



PC-IG User Guide

Operating and Using your AAIchemy™ PC Image Generator (PC-IG)

Part Number: 700-0842-01

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Regulatory Approvals

EMI: FCC Class A, CE Class A, & ETL.

Note

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Warnings

Changes or modifications to this device that are not approved by the party responsible for compliance could void the user's authority to operate the equipment.

To reduce the risk of electrical shock, do not attempt to open the device unless instructed to do so. Do not use any tool for purposes other than instructed.

A Lithium Ion battery is included with the AAIchemy system motherboard. This battery is used for the Real Time Clock circuit. The expected lifetime of the battery is approximately 5 years. There is a danger of explosion if this battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the motherboard manufacturer. Dispose of used batteries according to the manufacturer's instructions.

There are no user-serviceable parts in the power supply. Refer all servicing of the power supply to qualified service personnel.



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Introduction

This introductory chapter describes the conventions used within this document and an overview of the AAIchemy™ PC-IG system.

Also discussed is the way in which users can contact Quantum3D technical support and access the online problem reporting and tracking system.

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Documentation Conventions

Icons



- The information icon is used to annotate important information.



- The exclamation icon is used to annotate cautionary information.

Fonts

- The ***bold-italics*** font type denotes menus or buttons.
- The **bold-underlined** font type denotes important files.

AAIchemy PC-IG System Overview

AAIchemy™ is a PC-based realtime image generator (PC-IG) that is designed and manufactured by Quantum3D™. AAIchemy includes a 4U 19" rack-mountable PC subsystem with one or two AA5™ high-performance realtime 3D graphics channels. The AA5 is also designed and manufactured by Quantum3D. All AAIchemy PC-IG systems include a Heavy Metal™ 2 (HM2) chassis manufactured by Quantum3D.

The AA5 graphics subsystem utilizes the 3dfx® VSA-100 graphics chipset and delivers hardware-implemented full-scene anti-aliasing with industry-leading 3D graphics performance. The AA5 graphics subsystem is configured either as a single PCI board with eight VSA-100 chips, as two interconnected PCI boards with a total of sixteen VSA-100 chips, or as two independent PCI boards (unconnected) with eight VSA-100 chips on each board.

AAIchemy provides 3D rendering of complex synthetic environments at realtime frame rates (e.g. 60 Hz) without any distracting visual artifacts. AAIchemy also supports Quantum3D's SwapLock™ channel synchronization technologies for multi-channel, wide field-of-view applications. AAIchemy also supports optional QSync™, which – combined with SwapLock – provides Genlock and swapbuffer synchronization for double-buffered applications.

Simulation Scene Managers that Support AAIchemy

The following Scene Manager software runs on AAIchemy PC-IGs. Contact your software provider(s) for specific information on running their applications on AAIchemy. If you wish to use a software product not listed here, please contact that provider with regard to their support for the AAIchemy PC-IG.

- X-IG; Carmel Applied Technology
- Vtree, Mantis; CG2
- SE/View; Lockheed Martin
- VegaNT; MultiGen-Paradigm
- OpenGVS; Quantum3D
- SoftVR; Soft Reality
- SPACE Magic; Thales Training and Simulation



Supported Rendering APIs

- ❑ **3dfx Glide**
Glide is the native rendering API for 3dfx chips. Software providers or integrators wishing to port applications to Glide should contact Quantum3D developer support via the Quantum3D website (www.quantum3d.com/support).
- ❑ **Quantum3D SimGL**
SimGL™⁽¹⁾ is an API developed specifically for simulation applications. It enables most applications written for OTW-type simulation in OpenGL® 1.2 to run on Direct3D or Glide Hardware, such as AAIchemy. In fact, many of the simulation scene managers listed above utilize SimGL to run on AAIchemy.

Contacting Quantum3D Technical Support

Quantum3D technical support provides a web based online problem tracking and reporting system. Please remember that hardware products – and some software products – are only covered during their warranty period (or maintenance period in the case of software, such as OpenGVS). You may want to review the warranty documentation that accompanied your system and be prepared to provide proof of warranty coverage to Quantum3D upon request.

Any Quantum3D customers or authorized representatives may visit our online support system at:

<http://www.quantum3d.com/support>

This web location contains a link to our online problem reporting and tracking system. This system allows you to create your own customer account(s) as well as create and manage support-related incidents online.

Obtaining the Most Current Version of this Manual

The most current version of this manual is available from the Quantum3D support website at:

<http://www.quantum3d.com/support>

¹ This product is based on the published OpenGL® API, but is not an implementation that is certified or licensed by Silicon Graphics Inc. under the OpenGL API.



Setting Up and Maintaining the Hardware

Follow the instructions in this chapter to set up and maintain your AAIchemy PC-IG hardware.

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Inspect the Shipment

AAIchemy PC-IG systems are packaged to withstand the roughest of treatment during shipping. The box, foam core padding, and anti-static bag should be stored safely away in case you need to ship the system for any reason in the future. Inspect the cardboard box the system arrived in. If there is any unusual damage to the box, make note of the damage on the delivery form and contact Quantum3D support (www.quantum3d.com/support).

Unpacking the System



An AAIchemy PC-IG system weighs approximately 60 lbs (including the packaging). If you are unable to lift this weight safely, you should obtain assistance in unpacking and moving the system.

Open the Box

Carefully cut the tape on top of the large cardboard box and open the box.

Remove the Accessory Box

The accessory box is a thin box packed on top of the computer system within the large box. Remove this box and set it aside.

Remove the Computer System

Clear a large area on a desk or table on which to place the computer system. You can also place the computer temporarily on the floor. Remove the top portion of foam protecting the computer system. Have two people lift the unit (one on each side). Keeping your back straight, bending at the knees and using your legs as much as possible, place each of your hands directly on the ends of the computer system, take the system out of the box and place it on the cleared area. Remove the plastic static/dust guard from the system and place it back in the box, along with the top foam insert.

Open the Accessory Box

Carefully cut the tape that holds the accessory box closed and open the box.

Locate the Packing List and Confirm Contents

Confirm the contents of the accessory Box and ensure that each part is free of damage. The accessory box for a typical AAIchemy PC-IG system configuration will contain the following items:

- Windows 2000 license and CDROM (Windows NT optional).
- Boot floppy labeled "AAIchemy SX Boot Disk" (DO NOT LOSE OR MODIFY THIS DISK).
- Pentium® III processor certificate of authenticity.
- Disk drive installation and reference manual
- Removable drive enclosure user's guide.
- Power Cable.
- Two shielded RJ45-to-RJ45 CAT5 cables for SwapLock multi-channel synchronization.
- Keys and screwdriver.
- Keyboard and mouse (optional).

After you have removed, inspected, and confirmed these contents, place the empty accessory box back in the main shipping box. The shipping box and associated materials are specifically designed for shipping AAIchemy PC-IG systems and should be retained for future use.

AAIchemy Configurations

All Configurations

All AAIchemy PC-IG systems come equipped with the following key features:

- ❑ Dual-processor Pentium III CPUs.
- ❑ 133 MHz host processor bus.
- ❑ Up to 4 GB system RAM (PC133 ECC SDRAM). Base configuration is 256 MB.
- ❑ ATA-100 EIDE disk subsystem standard (Ultrawide SCSI III option).
- ❑ Dual PCI busses (six PCI slots).
- ❑ AGP Pro slot with AGP NVIDIA 2D graphics subsystem (3D graphics option is available).
- ❑ At least one network interconnection card (NIC) – see the Master and Channel Configurations below for more details.
- ❑ Integrated Sound Blaster®-compatible audio.

Master Configurations

An AAIchemy PC-IG master system configuration is used to run a simulation and control a distributed simulation environment. Such a configuration does not contain any AA5 high-performance realtime 3D graphics subsystems. In addition to the features noted above, Master configurations provide:

- ❑ Two single-port 10/100 Ethernet network cards (NICs).
- ❑ 300W PFC auto-ranging power supply.
- ❑ Sound Blaster® Live!™ soundcard (option).

Channel Configurations

An AAIchemy PC-IG channel configuration is used to drive one or two 3D graphics channels. There are three visual channel configurations:

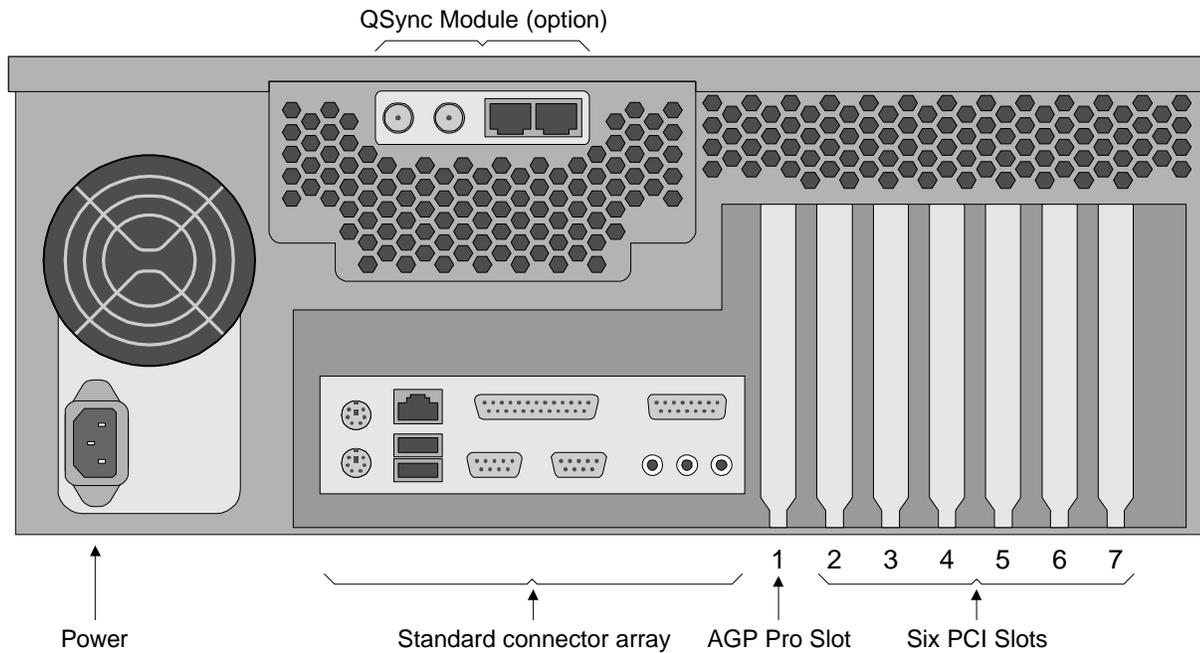
- ❑ **SB (single board)**
Comes equipped with one AA5 high-performance 3D graphics subsystem that drives a single channel.
- ❑ **DB (dual board)**
Comes equipped with two AA5 high-performance 3D graphics subsystems that drive a single channel.
- ❑ **DC (dual channel)**
Comes equipped with two AA5 high-performance 3D graphics subsystems that drive two independent channels.

All three of these visual channel configurations also provide the following features:

- ❑ A single-port 10/100 Ethernet network card (NIC) as standard (a dual-port card option is available).
- ❑ AV4 PFC 600W auto-ranging power supply.
- ❑ Special-purpose nVSensor sensor post-processor board (option). Note that this option is only available on SCSI-based systems.
- ❑ QSync synchronization module (option).

Configuration Summary

A generic view of the AAlchemy PC-IG back panel is shown below. This is followed by a table summarizing the various AAlchemy configurations, which is followed in turn by back-panel illustrations of the various configurations.



Master Configurations		PSU	AGP (Slot 1)	PCI					
				(Slot 2)	(Slot 3)	(Slot 4)	(Slot 5)	(Slot 6)	(Slot 7)
Master	EIDE (Standard)	300W PFC	2D graphics (3D option)	IDE Controller	—	—	Sound card (optional)	1-port NIC	1-port NIC
	SCSI (Option)			—	—	—	Sound card (optional)	1-port NIC	1-port NIC

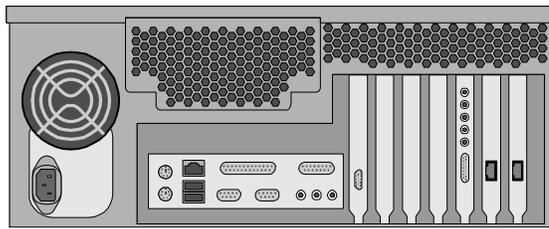
Channel Configurations		PSU	AGP (Slot 1)	PCI					
				(Slot 2)	(Slot 3)	(Slot 4)	(Slot 5)	(Slot 6)	(Slot 7)
SB Single AA5 1 Channel	EIDE (Standard)	AV4 600W PFC	2D graphics (3D option)	IDE Controller	Note #1	Note #1	Note #1	AA5	1-port NIC (2-port option)
	SCSI (Option)			1-port NIC (2-port option)	Note #1	Note #1	Note #1	AA5	Sensor card (option)
DB Dual AA5 1 Channel	EIDE (Standard)	AV4 600W PFC	2D graphics (3D option)	IDE Controller	Note #2	AA5	Note #2	AA5	1-port NIC (2-port option)
	SCSI (Option)			1-port NIC (2-port option)	Note #2	AA5	Note #2	AA5	Sensor card (option)
DC Dual AA5 2 Channel	EIDE (Standard)	AV4 600W PFC	2D graphics (3D option)	IDE Controller	Note #2	AA5	Note #2	AA5	1-port NIC (2-port option)
	SCSI (Option)			1-port NIC (2-port option)	Note #2	AA5	Note #2	AA5	Sensor card (option)

Note #1: The AA5 in the single AA5 single channel configuration always occupies slot 6 (slots 3 through 5 remain unavailable).

Note #2: The AA5s in the dual AA5 single and dual channel configurations always occupy slots 4 and 6 (slots 3 and 5 remain unavailable).

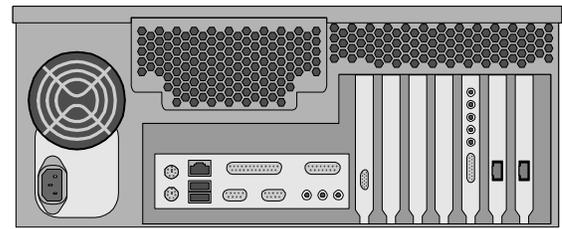
Note #3: The nVSensor card option is only available in SCSI-based channel configurations (it is not available in any master configuration).

Note #4: The QSync module option is only available in channel configurations (both EIDE and SCSI), not in master configurations.



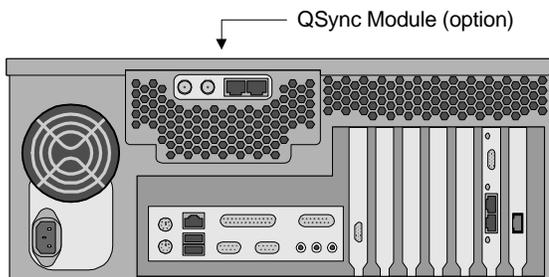
- 2D graphics (3D option)
- IDE Controller
- Sound card (option)
- Single-port 10/100 NIC
- Single-port 10/100 NIC

Master configuration (EIDE)



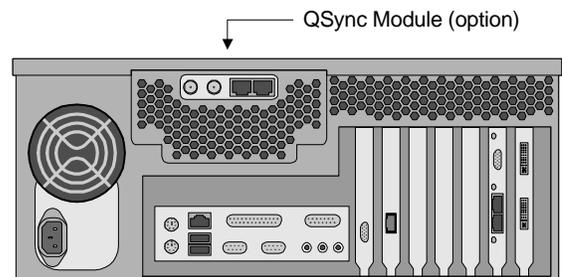
- 2D graphics (3D option)
- Sound card (option)
- Single-port 10/100 NIC
- Single-port 10/100 NIC

Master configuration (SCSI)



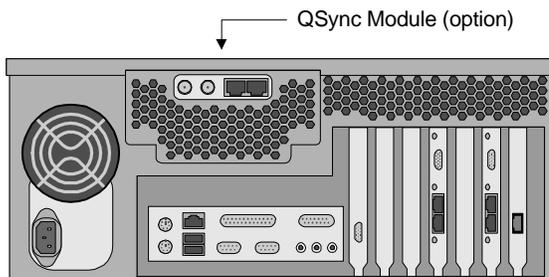
- 2D graphics (3D option)
- IDE Controller
- AA5 (3D Graphics)
- Single-port 10/100 NIC (dual-port option)

SB (1 x AA5) channel config. (EIDE)



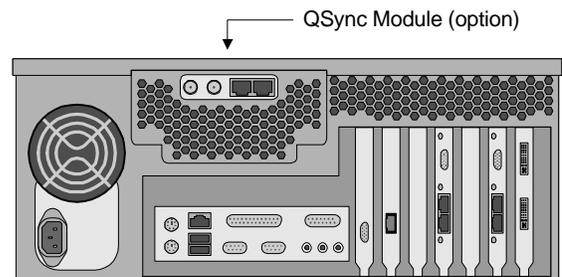
- 2D graphics (3D option)
- Single-port 10/100 NIC (dual-port option)
- AA5 (3D Graphics)
- nVSENSOR post-processor (option)

SB (1 x AA5) channel config. (SCSI)



- 2D graphics (3D option)
- IDE Controller
- AA5 (3D Graphics)
- AA5 (3D Graphics)
- Single-port 10/100 NIC (dual-port option)

DB/DC (2 x AA5) channel config's (EIDE)



- 2D graphics (3D option)
- Single-port 10/100 NIC (dual-port option)
- AA5 (3D Graphics)
- AA5 (3D Graphics)
- nVSENSOR post-processor (option)

DB/DC (2 x AA5) channel config's (SCSI)

Installation and Connection of a Standalone System

Location and Operating Environment

The AAIchemy PC-IG unit needs to be installed in a location with the capacity to safely support at least 55 lbs. The front and rear panels of the unit should be unobstructed to permit the free flow of cooling air through the intake fans at the front of the unit and exhaust air from the vents at the rear of the unit. If the unit is to be installed in a restricted or enclosed space, care should be taken to prevent the re-circulation of heated exhaust air to the front intake. The operating environmental ratings are as follows:

- ❑ Operating temperature: +0° C to +30° C with relative humidity 10 to 90%; non-condensing.
- ❑ Operating vibration: 0.25G (3.5 to 500 Hz sine sweep, 0 to peak)
- ❑ Operating shock: 2G (2ms @ 1/2 sine wave)

Power Requirements

AAIchemy PC-IG power supplies are auto-sensing 100 to 240 VAC, 50 to 60Hz units. Ensure that the supplied power is sufficient, stable, and without spikes or surges for operation of your AAIchemy and other required equipment. Please see Appendix A for complete power specifications.

