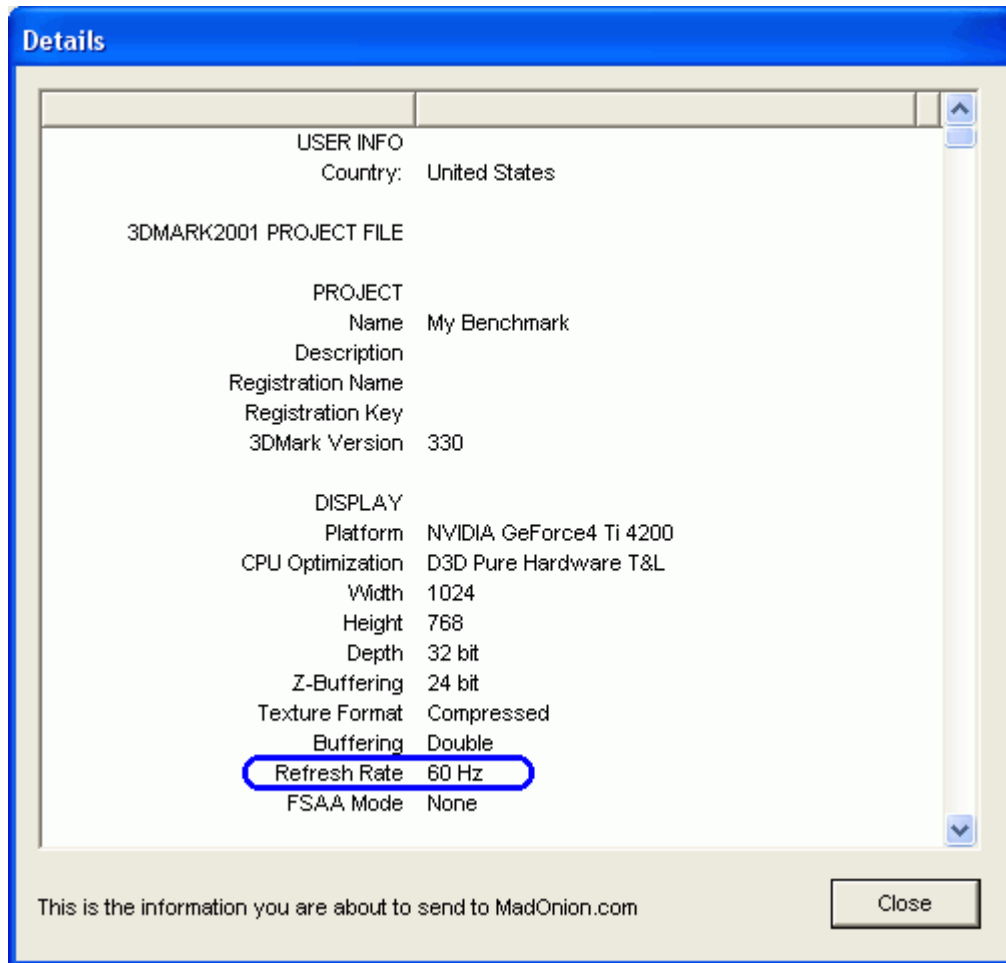
If you are running Windows 2000/XP then you probably have the "Refresh Rate" problem. This problem is that you cannot really change the Hz setting that controls the rate at which the monitor is refreshed. Regardless of how the setting is change, a refresh rate of 60Hz, which updates the screen 60 times per second, is used. This is the bare minimum refresh rate and it is unacceptably slow for many people. A refresh rate that is too slow may be perceived as a screen which is jittery or faintly flickering. It can best be seen on a screen that is mostly white. However, two people can look at the same screen with a setting such as 60Hz and one can find it pleasing and the other find it disturbing. Not all eyes are the same. But even if it's not plainly obvious that the screen is not steady, a slow refresh rate can cause headaches and eye strain.

All that said, if you're perfectly happy with how the screen looks then there's no need to go any further on this page. Of course, if more than just you is using the computer or may use the computer then you may want to continue even if you are satisfied.

The Refresh Frequency is accessed by clicking on Start, then Settings, then Control Panel, and then double-clicking the Display icon to bring up the Display Properties window. Click on the "Settings" tab and then push the "Advanced" button which brings up the Properties page for your particular video card and monitor. Click on the "Monitor" tab and you will see something like this. Notice I have the Refresh Frequency set to 85 Hertz. And this value will remain unchanged after a re-boot. But the computer is actually using a Refresh Frequency of 60 Hertz.