Equipment Required



Depending on your application(s), you may require some additional equipment, examples of which are discussed below. With regard to the following discussions, however, Quantum3D makes no claim that any specific customer-supplied equipment will be compatible with an AAIchemy PC-IG. Determination of the fitness of any such equipment for use with an AAIchemy PC-IG is entirely the responsibility of the user. Improper use of customer-supplied equipment with an AAIchemy PC-IG may void the manufacturer's warranty. In addition to your AAIchemy PC-IG, you will need the following equipment:

- ❑ **Desktop Monitor (2D Graphics)**

A multi-sync monitor for the primary Windows display capable of driving at least 1024 x 768 at 60 Hz (the capability of driving 1280 x 1024 at 60 Hz is even better). Note that you may wish to use a high-resolution display if you are using any software that utilizes a GUI for its operation. The video cable from the monitor should employ a standard DB15 video connector to interface to the AAIchemy's 2D graphics subsystem.

- ❑ **Display Device (3D Graphics)**

An AA5 high-performance 3D graphics subsystem is capable of driving resolutions up to 1600 x 1200 at 60 Hz. Ensure that your AA5 display settings are compatible with whatever display device you intend to use. The display video cable should include a standard DB15 video connector to interface to the AAIchemy's AA5 card (triple shielded cables with EMI suppression are highly recommended). You will require two such display devices if you are using a dual-channel AAIchemy PC-IG.



Note that if you are using a fixed-frequency monitor or display device, it is necessary to configure your AA5 graphics subsystem prior to testing the display. See the list of supported video resolutions and refresh rates in Appendix B. Failure to configure display properties so that they match the display device can result in permanent damage to the display device. Please be careful, especially when using older projector systems that are not multi-sync compatible.

- ❑ **10/100 Ethernet**

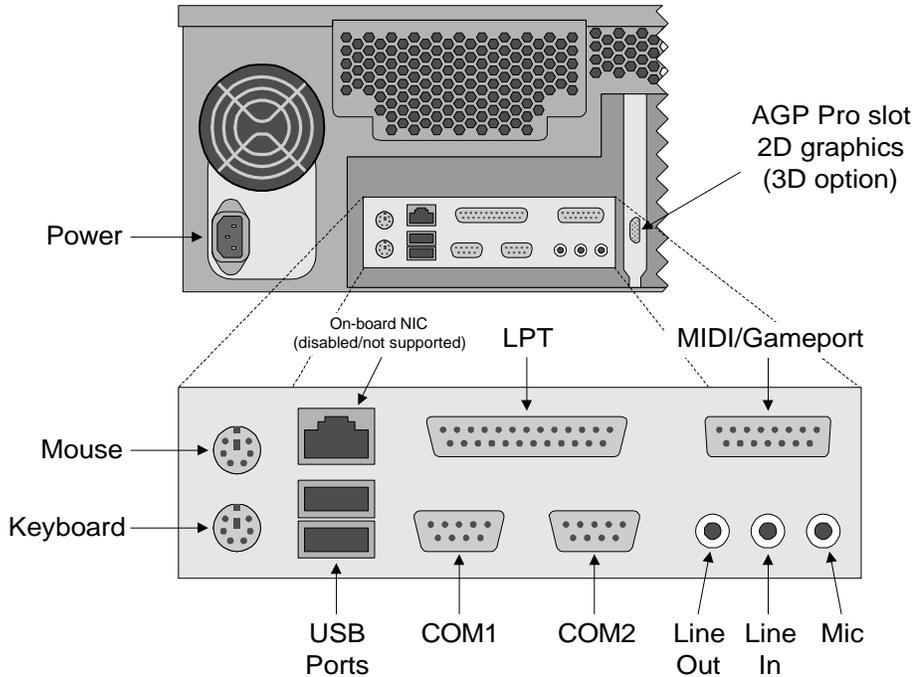
Connection with RJ45 cable if network connection is desired

- ❑ **PS/2 Keyboard and Mouse**

These may be supplied as an option with your AAIchemy PC-IG.

Keyboard, Mouse, Desktop Monitor (2D Graphics), NIC, and Power Connections

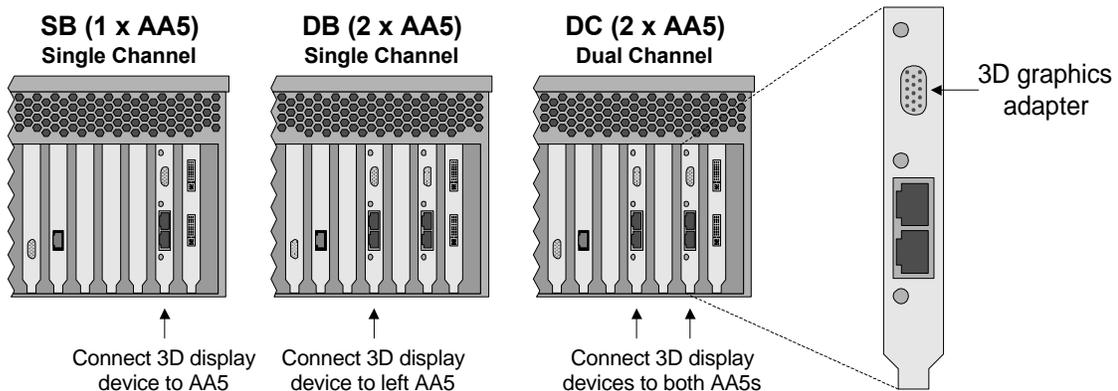
The mouse and keyboard connections are PS/2-compatible and are well marked towards the lower left of the AAchemy's rear I/O panel:



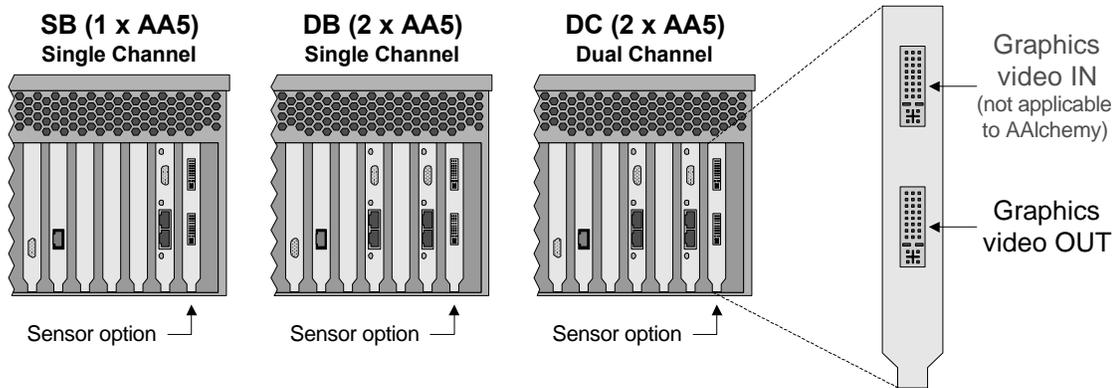
The AAchemy's desktop (2D graphics) display adapter is located in the vertical AGP Pro slot to the right of the main I/O panel. Connect the power cord (use the cord supplied with your AAchemy), keyboard, mouse, and desktop monitor cables to the appropriate connectors. Note that the on-board NIC connector is disabled and is not supported. Instead, use the two single-port NIC cards on a master configuration AAchemy or the single/dual-port NIC card on a channel configuration AAchemy. Gently insert the network cable(s) in the RJ45 connector(s) until you hear a slight click.

3D Graphics Display Connections

In the case of a channel configuration, connect your 3D graphics monitor or other display device to the adapter on the AA5 as shown below. A dual-channel configuration will require two display devices. (The illustrations below reflect SCSI configurations without the optional nVSensor board, but the AA5 connections are identical on EIDE configurations.)

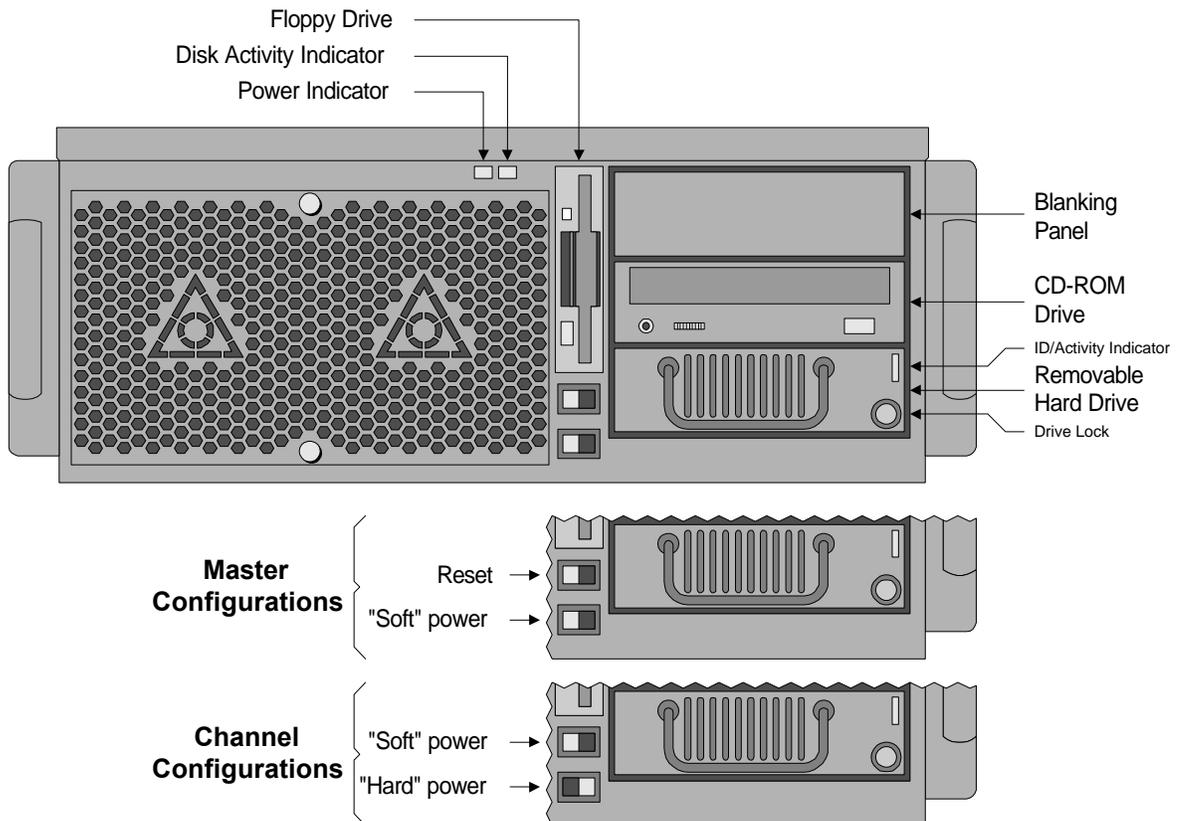


If your AAchemy is equipped with the special-purpose nVSensor sensor post-processor board option, then connect your sensor display to the *Graphics Video OUT* port on the sensor card (the lower port) using a DVI-I connector.



Powering On the System

Open the AAchemy's front access door by turning its knurled knob counter-clockwise until the door opens. This door (which is not shown in the illustration below) protects the media devices and power switches. The switch located near the bottom center of the unit is the power switch.



Master configurations have a momentary "soft power" On/Off rocker switch, with a reset switch mounted above this switch. Thus, in the case of a master configuration, use the On/Off rocker switch

to power the system up. When power is applied, the green power indicator light-emitting diode (LED) and the hard drive ID/Activity LED will come on, and the unit will boot as discussed below.



By comparison, channel configurations have a static-position “hard power” On/Off switch with a momentary “soft-power” switch mounted above. Set the “hard-power” On/Off switch to its ON position. Henceforth you should only use the “soft power” switch to turn the system on and off (the only time you need to use the “hard power” On/Off switch is when removing the channel unit for service). When power is applied to the system, the green power indicator LED and the hard drive ID/Activity LED will come on, and the unit will boot as discussed below.

Logging On for the First Time

The first time your AAlchemy is powered up, a Windows 2000 configuration wizard will step you through the process of configuring the system. If you are configuring your system for network operation, you may need to request network information from your systems administrator. The following provides an overview of the initial system power-up sequence:

- ❑ Windows 2000 Welcome Screen.
 - Click the **Next** button.
- ❑ License Agreement Screen.
 - Read the license agreement.
 - If you agree, click the **I accept this agreement** radio button.
 - Click the **Next** button.
- ❑ Personalize Your Software Screen.
 - Enter your name and company in the appropriate fields.
 - Click the **Next** button.
- ❑ Computer Name and Personalized Password Screen.
 - Enter the computer name for the system in the appropriate field.
 - Enter the administrator password for the system in the appropriate field.
 - Confirm the administrator password for the system in the appropriate field.
 - Click the **Next** button.
- ❑ Workgroup or Computer Domain Screen.
 - Enter the workgroup or computer domain for the system in the appropriate field.
 - If the computer is in a computer domain, select the radio button to add the system to a domain.
 - Click the **Next** button.
- ❑ The system will restart at this point. Login to the system by using the Administrator user and the password you set above. (Press the **Enter** key if you didn't set a password. However, please note that we strongly recommend that you set a password the first time you use the system to provide better security to your system.)



VERY IMPORTANT! Your AAlchemy as shipped by Quantum3D contains a hidden “Recovery” drive/partition (F: drive). This is discussed in more detail in the *Restoring the System* topic below, but it's important to note that under no circumstances should this “Recovery” drive/partition be removed, renamed, or modified in any way. Should you inadvertently do anything to your system that has the effect of changing the drive-naming scheme such that “F:” is no longer associated with the “Recovery” drive/partition, please contact Quantum3D support for instructions (www.quantum3d.com/support).

Shutting Down the System

In order to shut down an AAIchemy system gracefully you must perform the following steps:

- ❑ Click the **Start** button and then select the **Shut Down** option.



- ❑ Select one of the following options in the pull-down menu:
 - **Restart** Shutdown and restart the system.
 - **Shutdown** Shutdown the system.
 - **Log Off** Log off the current user session.
- ❑ Click the **OK** button.

Remote Power Up/Down

It may be convenient (or required) to cause an AAIchemy PC-IG to boot when power is applied from an external source, such as a remote circuit breaker. This is especially convenient when multiple AAIchemy units are mounted in a rack with a common power strip.

In such a case you will initially have to power on the AAIchemy system manually. However, once the system has undergone the normal shutdown procedure as described above, you may remove power externally instead of using any of the switches available on the AAIchemy unit. This leaves the AAIchemy's power control circuitry in a state such that the system will boot automatically the next time power is applied. As long as the unit is powered up and down using this method, it will continue to function as described above. However, if the unit is switched off manually – using either the “hard” or “soft” power switches – then it will need to be switched on manually the next time it is powered up.

Restoring the System

It's important to note that your AAIchemy as shipped by Quantum3D contains three drives/partitions. These comprise the operating system drive/partition (C: drive), the data drive/partition (D: Drive), and a hidden drive/partition (F: drive) containing an image of the C: drive. In certain cases, you may wish (or be directed by Quantum3D support) to completely re-initialize your AAIchemy PC-IG and restore the system partition to its default configuration. The following information is provided to enable you to recover the C: drive from this image.

Bootable Floppy

A bootable floppy labeled “AAIchemy SX Boot Disk” is shipped with each AAIchemy system. This floppy will automatically restore the image from the “Recovery” partition to the C: drive. Keep this boot floppy in a safe and secure location and do not modify it in any way.

Effects of C: Drive Recovery



When the C: drive is recovered from the image on the “Recovery” partition, it will require an identical amount of disk space to that originally used by the C: drive. Since you are reloading an image copy of the original C: drive, files added to the C: drive after the system was received will no longer be available. Thus, you must backup any files that need to be saved from the C: drive prior to the image recovery.

Loading the C: Image

- ❑ Place the boot floppy labeled “AAIchemy SX Boot disk” in the floppy drive.
- ❑ Power on the system.
- ❑ An image of the C: drive will be copied automatically to the C: drive.
- ❑ When a message appears that the image restore is complete, remove the floppy and reboot the system.
- ❑ Repeat the initial system power up procedures as discussed earlier in this user guide.

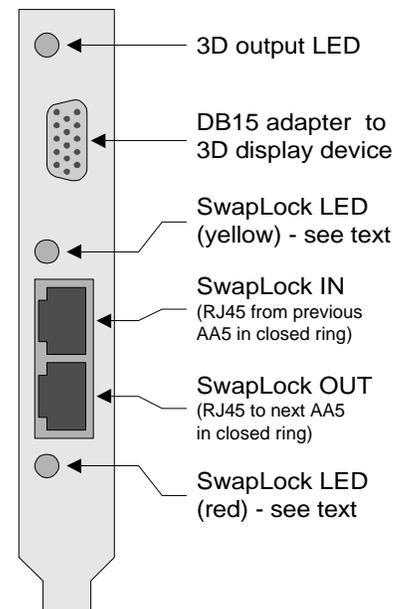
Multi-channel Synchronization Cabling Instructions

Visual computing applications often require multiple display channels. In order to maintain visual fidelity in these cases, it is extremely important that the system treats the multiple displays as a single "virtual canvas" and that they all behave as though they were a single large display.

Thus, in order to accommodate the requirements of the most demanding visual computing applications, AAIchemy’s AA5 high-performance 3D graphics subsystems support Quantum3D’s SwapLock channel synchronization technologies for multi-channel, wide field-of-view applications.

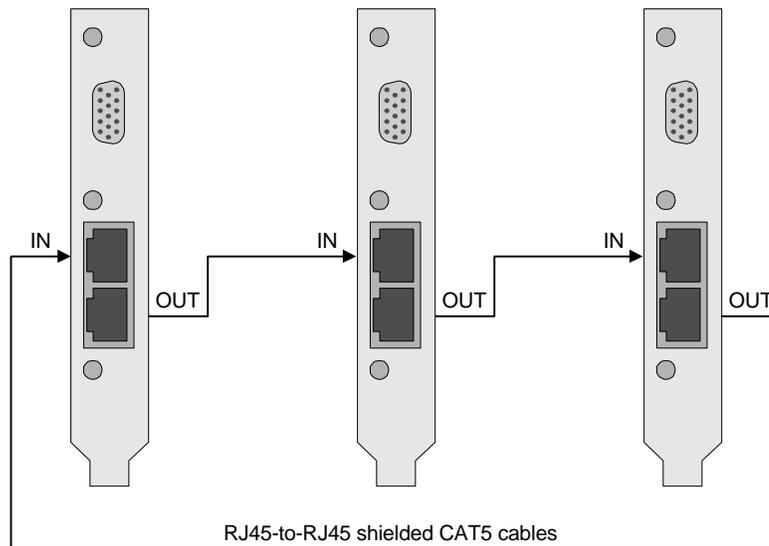
If you look at the back-plate of the AA5 subsystem, you'll see a number of connectors as shown in the illustration to the right.

SwapLock synchronizes the buffer swap operation between multiple graphics subsystems. One subsystem in the ring is chosen to be the *SwapLock master*, while the remaining subsystems are designated as *SwapLock slaves*. (The way in which masters and slaves are designated – along with the way in which you set the type of SyncLock you are using – is discussed in the *Setting Up the Software and Devices* chapter in this user manual.)



Observe the two SwapLock LEDs (light-emitting diodes) shown in the back-plate illustration. If the AA5’s SwapLock is disabled (the subsystem is set to behave like a single-board configuration), both of these LEDs will be off. (Note that no graphics subsystem in a SwapLock ring should be disabled unless *all* are disabled.) If the AA5 is configured as a SwapLock slave, both LEDs will be on solidly. By comparison, if the AA5 is configured to be the SwapLock master, both LEDs will blink rapidly (if there is any break in the SwapLock chain, the SwapLock master LEDs will pulse slowly).

In order to cable AAlchemy systems for multi-channel synchronization, a shielded RJ45-to-RJ45 CAT5 cable is needed for each AA5 graphics subsystem (every channel configuration AAlchemy comes equipped with two SwapLock cables). SwapLock outputs are connected to SwapLock inputs. The SwapLock OUT connector from the first graphics channel is routed to the next channel's SwapLock IN connector. This daisy chaining continues until you reach the last channel, whose SwapLock OUT connector is routed back to the first channel's SwapLock IN connector. This configuration is often referred to as a *SwapLock Ring*:



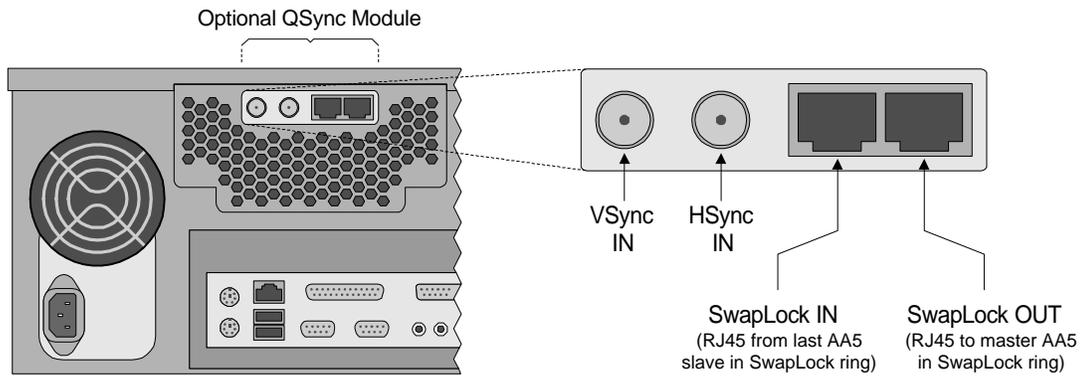
If your AAlchemy contains two AA5 subsystems configured as a single channel (and assuming that the nVSensor sensor post-processor option has NOT been installed), you should only connect your display device to the AA5 subsystem on the left – the one closest to the AGP Pro slot (this subsystem will be the one with its 3D output LED active). Similarly, the cables forming the SwapLock ring should only be connected to this AA5.

By comparison, if your AAlchemy contains two AA5 subsystems being employed in a dual-channel configuration (again assuming that the nVSensor sensor post-processor option has NOT been installed), you should connect an independent display device to each AA5 subsystem. In this case, the cable from the SwapLock OUT of the previous system in the ring should be connected to the SwapLock IN on the first (left-most) AA5; the SwapLock OUT from the first AA5 should be connected to the SwapLock IN on the second (right-most) AA5, and the SwapLock OUT from the second AA5 should be used to drive the next system in the ring.

Using External QSync™ Synchronization

The QSync module is an optional AAlchemy accessory that allows single or multiple AAlchemy channels to utilize external synchronization signals. This results in pixel-level GenLock synchronization of the AAlchemy's AA5 graphics subsystems to the external source.

QSync accepts the HSync and VSync information available from externally generated, standard graphics video devices. This video input signal is processed by QSync and can be used to GenLock any number of AA5 graphics subsystems.

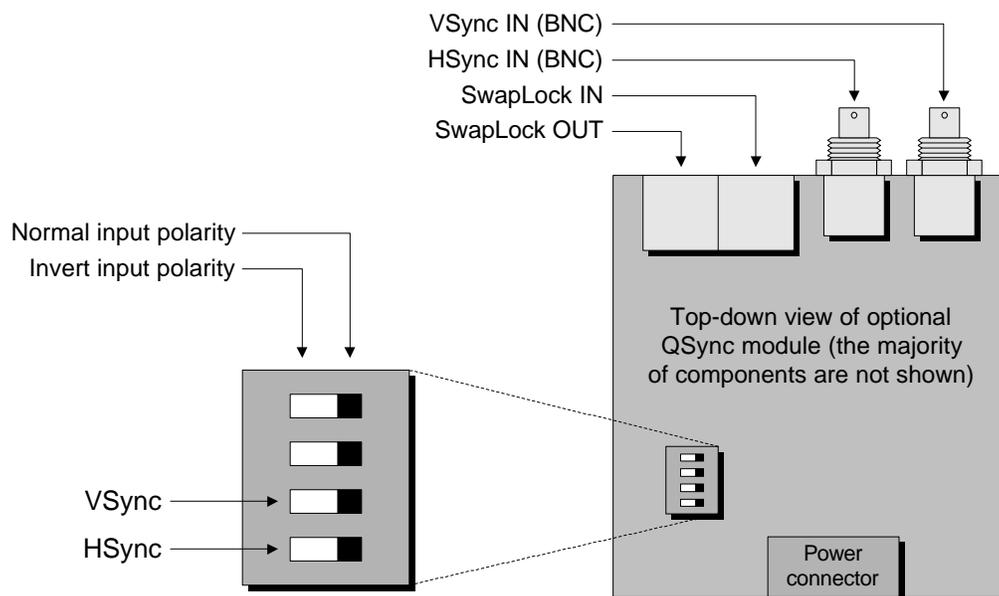


In order to use your QSync module, you will need the following:

- ❑ An HSync signal source (TTL level, 75Ω)
- ❑ A VSync signal source (TTL level, 75Ω)
- ❑ Two 75Ω BNC cables for connecting the HSync and VSync sources to QSync
- ❑ An existing, operating AAchemy SwapLock ring or standalone single channel system.

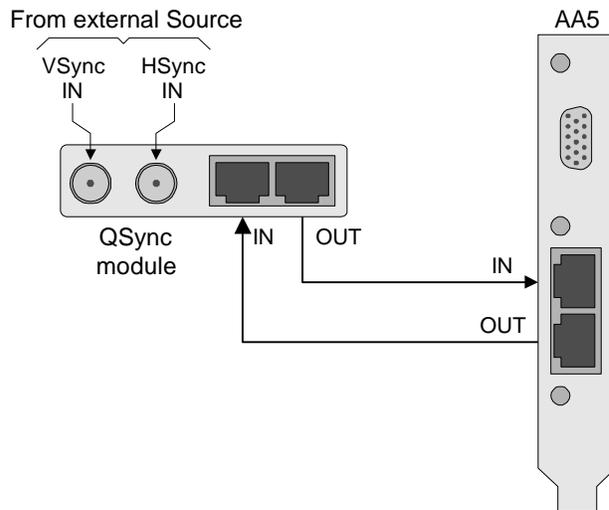
After connecting the QSync module to the HSync and VSync sources, the QSync module's SwapLock OUT must be connected to whichever AA5 graphics subsystem is configured as the SwapLock Master. In order for QSync to work properly, the AA5 subsystem driven by the QSync module's SwapLock OUT must be set to receive an external sync source. (This is performed using the *Multi-Channel Synchronization* controls provided with the AA5 subsystem's **Display Properties** dialog – see the discussions in the *Setting Up the Software/Devices/Network* chapter of this user guide for more details). Note that this option is only available when the AA5 subsystem is configured as a Master. All other AA5 subsystems in the SwapLock ring must be designated as slaves.

By default, the QSync module expects to see normal (positive-going) synchronization signals on the VSync and HSync inputs. However, the synchronization polarity can be specified using on-board switches as illustrated below:

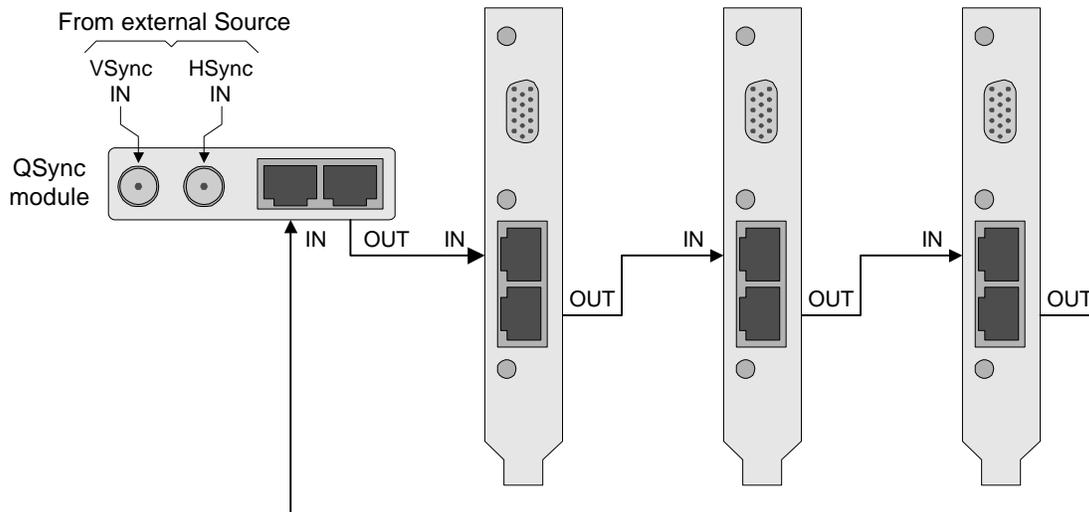


GenLocking outputs from video sources such as SGI Onyx and Evans & Sutherland ESIG systems may be used as inputs to QSync. The HSync and VSync sources are often provided from a monitor feed that contains H/V sync information. These monitors usually have 5 BNC connectors: Red, Green, and Blue (For the RGB signals, respectively), along with a Black connector for vertical sync and either Gray or Yellow for horizontal sync. However, some schemes use White and Black wires for vertical and horizontal sync, respectively. Be sure to confirm the specifications for the specific equipment being used.

Cabling Diagram for a 1-channel QSync System



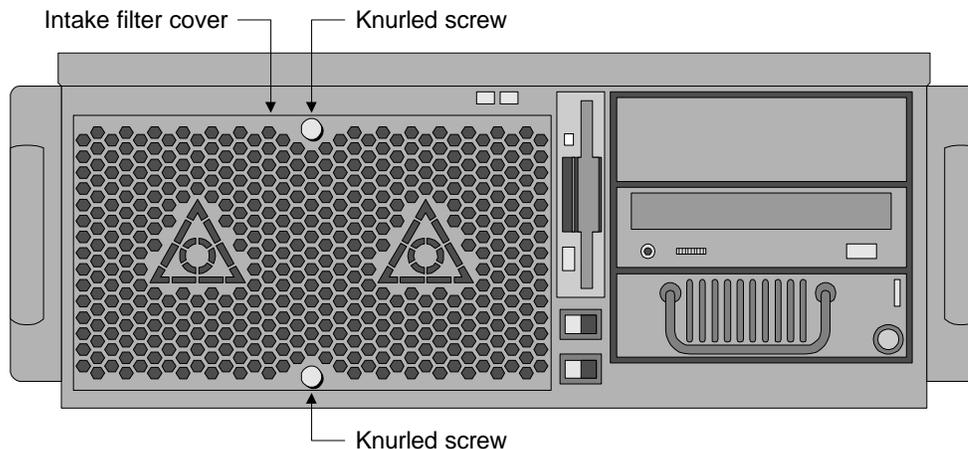
Example Cabling Diagram for a 3-Channel QSync System



Regular System Maintenance

Cleaning the Air Filter

An AAIchemy PC-IG is supplied with an intake air filter. The filter should be cleaned every month or as visible dust accumulates on the filter. The filter cover is attached to the front face of the AAIchemy unit by means of two knurled screws.



In order to clean the filter you should perform the following steps:

- Shut down the system and unplug the power cord.
- Remove the two knurled screws holding the intake filter cover to the front face of the AAIchemy system.
- Remove the filter element. This may be washed in water and mild soap, brushed, or vacuumed in order to remove dust. If it is washed, the filter must be completely dry before re-installation.
- Replace filter, cover, and screws.