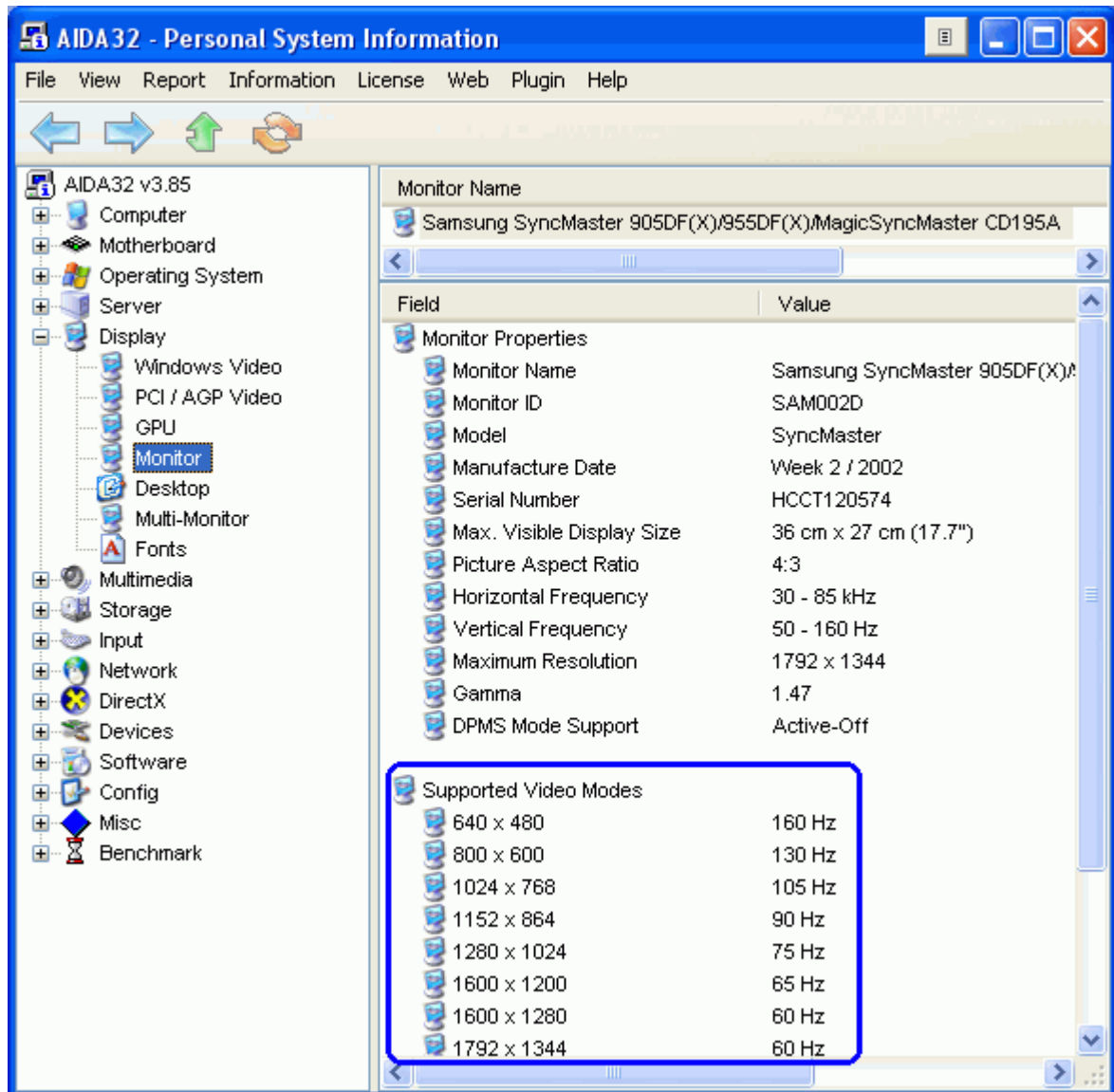


Here's one way to tell that the computer is really using a Refresh Frequency of 60 Hertz. Run the 3DMark2001 Second Edition benchmark I mention on the Benchmarks page. After the test completes, the benchmark displays the overall score. On this screen, push the "Show Details" button. Scroll down a bit and here's an example of what you might see. I've circled what's shown for Refresh Rate in blue.