Cleaning Interior Dust

You may elect not to use the supplied air filter in order to increase cooling airflow. In this case, the interior of the AAIchemy should be cleaned once a month or as visible dust accumulates. If the filter is used, interior cleaning should be performed every six months or as visible dust accumulates.

In order to clean the interior you should perform the following steps:

- Shut down the system and unplug the power cord.
- Remove the lid.
- Using a commercially available compressed air PC cleaning product, blow the accumulated dust out of the unit. Pay special attention to air passages, grills, and heat sinks.
- Replace the lid.

Replacing the Lithium Battery

A Lithium Ion battery is included with the AAIchemy system motherboard. This battery is used for the Real Time Clock circuit. The expected lifetime of the battery is approximately 5 years.



There is a danger of explosion if this battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the motherboard manufacturer. Dispose of used batteries according to the manufacturer's instructions.

In order to replace the lithium battery you should perform the following steps:

- Shut down the system and unplug the power cord.
- Remove the lid.
- Remove and replace the lithium battery according to the manufacturer's instructions.
- Replace the lid.

Removing/Installing AA5 Graphics Subsystems

Instructions on removing and/or installing AA5 graphics subsystems are available from Quantum3D support (www.quantum3d.com/support).



Setting Up the Software/Devices/Network

Follow the instructions in this chapter to set up the software, devices, and network for your AAIchemy.

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Setting Up the Audio

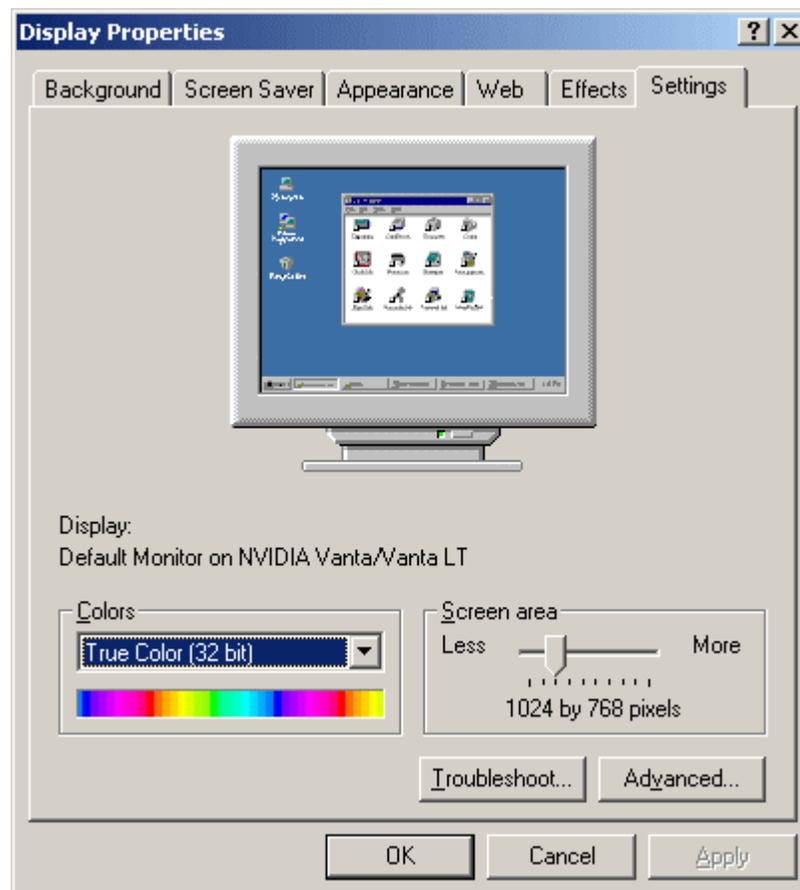
When you receive your AAIchemy PC-IG, you will find that the standard system audio has been pre-installed on the system. Alternatively, if you ordered the Sound Blaster Live! option, you will find that this driver has been pre-installed. (Note that, in this latter case, you will still need to install any desired applications from the Sound Blaster Live! CD.)

Setting Up the System Video (2D Graphics)

When you receive your AAIchemy PC-IG, you will find that the system video has been pre-installed with the following characteristics:

- ❑ Color depth: True Color
- ❑ Resolution: 1024 x 768
- ❑ Frequency: 60 Hz

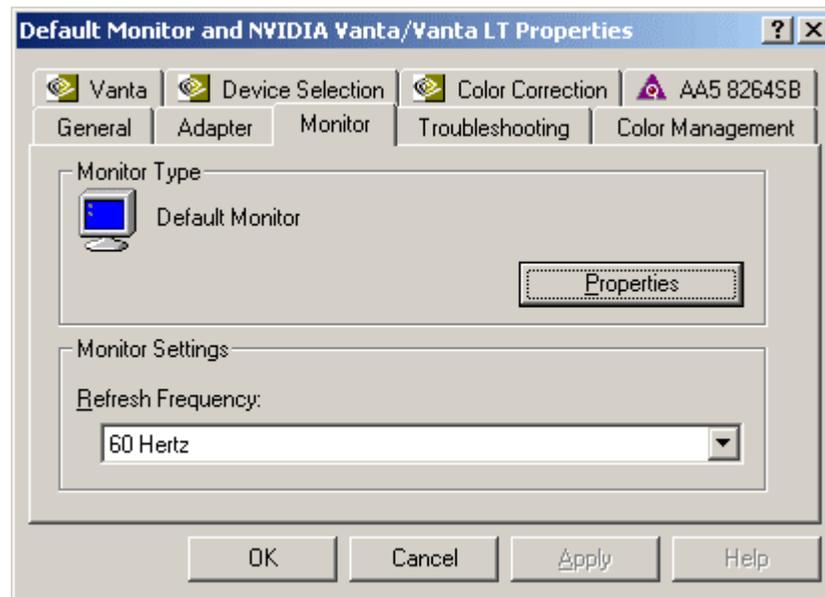
In order to change the color or resolution, use **Start > Settings > Control Panel > Display** and then select the **Settings** tab on the resulting form:



- ❑ Select the required color depth in the **Colors** pull-down menu.
- ❑ Select the resolution with the slider in the **Screen area** portion of the dialog.
- ❑ Left-mouse click the **Apply** button to apply these changes.
- ❑ A dialog/window will appear prompting you to allow the new settings to be applied. Click the **OK** button to apply these settings.

- Once the changes have been applied, a new dialog/window will appear prompting you to keep your new settings. Click the **OK** button to keep these settings.

In order to change the monitor frequency, select **Start > Settings > Control Panel > Display** as discussed on the previous page and click the **Advanced** button:



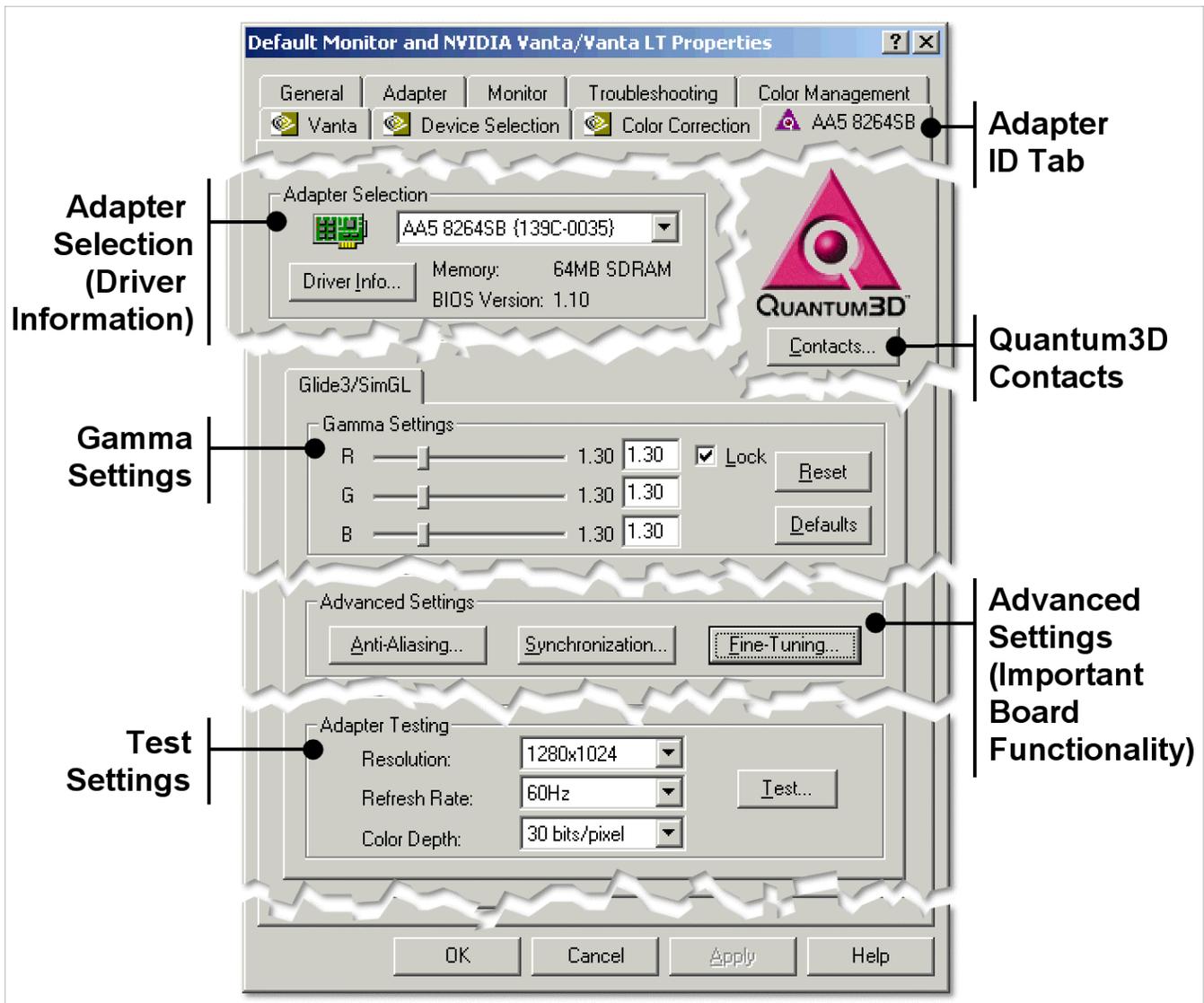
- Select the **Monitor** tab.
- Select the desired frequency in the **Refresh Frequency** pull-down menu.
- A dialog/window will appear prompting you to allow the new settings to be applied. Click the **OK** button to apply these settings.
- Once the changes have been applied, a new dialog/window will appear prompting you to keep your new settings. Click the **OK** button to keep these settings.

Setting Up the AA5 Subsystem(s) (3D Graphics)



Note that your application software will normally set many of the properties associated with the AAchemy's AA5 graphics subsystems. Setting these properties using the **Display Properties Control Panel** as discussed below will override the application settings. Overriding the application settings can conflict with the operation of the application and can change performance, produce video artifacts, or cause the application to fail completely. Please check with your software provider for the correct settings for your application.

The AAchemy's AA5 configuration controls can be found on the **Display Properties** control panel. In order to access this control panel, use **Start > Settings > Control Panel**. After the control panel window appears, double-click on the **Display** icon (an alternative technique is to right-mouse click on the Desktop and select the **Properties** option). Select the **Settings** tab and click on the **Advanced** button. Once the **Display Properties** window appears as shown below, choose the **AA5** tab to access all AA5 display properties controls.



Adapter Identification

The '8xxx' number on the **Adapter ID** tab identifies the type of AA5 graphics subsystem that has been detected on your system, such as 8264SB illustrated in the above figure. This identification is also displayed in the **Adapter Selection** pull-down menu.

Adapter Selection

If you have a dual-channel system – that is, a system with two independent AA5 display subsystems – then you can select a specific AA5 using the **Adapter Selection** pull-down menu located at the top-center of the AA5 **Display Properties** window.

Clicking the **Driver Information** button will display the current driver version information. This page contains the versions of the firmware and drivers installed on the system. The firmware revision number is depicted by the **TimingCtrlRev** field; drivers are depicted as **Glide3** and **SimGL**. This information can be used to confirm correct driver installation and revisions.



As part of any technical support incident, Quantum3D support (www.quantum3d.com/support) will require you to identify the type of AA5 graphics subsystem you have in your system. Use the contents of this **Driver Information** window to answer any questions regarding your AA5 hardware and software configuration.

Contacts

Clicking the **Contacts** button displays a window containing the current URL, email, telephone, and fax numbers for Quantum3D technical support. Note that all support incidents should be filed using the online support system at the Quantum3D support website (www.quantum3d.com/support).



Gamma Settings

The **RGB** sliders in the **Gamma Settings** portion of the **Display Properties** window can be used to modify the color balance and the overall intensity of the AA5 video output. Moving a slider to the left compresses the intensity range while moving it to the right expands the range. The red, green and blue numbers shown in the control panel represent the values used to gamma-correct the video output. The default values are 1.30 for red, green, and blue (a scale factor of 1.0 creates a linear 10-bit gamma-correction table). Using the **Lock** checkbox allows you to adjust the red, green and blue gamma values together. Removing the check box enables you to adjust each gamma value separately.

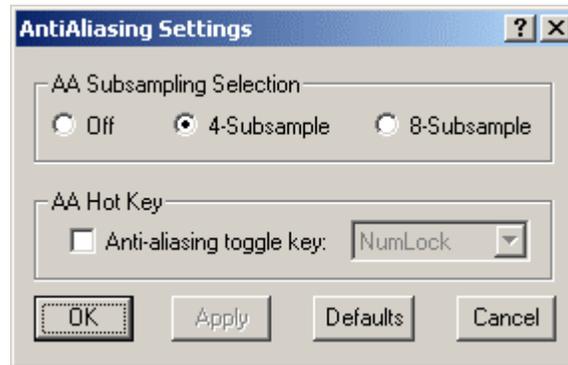
The **Reset** button resets the gamma values to whatever values were specified the last time the AA5's **Display Properties** were applied.

The **Defaults** button returns the settings to their factory default values.

Advanced Settings

Anti-aliasing Settings

Clicking the **Anti-aliasing** button on the **Display Properties** window displays a sub-window that allows you to control the quality of anti-aliasing performed by the AA5 graphics subsystem(s):



- ❑ **AA Subsampling Selection**

Choices are **Off** (no anti-aliasing), **4-Subsample**, or **8-Subsample**. The default selection of **4-Subsample** provides high image quality with excellent pixel fill-rate. The selection of **8-Subsample** allows the hardware to use 8 sub-pixel samples to determine the resulting pixel color. This setting produces the highest image quality, but has a significant performance-impact on pixel fill-rate.
- ❑ **Anti-aliasing Toggle Key**

This checkbox enables a hot key that can be used within any application to toggle full-scene anti-aliasing on and off. You can select which key is to be used with the pull-down menu to the right. This feature is useful for comparing image quality with anti-aliasing turned on and off.

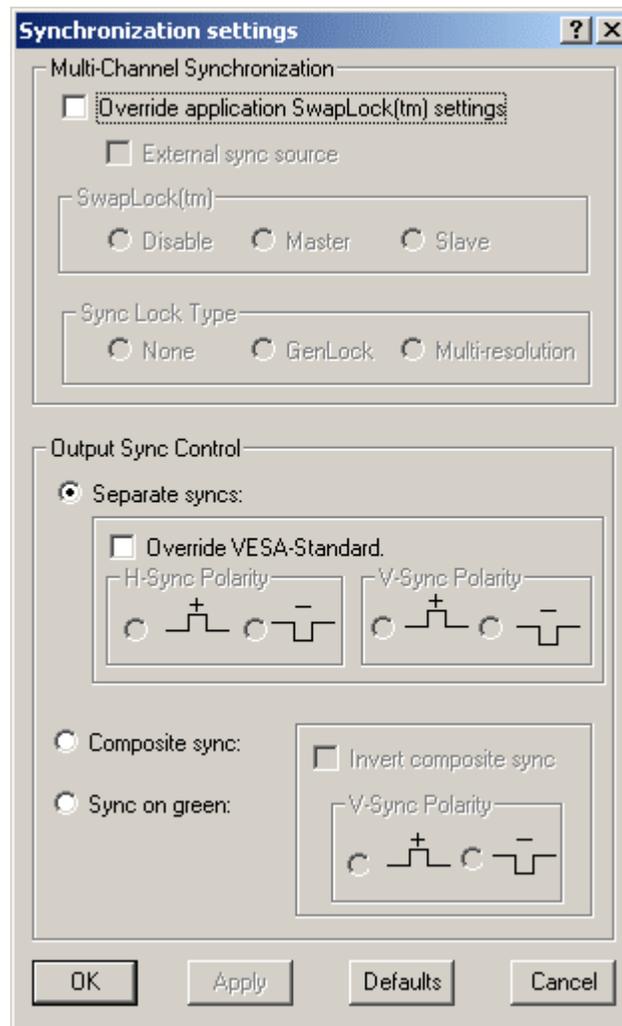
Synchronization Settings

Clicking the **Synchronization Settings** button on the **Display Properties** window provides an interface to the AA5 subsystem's **SwapLock**, **SyncLock**, and **Genlock** capabilities. Genlock synchronizes the horizontal and vertical retrace of multiple graphics systems to provide pixel-level synchronization across multiple graphics systems and video display devices. SwapLock provides synchronization of the buffer swaps across multiple graphics channels. This interface is shown on the following page.