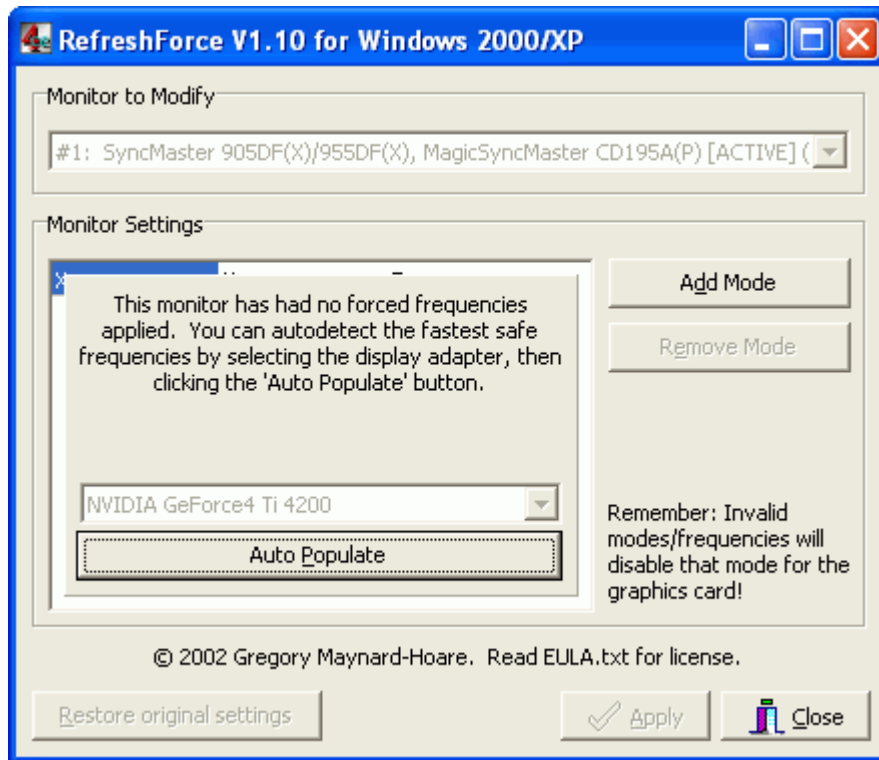


So there's proof that the problem exists. It's very common, but the fix is easy and, best of all, the fix is free. There is a freeware utility called RefreshForce which can be used to cleanly fix the problem. [Download RefreshForce from here](#) and install it.

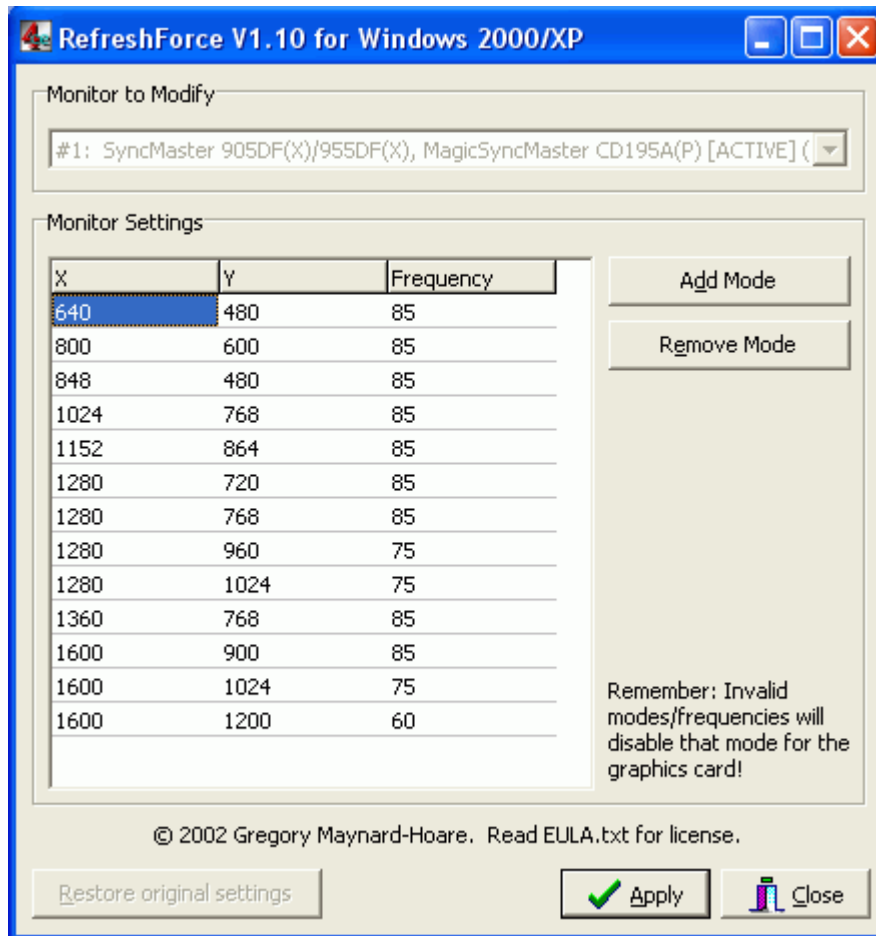
The System Information utility AIDA32 that I mention on the [AGP/Motherboard Chipset](#) page will tell you the maximum refresh rates available to your computer at various resolutions. Execute AIDA32, then click on Display and then click on Monitor. As an example, my results are circled in blue.



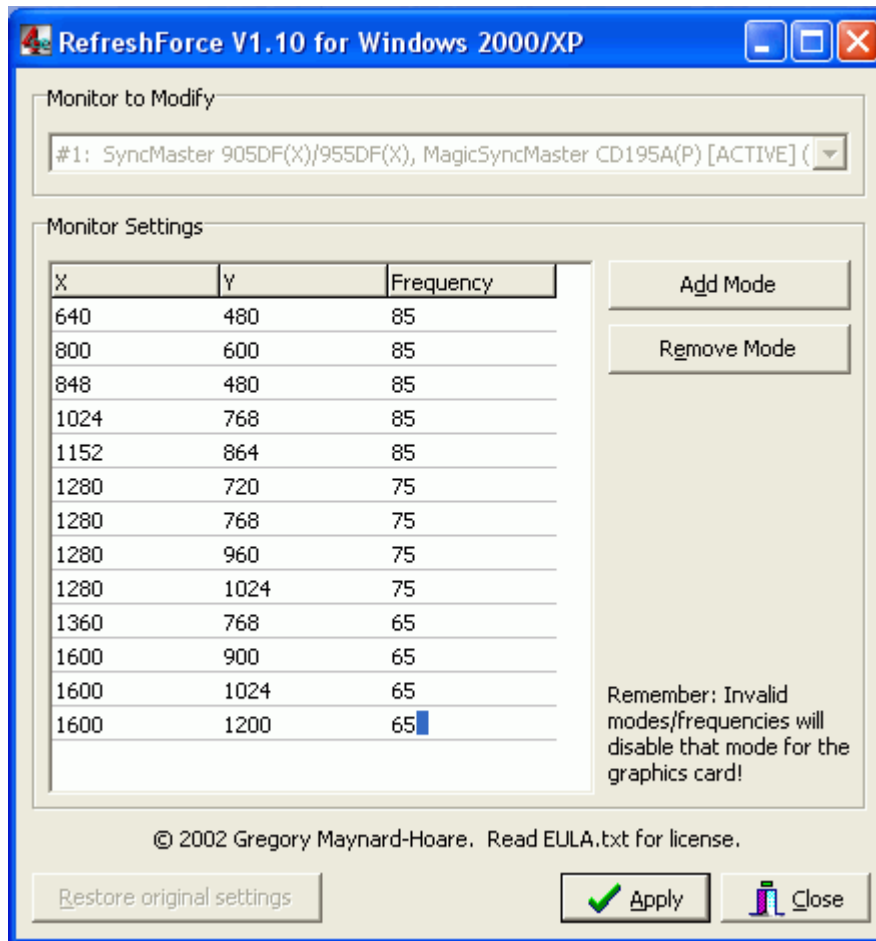
RefreshForce can set the Refresh Frequency for each screen resolution to the setting you prefer. It only needs to be executed once and not re-executed after each boot. The vast majority of computer users never change their Refresh Frequency again once they have it set to the value they prefer. Although a value of 60 Hertz is quite common, many people prefer either 75 Hertz or 85 Hertz. It's fine to use the higher values as long as it's a value supported by your video card and monitor. Here is the RefreshForce startup screen.



Click on "Auto Populate". The window changes to look something like this:



Change the Refresh Frequency of the resolutions to the value you prefer. Do not choose a setting which is higher than that supported for your configuration. Here are the values I entered. Obviously I prefer 85 Hertz, but notice I didn't exceed the maximum values reported by AIDA32. Once the values are entered, push the "Apply" button, confirm the changes and exit RefreshForce. Re-boot the computer to put the changes into effect.



On performing the 3DMark2001 Second Edition benchmark again, the "Show Details" button now gives these results. Notice the Refresh Rate is now using the "Default" value which has been set for the Refresh Frequency for the current screen resolution.

## Details

### USER INFO

Country: United States

### 3DMARK2001 PROJECT FILE

#### PROJECT

Name My Benchmark

Description

Registration Name

Registration Key

3DMark Version 330

#### DISPLAY

Platform NVIDIA GeForce4 Ti 4200

CPU Optimization D3D Pure Hardware T&L

Width 1024

Height 768

Depth 32 bit

Z-Buffering 24 bit

Texture Format Compressed

Buffering Double

Refresh Rate Default

FSAA Mode None

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