- ❑ **Override Application SwapLock Settings**

Software applications that use the Quantum3D Glide extensions for SwapLock can be overridden using the **Override Application SwapLock Settings** checkbox. This can also be used if SwapLock is required but the application program does not use the Quantum3D Glide extensions for SwapLock.
- ❑ **External Sync Source**

If you are using QSync and have an external source connected to the QSync module, then click the **External Sync Source** checkbox to allow the AA5 subsystem to sync to the external reference source.

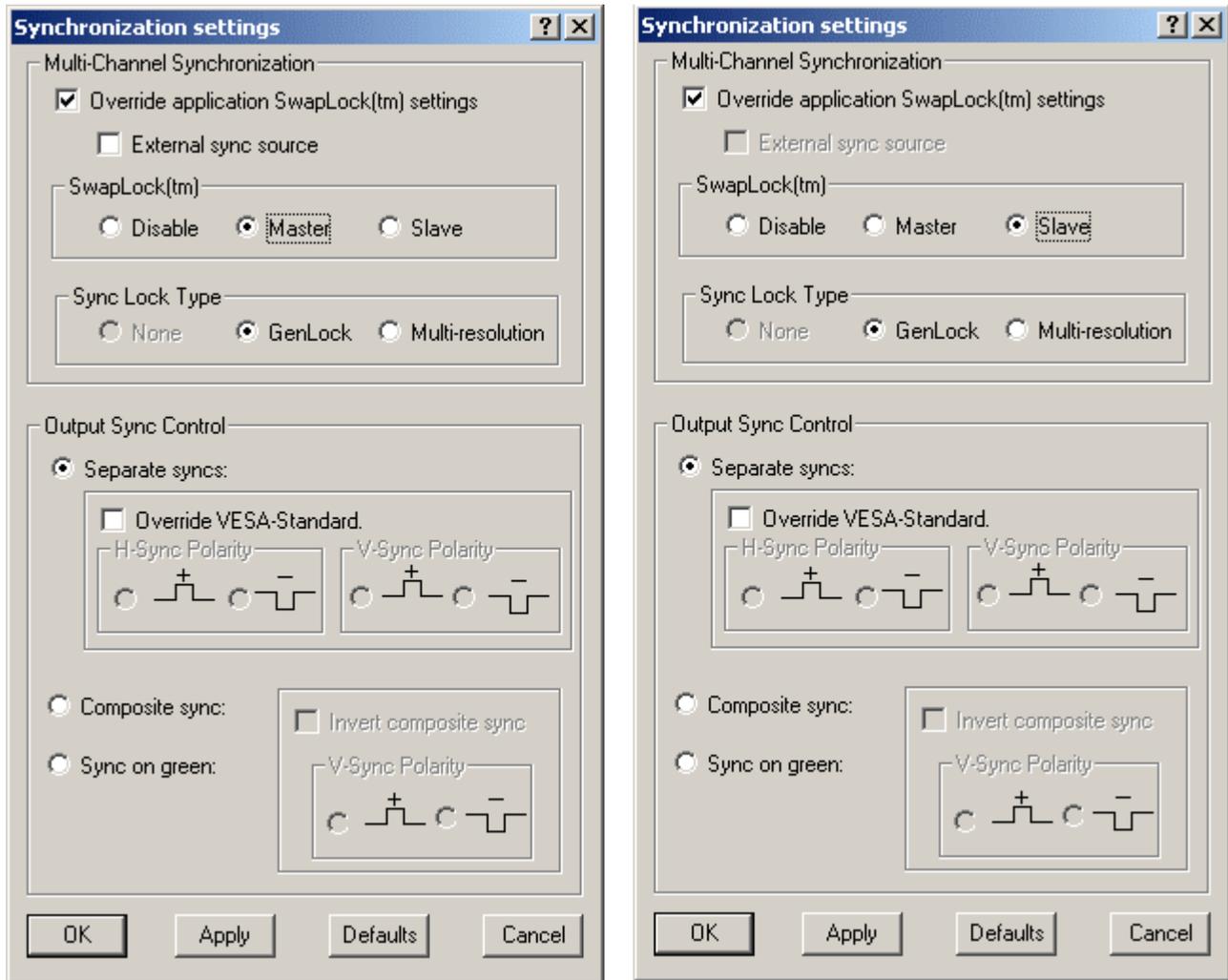


□ SwapLock

SwapLock synchronizes buffer swap operations between multiple graphics subsystems. As was discussed in the *Setting Up the Hardware* chapter in this user manual, the subsystems must be physically connected in a ring using shielded CAT5 cables with RJ45 connectors; SwapLock outputs are connected to SwapLock inputs; and the SwapLock output of the last graphics channel in the ring connects to the SwapLock input of the first graphics channel.

One system in the ring must be designated as being the SwapLock master, while all of the others must be designated as slaves. Use the **Disable**, **Master**, and **Slave** radio buttons to specify which graphics subsystem is the master and which are slaves. Note that no graphics subsystem in a SwapLock ring should be disabled unless *all* are disabled.

- The **Disable** radio button disables master and slave operation. In this case, the AA5 graphics subsystem will behave like a single-board configuration.
- The **Master** radio button selects this AA5 subsystem to be the master in a SwapLock ring. The master adapter will generate SwapLock signals. If you are using QSync or an external sync source, then the system that is accepting SwapLock input from the external sync source must be the master system. There can be only one SwapLock master in a SwapLock ring.
- The **Slave** radio button selects this AA5 subsystem to be a slave in a SwapLock ring. A slave adapter will receive SwapLock signals from the master (possibly via another slave).



❑ **SyncLock Type**

The **SyncLock Type** determines the synchronization of horizontal and vertical retrace between multiple graphics channels.

- If the **None** option is selected then no synchronization is performed.
- The **Genlock** option provides both horizontal and vertical retrace synchronization. Genlock provides pixel-level synchronization across all systems in the SwapLock ring. Genlock requires all graphics systems to be of the same resolution. Because of this, all graphics applications using Genlock must be configured to operate using identical resolutions and refresh rates. One method of doing this is via the Glide3 and SimGL **Fine Tuning** parameters as discussed later in this chapter.
- If the **Multi-resolution** option is selected, then only the vertical retrace is synchronized. This means that output resolutions may vary across the various graphics subsystems forming the ring.

❑ **Output Sync Control**

The **Output Sync Control** section of the **Synchronization Settings** page controls the signal format of the video output from the AA5 subsystem. These settings control the actual sync signals going to the display device, but do not affect the signals carried on the SwapLock ring.

- The **Separate Syncs** option enables communication of both horizontal and vertical sync timing information on separate pins of the AA5's standard DB15 video output connector. This is the default setting
- The **Override VESA Standard** option will allow the polarity of the horizontal and vertical sync timing to be independently selected when using the **Separate Syncs** option.
- The **Composite Sync** option enables communication of both horizontal and vertical sync timings on a common pin of the AA5's video output connector.
- The **Sync on Green** option enables communication of both horizontal and vertical sync timings on the same pin of the AA5's video output connector that carries the green signal.

Fine-Tuning Settings

Clicking the **Fine-Tuning** button on the **Display Properties** window provides an interface that allows you to modify the Glide3 and SimGL settings. This interface is shown on the following page. The Glide3 settings will affect any application program that uses the Glide graphics API. If you are using a Glide version of OpenGVS or SimGL, these settings will override any settings made in the **SimGL Fine-Tuning** section.



Note that realtime software applications typically define many of the required AA5 settings at runtime. Overriding these application settings can conflict with the application's operation and may affect performance or cause visual artifacts. In some cases, overriding the application settings may cause application failure. You should consult your software application providers for the correct settings for their applications.

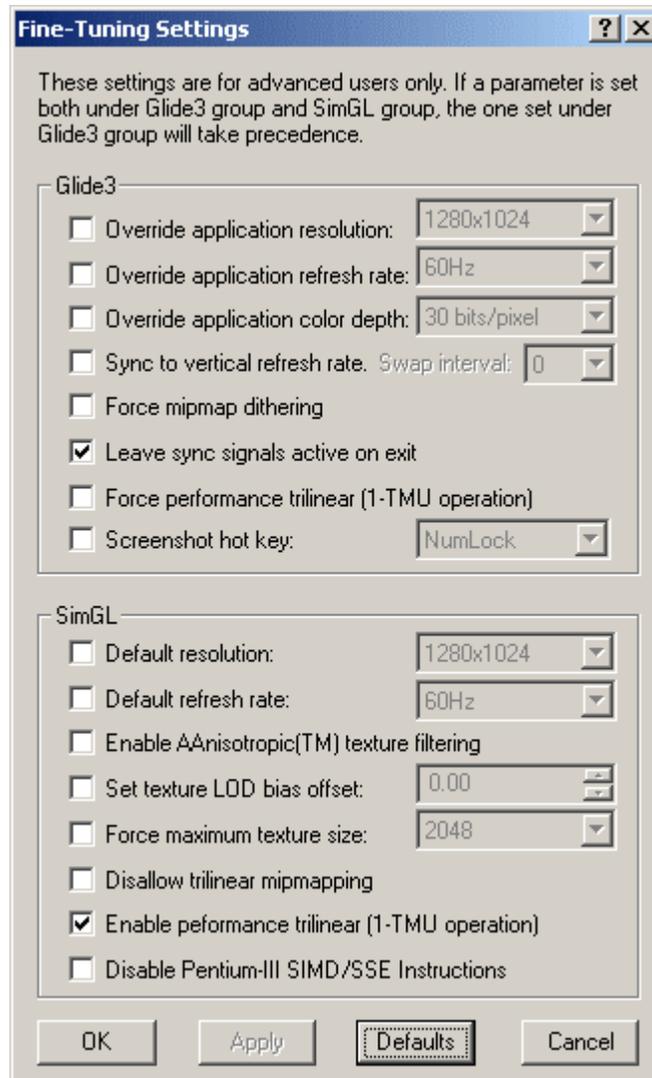
❑ **Glide3 Settings**

- The **Override Application Resolution** option can be used to specify the desired resolution, independent of the application. This can be useful for choosing the image quality or helping to determine performance. Using a higher resolution can in some cases reduce performance and using a lower resolution can increase performance; this is a common technique used to test if an application has a fill-rate bottleneck.
- The **Override Application Refresh Rate** option can be used to specify the desired monitor refresh rate. If the application specifically requests a different refresh rate, it will be ignored in favor of the selected override refresh rate.
- The **Override Application Color Depth** option will override any color depth defined by the application. This can be used to tune fill-rate. The lower the number of bits-per-pixel, the less information is needed in order to fill the pixels on the screen. If the application is fill-rate limited, then it is possible that this option will increase performance if a lower color depth is used. Lowering the color depth will also reduce the amount of memory used for the frame buffer and increase the amount of memory available for textures. Note that lowering color depth will also lower the accuracy of your Z depth buffer.

Also note that overriding the application color depth can conflict with the application's operation, performance, and look-and-feel. In some cases it may cause application failure.

- The **Sync To Vertical Refresh Rate** option will synchronize the update rate of the frame buffer with the monitor refresh rate. When this box is not checked and in its default state, buffer swaps will occur on every vertical retrace. When this box is checked, you can choose when the buffer swaps will occur. See also the **Swap Interval** discussions below.
- The **Swap Interval** field controls how many Vertical Refresh intervals pass before the Swap Buffer command is issued in an application that uses double or triple buffering. In order to set

the **Swap Interval**, you must first check the **Sync To Vertical Refresh Rate** option. A Swap Interval of 0 will allow the hardware to swap frame buffers as fast as possible as buffer swaps will not be synchronized to the vertical refresh rate. This is the preferred setting when running graphics performance benchmarks, because the graphics update rate will not be limited by the monitor refresh rate. A Swap Interval of 1 will result in front and back buffers being swapped at every vertical refresh. This setting will prevent tearing and provide smooth animation. A swap interval of 2 will provide buffer swaps on every 2nd vertical refresh; 3 on every third, etc. For more information on Swap Buffers, see the *OpenGL Programming Guide* (Addison-Wesley Publishing Company).



- The **Force Mipmap Dithering** option will force Glide to dither mipmaps and can result in higher image quality when textures use few colors and show banding.
- The **Leave Sync Signals Active on Exit** option leaves the video sync signals active after graphics have ceased on the 3D display. Without this option enabled, the display connected to your AAIchemy hardware will not have a sync signal after a graphics application program shuts down. Turn this option on if using a display that requires a constant sync signal.
- The **Force Performance Trilinear** (PT) option uses special Quantum3D-developed hardware functionality that enables rendering 2 pixels per clock rather than just one, while still

performing trilinear texture blending. Without PT, you would have to choose between 2 pixels per clock operation and trilinear mipmapping. Using PT will automatically force the maximum color depth to be 22 bits per pixel, but will increase your fill rate. Applications that require the maximum fill rate should use this feature.

- The **Screen Shot Hotkey** option allows you to specify a hotkey that can be used to take a snapshot of the graphics being displayed on-screen while your application is running. If you are running in anti-aliased mode, then the resulting image will also be anti-aliased. Choose which hotkey you would like to use, start up your 3D graphics application, and use this key to capture an image to a file. The initial file will be named **glide0000.bmp**, where the 0000 will increment for each subsequent screen capture. These files will be placed in the root directory where your application is running.

□ SimGL Fine Tuning

- The **Default Resolution** option can be used to specify the desired resolution independent of the application. This can be useful for choosing the image quality or helping to determine performance. Using a higher resolution can in some cases reduce performance and using a lower resolution can increase performance. This is especially true of fill-rate limited applications.
- The **Default Refresh Rate** option can be used to specify the desired monitor refresh rate. If the application specifically requests a different refresh rate, it will be ignored in favor of the selected override refresh rate.
- The **Enable AAnisotropic Texture Filtering** option gives applications the ability to perform the advanced feature of AAnisotropic texture filtering. AAnisotropic filtering can greatly improve the image quality of textures applied to long thin objects. When viewing these objects from an angle (e.g. looking down a long road), the blurring effect caused by traditional texture filtering techniques is very noticeably reduced when AAnisotropic texture filtering is enabled.
- The **Set texture LOD Bias Offset** option allows you to control the distance at which mipmap levels are calculated when using texture filtering such as point, bilinear, trilinear, and AAnisotropic. It is typically hard to see the difference between mipmap levels with tri-linear and AAnisotropic enabled, but is relatively easy to notice when using point or bilinear filters.
- The **Force Maximum Texture Size** option is used to limit the maximum size of any texture maps that are used. When enabled, this feature will force any texture larger than the set limit to be down-sampled as it is loaded into AA5's texture memory. This feature is sometimes used when the application requires more texture memory than is available on your AA5 subsystem.
- The **Disallow Trilinear Mipmapping** option turns off trilinear mipmap filtering. Any application attempting trilinear filtering will be forced to perform bilinear texture filtering. In some cases this option can improve visual qualities, even though it may increase the texture aliasing.
- The **Enable Performance Trilinear** (PT) option uses special Quantum3D-developed hardware functionality that enables rendering 2 pixels per clock rather than just one, while still performing trilinear texture blending. Without Performance Trilinear, you would have to choose between 2 pixels per clock operation and trilinear mipmapping. Using Performance Trilinear will automatically force the maximum color depth to be 22 bits per pixel, but will increase your fill rate. Applications that require the maximum fill rate should use this feature.
- Pentium III SIMD/SSE instructions allow the SimGL driver to perform graphics operations using a *Single Instruction Multiple Data* technique. Using SIMD improves graphics transformation and lighting performance on any Pentium III-class system. The **Disable Pentium-III SIMD/SSE Instructions** option forces the driver to not use these instructions.

Testing the AA5 3D Graphics Output

Use the **Adapter Testing** area of the **Display Properties** window to test the operation of the AA5 graphics subsystem(s) and their connection to your display device(s). First choose the desired **Resolution**, **Refresh Rate**, and **Color Depth**, and then click the **Test** button. Confirm that a Quantum3D logo appears spinning on the display device.



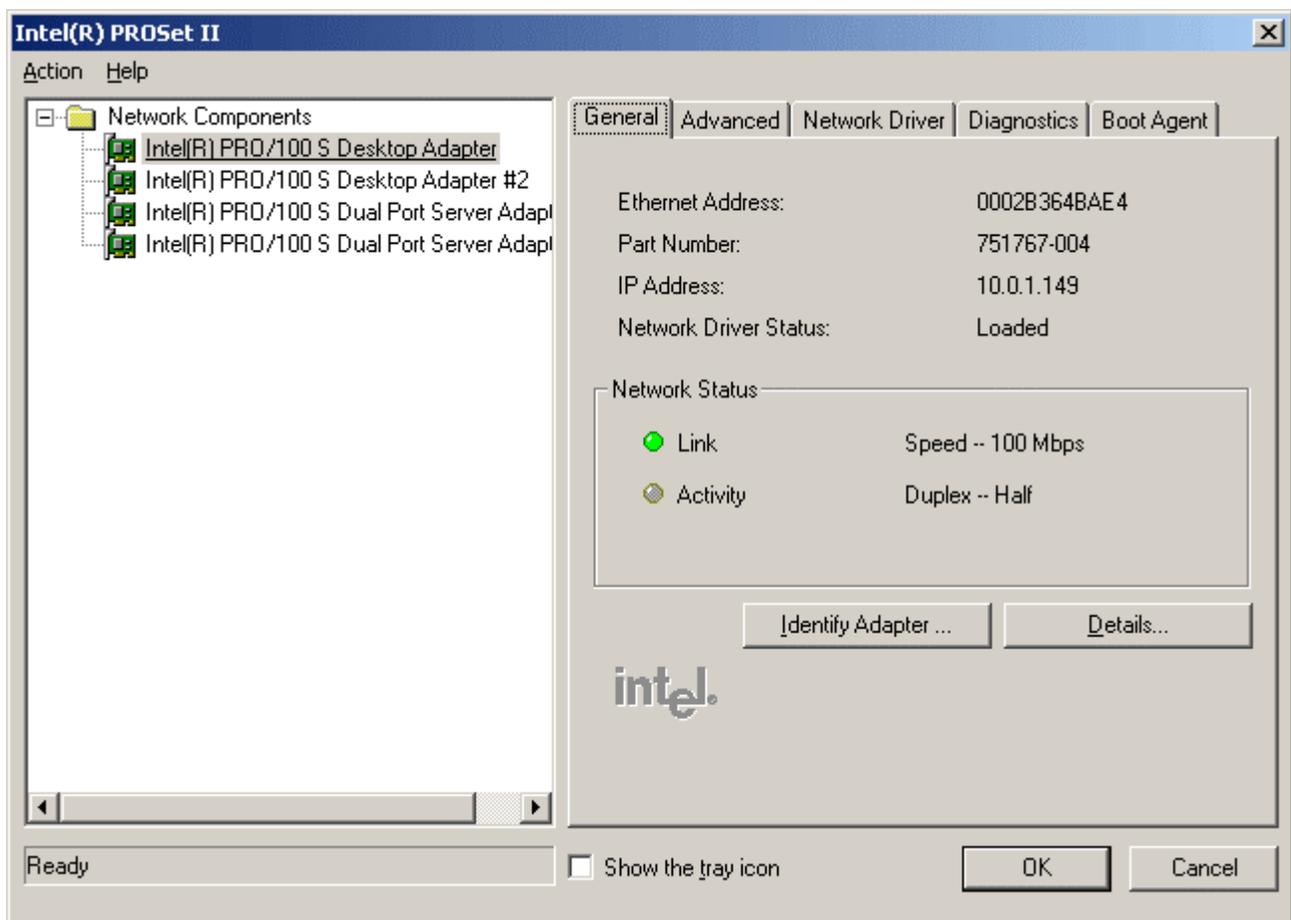
Note that these settings do not affect the normal operation of the AA5 graphics subsystem(s). The parameters set here will affect only the test output. See the **Advanced Settings** discussions above to manually change the normal operating parameters.

Setting Up the Network

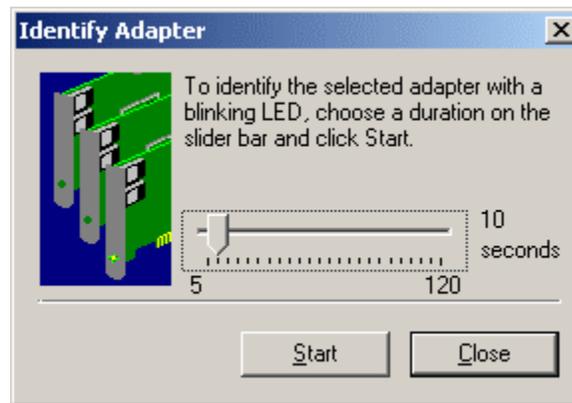
Differentiating Between Multiple NICs

If you have two single-port NICs or a dual-port NIC in your AAlchemy PC-IG, use the following process to identify them.

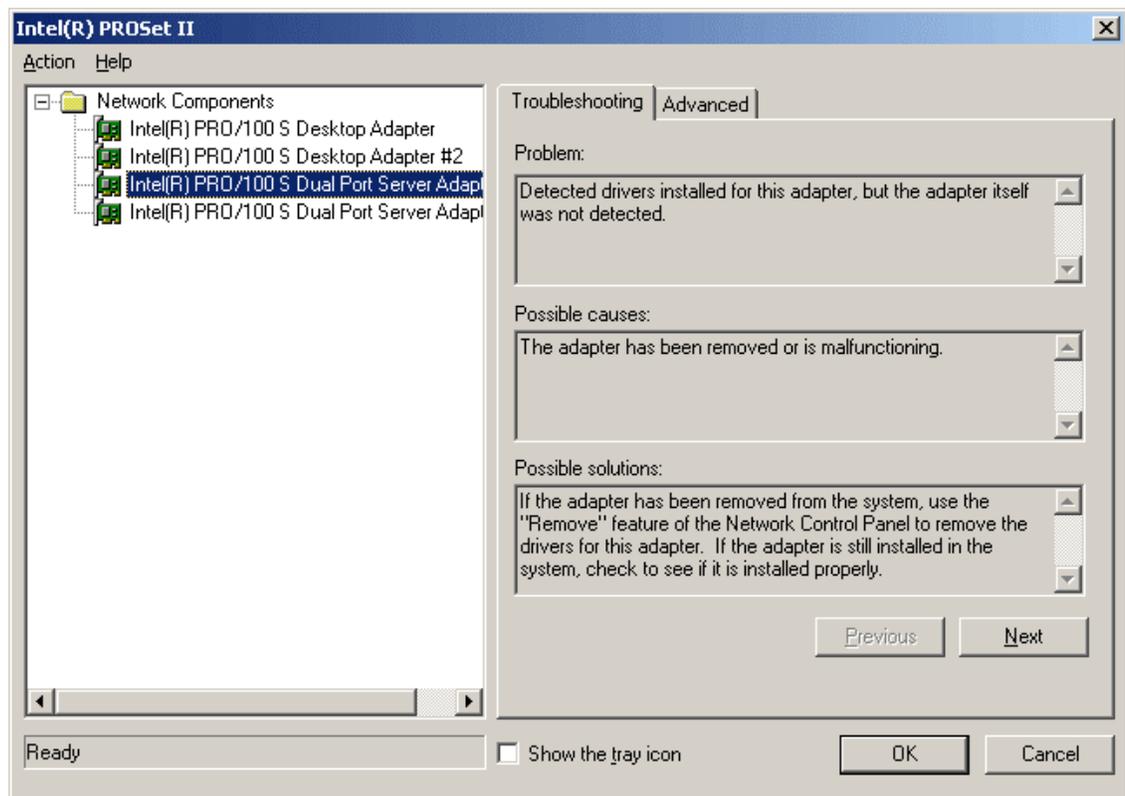
- ❑ Use **Start > Settings > Control Panel > Intel(R) ProSet II**



- ❑ Click on a **Network Component**.
- ❑ Click on the **Identify Adapter** button in the **General** tab.



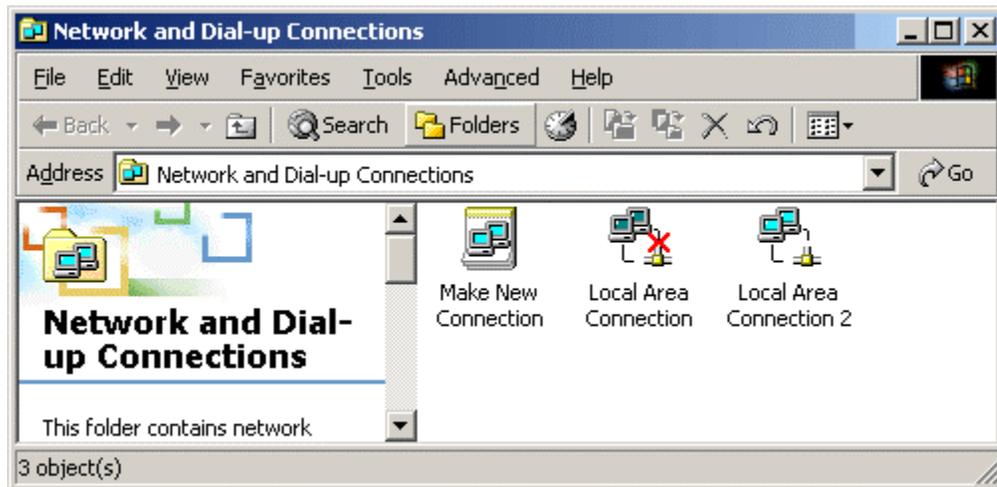
- ❑ Move the slider to increase or decrease the amount of time for the LED to blink if required.
- ❑ Left-mouse click on the **Start** button.
- ❑ Identify the NIC card:
 - On a NIC card with a single NIC connector, the LED will blink above the NIC connector on the NIC card specified.
 - On a dual NIC card, the LED next to the top right corner of the NIC connector specified will blink.
- ❑ Click the **Close** button to dismiss the **Identify Adapter** form.
- ❑ Note that there will be some NIC cards listed in the ProSet II that are not installed. You can ignore these as shown below:



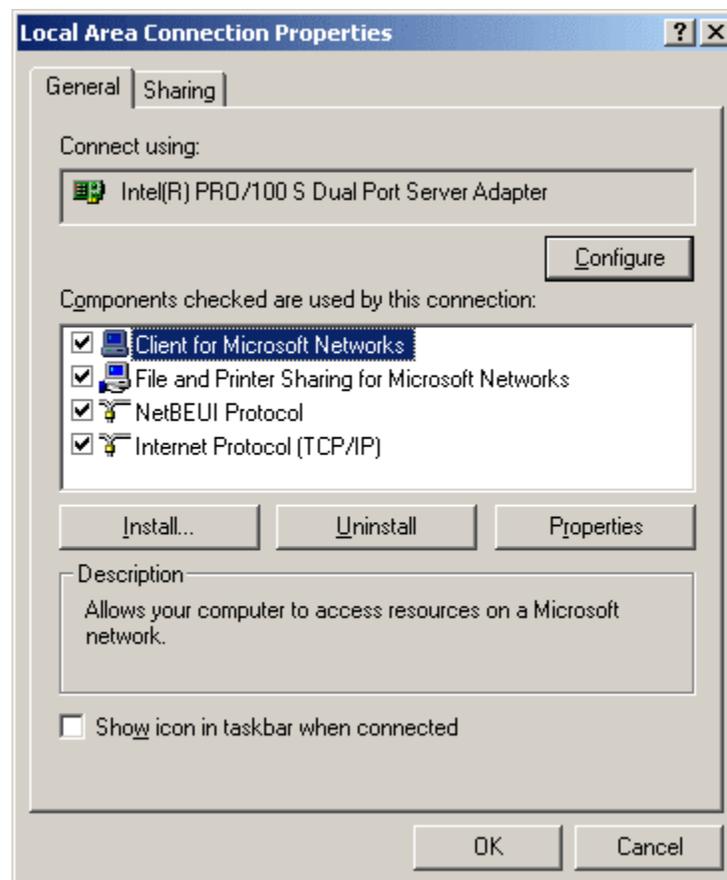
Network TCP/IP Windows 2000 Configuration Procedure

The network TCP/IP is configured so as to obtain an IP address automatically. If a specific address is required, then use the following process to specify this address.

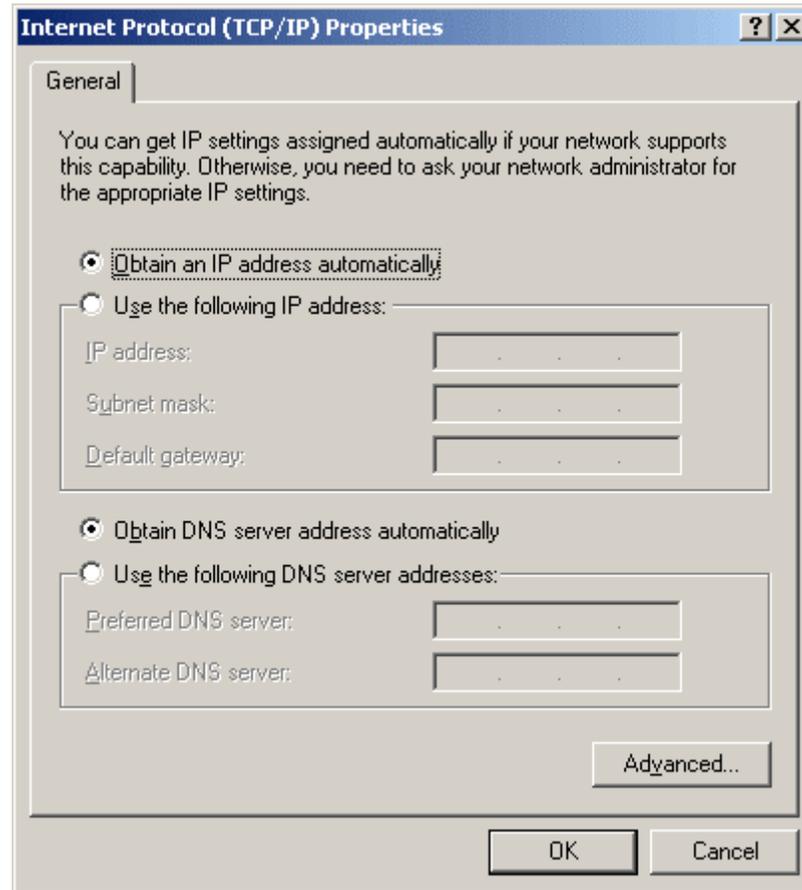
- Right-mouse click on the **My Network Place** icon on the desktop.
- Left-mouse click on the **Properties** selection.



- Right-mouse click on the **Local Area Connection** item.
- Left-mouse click on the **Properties** selection.



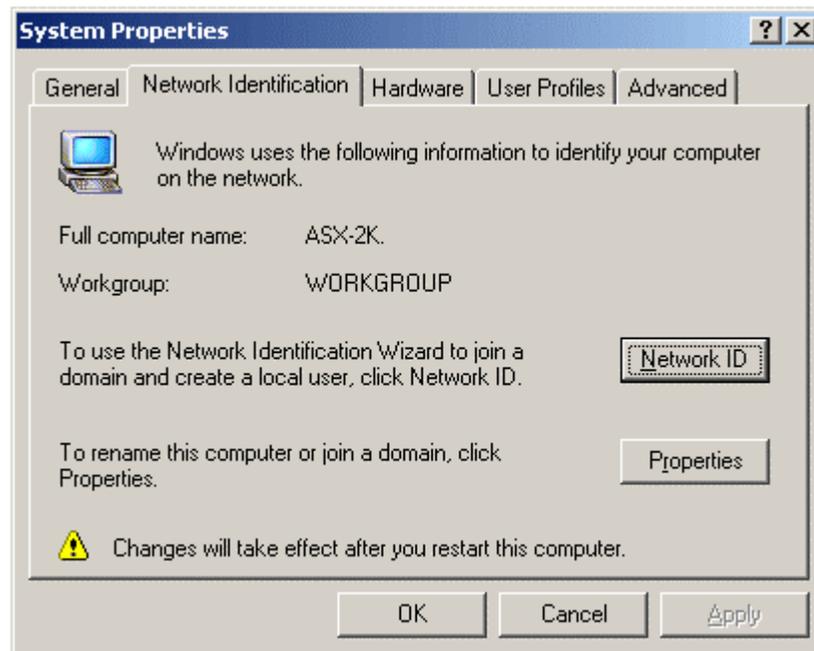
- ❑ Double-click on the **Internet Protocol (TCP/IP)** item.



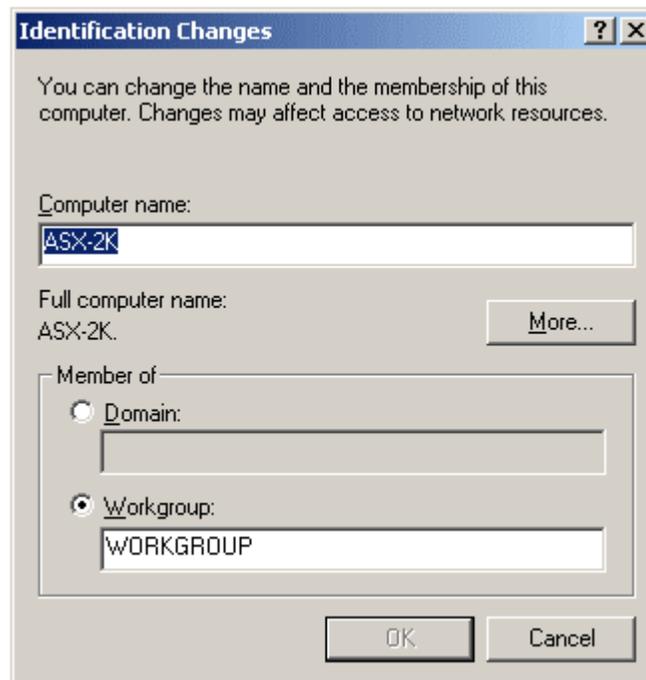
- ❑ Enter the appropriate IP address data and DNS address data for your network (use the **Advanced** button to specify the WINS addresses and setup).
- ❑ Click the **OK** button.
- ❑ The system will prompt you to restart the system for these network changes to take effect. Click the **Yes** button to restart the system

Network Name and Workgroup/Domain Windows 2000 Configuration Procedure

- ❑ Right-mouse click on the **ASX-2K** computer icon on the desktop.
- ❑ Left-mouse click on the **Properties** selection.



- ❑ Choose the **Network Identification** tab.
- ❑ Click on the **Properties** button to change the computer name, change the workgroup name, or join a domain.





- ❑ Make any changes to the appropriate fields and click the **OK** button to accept these changes and dismiss this form.
- ❑ An informational form will appear telling you that you need to reboot the system for these changes to take effect. Click the **OK** button to acknowledge this form (note that this will NOT cause the system to reboot at this time).
- ❑ Click the **OK** button on the main **System Properties** form to accept the changes and dismiss this form.
- ❑ The system will prompt you to restart the system for these network changes to take effect. Click the **Yes** button to restart the system.

Removing/Installing AA5 Graphics Drivers

Instructions on removing and/or installing AA5 graphics subsystem drivers are available from Quantum3D support (www.quantum3d.com/support).

Appendix A: AAIchemy System Specs

Power Requirements

All AAIchemy PC-IGs come equipped with power factor correction (PFC) auto-sensing, 50 to 60 Hz, 100 to 240 VAC power supplies and cooling fans. Typical configurations require the following power:

	Power Rating	Current	
		100 to 120 VAC	200 to 240 VAC
Master	300W	5.0A	3.0A
Channel (SB/DB/DC)	600W	7.0A	4.0A



Substandard power is a major factor in computer failures – including AAIchemy PC-IGs – so the use of a power-conditioning uninterruptible power supply (UPS) is highly recommended. Exposing your AAIchemy system to substandard power may invalidate/cancel your warranty.

Physical Properties

- ❑ **Chassis**
Ruggedized 4U 19" rack-mountable chassis with retention mechanism for add-in boards and I/O cables.
- ❑ **Weight**
55 pounds (60 pounds as delivered including packaging materials).
- ❑ **Dimensions**
Height = 6 15/16", Width = 19", Length = 23 1/4"
- ❑ **Acoustical Output**
63 dB at 1 meter.

Appendix B: AA5 Subsystem Specs

Overview

One or two AA5 high-performance 3D graphics subsystems are included in all AAIchemy PC-IG visual channel configurations. Designed and manufactured by Quantum3D, the AA5 features a unique special-purpose hardware feature – *Performance Trilinear (PT)*. Due to the fact that a PT-enabled board can output two pixels per clock instead of just one, PT can double the pixel fill-rate performance of your application when its feature set is enabled and you are rendering with 22-bpp color. Each AA5 high-performance 3D graphics subsystem includes:

- ❑ A PCI graphics card with eight VSA-100 chips.
- ❑ 32 or 64 MB unified memory on-board (shared frame buffer and texture memory).
- ❑ Independent 3D-only output (using a standard DB15 video connector).
- ❑ Hardware implemented, automatic full-scene, sub-pixel anti-aliasing (4 or 8 sub-samples per pixel available).
- ❑ T-Buffer for depth-of-field, depth-of-focus, soft shadows, and other effects.
- ❑ Anisotropic texture filtering
- ❑ 891 megapixels-per-second trilinear texture fill rate with 4-sub-sample full-scene anti-aliasing, alpha blending, and per-pixel fog enabled (color depth 30-bpp plus 8 alpha bits = 38 bits total).
- ❑ Texture paging rates of up to 528 megatexels-per-second (peak).
- ❑ Triangle throughput in excess 1.4M textured independent triangles-per-second (peak), with on-chip triangle set-up engine.
- ❑ Programmable video resolution and refresh rates.
- ❑ 22-bit (7-8-7) and 30-bit (10-10-10) color settings available.
- ❑ Hardware floating-point Z-buffer (16-bit resolution when color resolution is set to 22-bpp color and 24-bit resolution when color resolution is set to 30-bpp color).
- ❑ Support for single, double, and triple buffering (frame buffer).
- ❑ Transparency and chroma-key support, including support for screen-door transparency.
- ❑ Hardware support for non-linear fog table.
- ❑ Per-pixel atmospheric effects (OpenGL compliant).
- ❑ OpenGL-compliant alpha blending.
- ❑ Texture map resolutions up to 2048 x 2048 texels per map.
- ❑ Analog RGB output supports non-interlaced video.
- ❑ Hardware implemented 4-bit-per-texel 3DFX™ FXT1™ texture compression.
- ❑ Perspective correct bilinear and trilinear texture filtering with per-pixel LOD MIP-mapping with support for Gouraud, detailed, and projected texture mapping.
- ❑ Support for SwapLock (swap buffer sync and Genlock).
- ❑ Support for QSync Genlock I/O option (external Genlock).

Detailed Specifications

Subsystem Models

Note that all AA5 subsystems are PT-enabled, which means they can output two pixels per clock instead of just one (see also the discussions in the previous section).

AA5 3D Subsystem	# Channels	# PCI Slots (Boards)	# Graphics Chips	Memory per Chip	# Pixels per Clock
8232SB	1	1	8	32 MB	2
8264SB	1	1	8	64 MB	2
8232DB	1	2	16 (8 per board)	32 MB	4
8264DB	1	2	16 (8 per board)	64 MB	4
8232DC	2	2	16 (8 per board)	32 MB	2
8264DC	2	2	16 (8 per board)	64 MB	2

Color Depth and Alpha Buffer



The AA5 may be set to output color with either 22-bit or 30-bit color depths. Note that these settings refer only to the RGB (red, green, and blue) components of the processed and displayed color. This should not be confused with often quoted color depths that include the available depth of the alpha channel. For instance, the standard 32-bit color depth claimed for most commercial boards or chipsets actually has only 24 total bits of color information with 8 bits of alpha. If the AA5 were to be described using the same convention, it would be referred to as a 38-bit color subsystem.

	Color Only				With Alpha	
	Red	Green	Blue	Total	Alpha	Total
Standard 32-bit scheme	8	8	8	24	8	32
AA5 22-bit setting	7	8	7	22	N/A*	22*
AA5 30-bit setting	10	10	10	30	8	38

* Note that the AA5's alpha buffer is only active at the 30-bit color setting.

Where maximum color fidelity is required, the AA5's 30-bit setting allows 10 bits per color component. By comparison, the AA5's 22-bit color setting supports almost the same amount of color information as that available on a standard 32-bit commercial graphics product (the difference is usually imperceptible for most training applications).

Depth Buffer

The AA5's depth buffer consists of a hardware-implemented floating-point Z-buffer. The Z-buffer precision is automatically set to 16-bits when the 22-bit color depth is selected and to 24-bits when 30-bit color depth is selected. Color depth and Z-precision may not be selected independently.

Video Output Resolutions and Refresh Rates

The video output resolutions and refresh rates supported by the AA5 are illustrated in the following matrix:

Resolution	Refresh Rates					
	50 Hz	60 Hz	70 Hz	72 Hz	75 Hz	85 Hz
640 x 480	Yes	Yes		Yes	Yes	Yes
800 x 600	Yes	Yes		Yes	Yes	Yes
960 x 720		Yes			Yes	Yes
1024 x 768	Yes	Yes	Yes		Yes	Yes
1024 x 1024		Yes			Yes	Yes
1152 x 864		Yes			Yes	Yes
1280 x 940			Yes			
1280 x 960		Yes			Yes	Yes
1280 x 1024	Yes	Yes			Yes	Yes
1600 x 1200		Yes				

Texture Support

- ❑ Anisotropic texture filtering.
- ❑ Texture map resolutions up to 2048 x 2048 texels per map.
- ❑ Hardware-implemented 4-bit-per-texel 3DFX FXT1 texture compression, which utilizes texture memory more efficiently by providing a compression factor of 8 (as compared to 32-bit-per-texel formats) and improves performance by reducing texture memory bandwidth requirements.
- ❑ Perspective correct bilinear and trilinear texture filtering with per-pixel LOD MIP-mapping and support for Gouraud, detailed, and projected texture mapping.

Texture Memory Available at Different Resolutions

The AA5 high-performance 3D graphics subsystem employs a unified memory architecture, which means that the graphics frame buffer and texture memory are shared. The following table shows the approximate amount of texture memory available at various frame buffer resolutions.



AA5 3D Subsystem	On-board Memory	Texture Space Available			
		800 x 600	1024 x 768	1280 x 1024	1600 x 1200
8232xx	32 MB	208 MB (26 MB)	176 MB (22 MB)	128 MB (16 MB)	72 MB (9 MB)
8264xx	64 MB	464 MB (58 MB)	432 MB (54 MB)	384 MB (48 MB)	328 MB (41 MB)

The numbers in **bold** show the effective texture memory at an 8:1 compression ratio.
The numbers in parenthesis show the physical texture memory (zero compression).

Performance Specifications

- ❑ 891 megapixels-per-second trilinear texture fill rate with 4-sub-sample full-scene anti-aliasing, alpha blending, and per-pixel fog enabled (color depth 30-bpp plus 8 alpha bits = 38 bits total).
- ❑ 528 megatexels-per-second peak texture paging rate.
- ❑ On-chip triangle set-up engine provides triangle throughput in excess of 1.4M textured independent triangles-per-second peak.

VESA Support

- ❑ VESA VBE 3.0 compliant.
- ❑ DDC (Display Data Channel) 2b compliant.
- ❑ VESA DPMS support.
- ❑ Up to 1600 x 1200 video resolution.

Appendix C: nVSensor Post-processor

Proprietary Information Notice

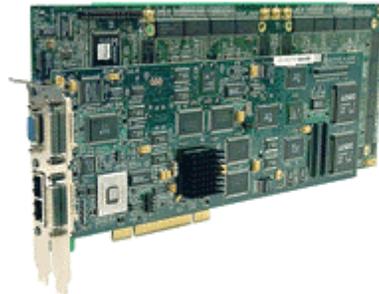


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nVSensor Input Interface

The nVSensor subsystem is interfaced to an AA5 3D graphics subsystem via a direct digital interface. That is, nVSensor is "mated" to an adjacent AA5 subsystem with a pair of 50-pin "Board Stackers." In this mode, the full 10-bit per color (RGB) information – including syncs and swap signals – are sent and received without the necessity for any analog conversions to be performed. This provides the highest quality video signals and dramatically simplifies video cabling.



nVSensor is interfaced to an AA5 via direct digital interface.

nVSensor Output Interface

The nVSensor subsystem has two DVI-I connectors. The output from the nVSensor subsystem is simultaneously provided in DVI digital format and analog format on the output DVI-I (the bottom connector). For DVI-D output, the Molex 88741-80XX cable is recommended (DVI-D Single Link). For analog output, the Molex 88741-83XX DVI to 15-pin mini-D (VGA) connector cable is recommended. Alternately, DVI to VGA 15-pin mini-D adapters – such as Molex 88741-8700 – can be used to adapt standard VGA cables to the nVSensor output DVI connector.

Equipment Required



Depending on your application(s), you may require some additional equipment, examples of which are discussed below. With regard to the following discussions, however, Quantum3D makes no claim that any specific customer-supplied equipment will be compatible with an AAIchemy PC-IG. Determination of the fitness of any such equipment for use with an AAIchemy PC-IG is entirely the responsibility of the user. Improper use of customer-supplied equipment with an AAIchemy PC-IG may void the manufacturer's warranty. In addition to your AAIchemy PC-IG, you will need the following equipment:

❑ **Desktop Monitor (2D Graphics)**

A multi-sync monitor for the primary Windows display capable of driving at least 1024 x 768 at 60 Hz (the capability of driving 1280 x 1024 at 60 Hz is even better). Note that you may wish to use a high-resolution display if you are using any software that utilizes a GUI for its operation. The video cable from the monitor should employ a standard DB15 video connector to interface to the AAchemy's 2D graphics subsystem.

❑ **Sensor Display Device (3D Graphics)**

The combination of the nVSensor and the AA5 high-performance 3D graphics subsystem is capable of driving resolutions up to 1600 x 1200 at 60 Hz. Ensure your display settings are compatible with whatever display device you intend to use.



Note that if you are using a fixed-frequency monitor or display device, it is necessary to configure your AA5 graphics subsystem prior to testing the display. See the list of supported video resolutions and refresh rates in Appendix B. Failure to configure display properties so that they match the display device can result in permanent damage to the display device. Please be careful, especially when using older projector systems that are not multi-sync compatible.

nVSensor Driver Installation

The nVSensor's configuration controls can be found on the **Display Properties** control panel. In order to access this control panel, use **Start > Settings > Control Panel**. After the control panel window appears, double-click on the **Display** icon (an alternative technique is to right-mouse click on the Desktop and select the **Properties** option). Select the **Settings** tab and click on the **Advanced** button. Once the **Display Properties** window appears as shown below, choose the **nVSensor** tab to access the appropriate display properties.



If your AAchemy system was shipped with the nVSensor option installed, but the above display does not appear, contact Quantum3D support (www.quantum3D.com/support). If you are directed to reload the nVSensor driver, proceed as follows.

Your system image will contain a folder called `C:\Program Files\Q3D\Drivers\nVSensor` containing the necessary files. Alternatively you can download the latest drivers from the Quantum3D

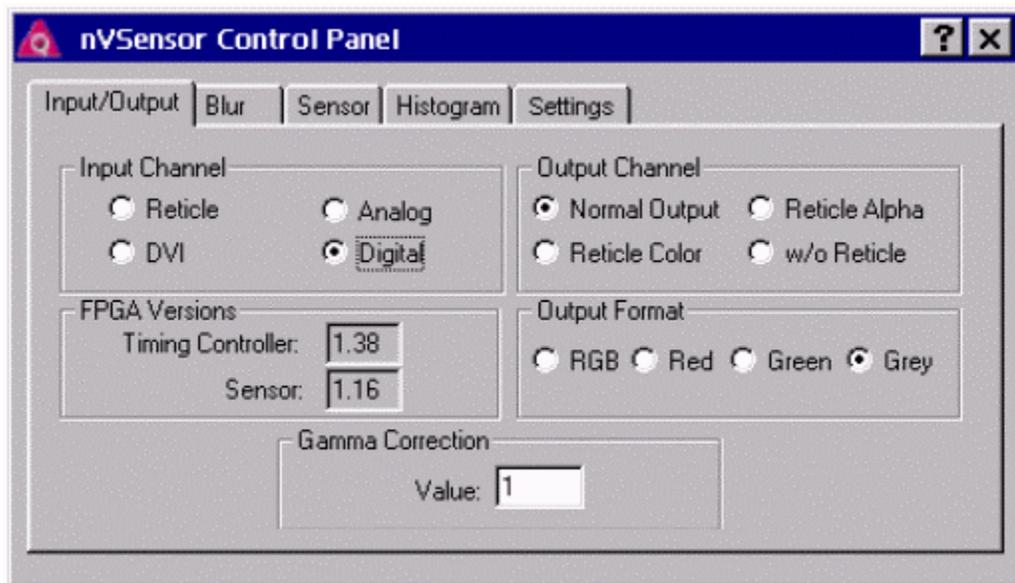
support website. Installation merely consists of right-mouse clicking on the **nVSensor.inf** file and selecting the **Install** option. Once the files have been copied over, complete the installation by rebooting the system. The **nVSensor** tab shown in the illustration above should now appear when **Display Properties** is selected.

nVSensor Setup

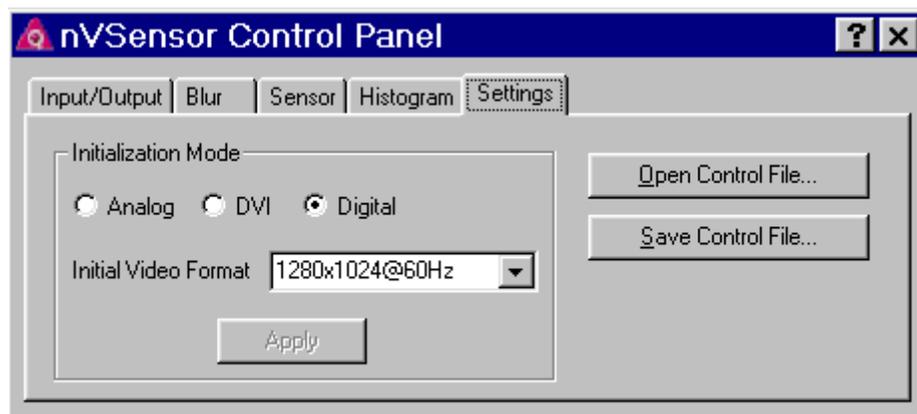
If your nVSensor has not yet been initialized (no image appears), perform the following steps to set the operational line rate. First launch the **Sensor Control Panel** by double-clicking on:

```
C:\Program Files\Q3d\nVSensor\nVSensorControlPanel.exe
```

A form similar to the following will appear:



- Select the **Settings** tab to access the form below:



- The **Initialization Mode** area will indicate the settings it believes to be current. Make sure the **Digital** interface option is selected.

- ❑ Next select the **Initial Video Format** from among the following options:
 - 640 x 480 at 60 Hz
 - 800 x 600 at 60 Hz
 - 1024 x 768 at 60 Hz
 - 1280 x 1024 at 60 Hz
- ❑ Click the **Apply** button to save your new settings, then close the **nVSensor Control Panel** and reboot the system. After this reboot, the nVSensor will be ready to run at the selected mode and video format.

Basic Operation

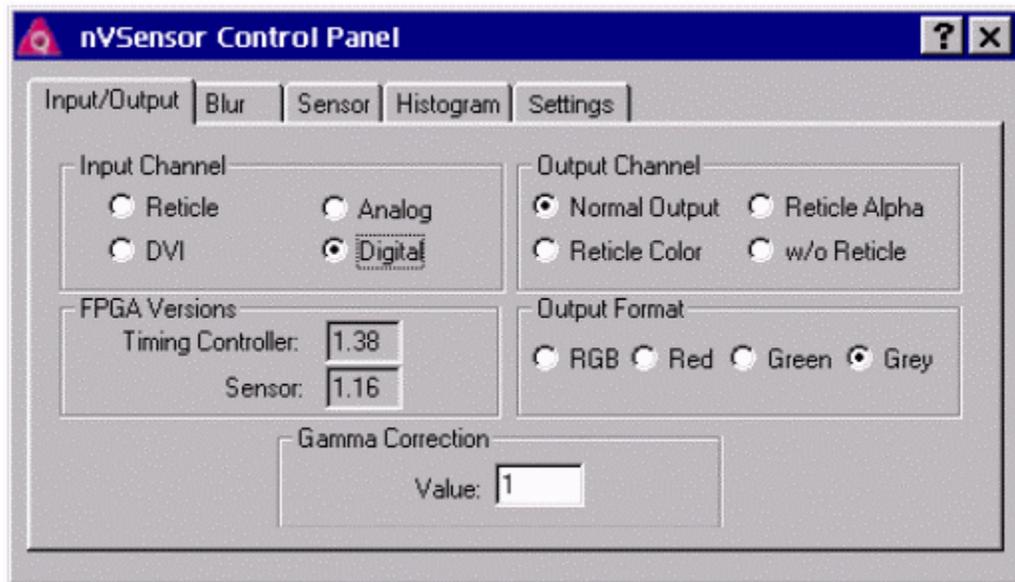
This section provides an overview into the nVSensor features that can be exercised from the **nVSensor Control Panel**. Note that you must first provide a video signal source of the proper format to the nVSensor's input.

The Input/Output Tab

Launch the **Sensor Control Panel** by double-clicking on:

```
C:\Program Files\Q3d\nVSensor\nVSensorControlPanel.exe
```

A form similar to the following will appear (on program start, all values will be read from the hardware):



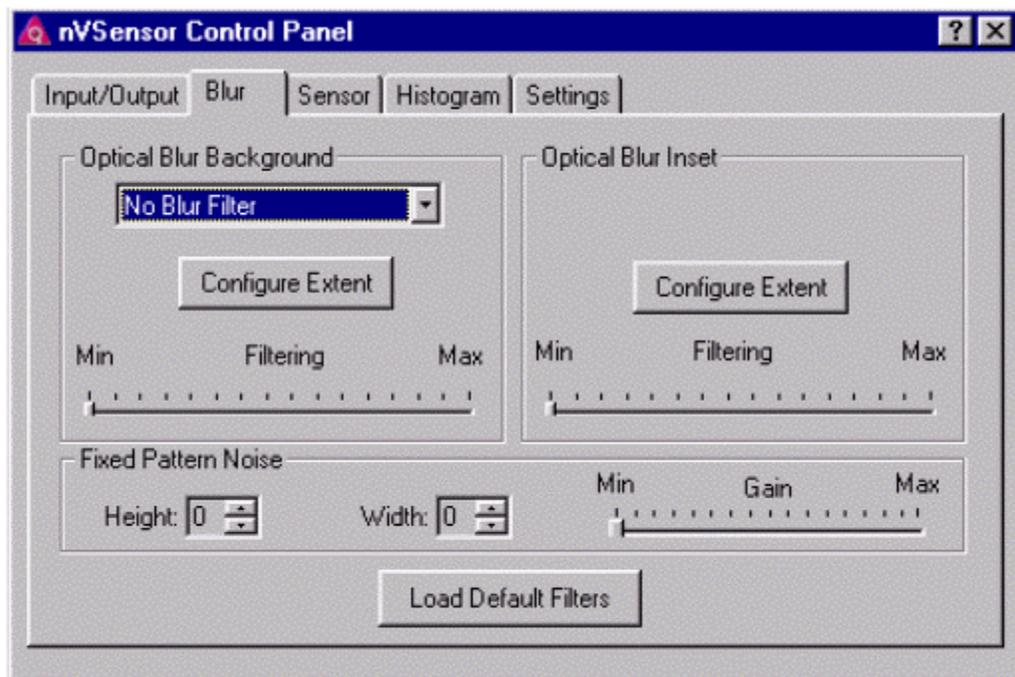
Select the **Input/Output** tab, which provides overall control of input and output.

- ❑ **Input Channel** allows you to select the signal source (this should be correct if the steps described above have been followed and the input source hasn't changed).
- ❑ **Output Channel** allows you to select from among **Normal Output** (input video with reticle overlay), **Reticle Color** (which forces reticle overlay with no input video), **Reticle Alpha** (in which the amount of alpha – reticle opacity – is rendered as black to white with no input video), and **w/o Reticle** (input video only). If you do not have an application providing a reticle then none will appear.

- ❑ **FPGA Versions** indicates the version numbers of the two FPGA devices. This is for informational purposes only.
- ❑ **Output Format** selects from among **RGB** (unmodified input – no sensor effects will appear), **Red** (sensor effects are output on the red channel only), **Green** (sensor effects are output on the green channel only), and **Grey** (sensor effects are output as a monochrome signal). Note that the input green channel is the color selected for sensor effects, which appear when red, green, or grey are selected.
- ❑ **Gamma Correction** defines a power function that can be used to calibrate the nVSensor output based on your display type. A value of 1.0 selects no correction. Values of 2.2 and higher are recommended starting points for standard CRT displays.

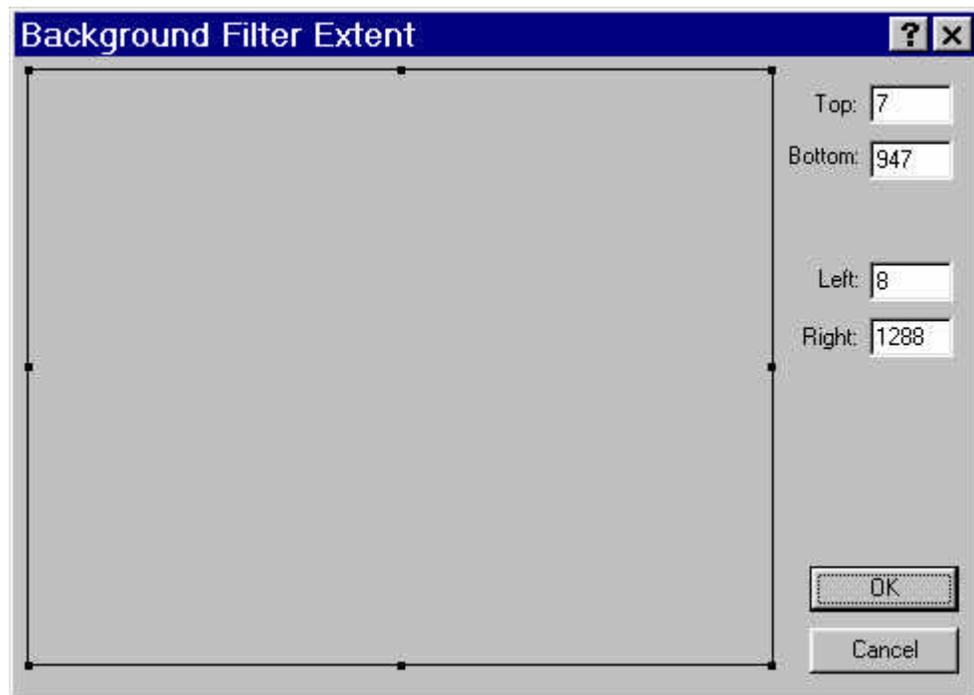
The Blur Tab

This tab controls the optical blurring effects that are performed immediately after the input and prior to the remaining sensor effects. These effects can be used to simulate focusing effects or sensor devices with inherent optical blurring. The **Fixed Pattern Noise** effect can be used to simulate failures or degradation in sensor elements.



If an application program has not initialized the blur filter contents, do so by clicking on the **Load Default Filters** button at the bottom of this form.

- ❑ The **Optical Blur Background** area of the **Blur** tab controls the filter that, when enabled, provides effects for the majority of the screen area. Controls within this area include:
 - Select between **No Blur Filter**, **Background Blur Filter** and **Background + Inset Filter**.
 - The **Configure Extent** button, which brings up a dialog box similar to the following figure:

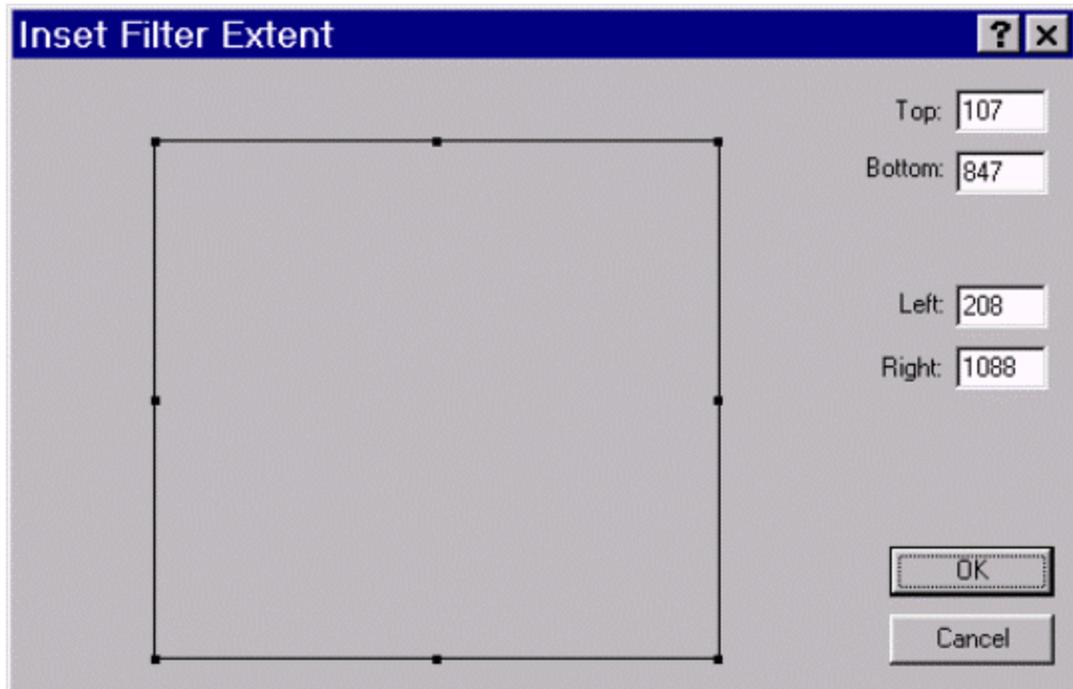


This bounding box (the black line) controls where the active (unblanked) region for blurring and all subsequent sensor effects will occur.

The filter extent defaults to the full screen coordinates (assuming these settings haven't been previously modified by an application). The bounding box can be adjusted by using your mouse to select and drag any of the eight control points (black squares) to the desired location. When the bounding box is less than full-screen, the entire box can be moved by placing the mouse cursor within the box (the cursor will change to a four-way arrow), holding the left mouse button down, and dragging the box to the desired location. The four fields labeled **Top**, **Bottom**, **Left**, and **Right** will automatically update to reflect the current settings. These fields can be edited manually for fine control of the bounding box.

The visible screen will only be updated after the **OK** button has been selected. Alternatively, you can click the **Cancel** button to avoid making any changes from this dialog box and return to the **Blur** tab.

- The **Filtering** slider controls the amount of the optical blur effect. The **Min** setting passes the image through unfiltered, while the **Max** setting provides the maximum amount of filtering in both dimensions.
- The **Optical Blur Inset** area of the **Blur** tab controls the filter that, when enabled, provides effects for a subset of the screen area. Controls within this box include:
 - The **Configure Extent** button, which brings up a dialog box similar to the following figure:



This bounding box (the black line) controls where the inset filter settings will be substituted for the background filter settings.

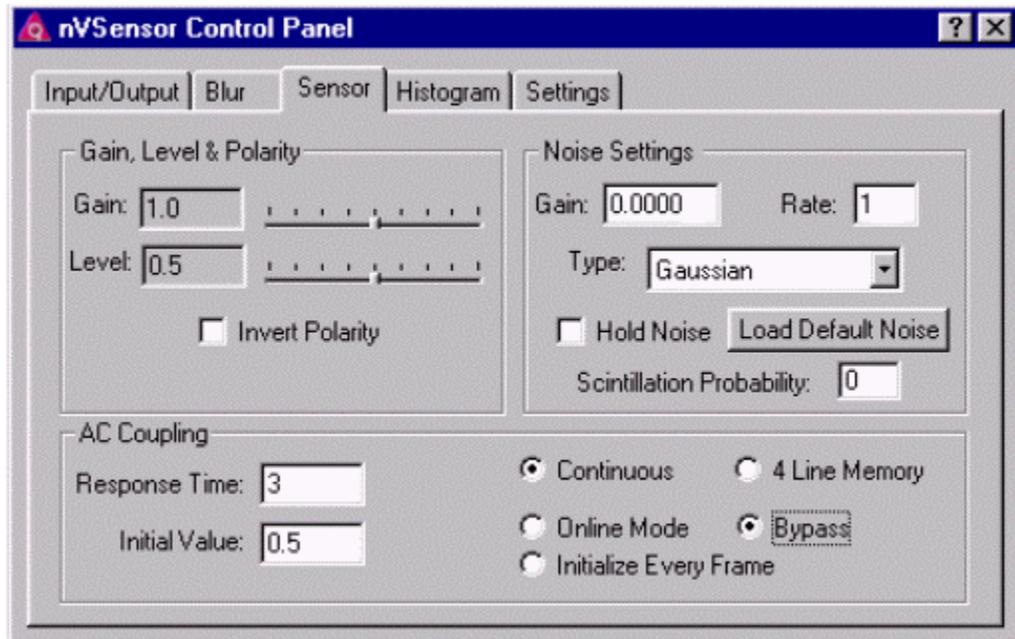
The filter extent defaults to preset values that are less than the full screen coordinates (assuming these settings haven't been previously modified by an application). The bounding box can be adjusted by using your mouse to select and drag any of the eight control points (black squares) to the desired location. When the bounding box is less than full-screen, the entire box can be moved by placing the mouse cursor within the box (the cursor will change to a four-way arrow), holding the left mouse button down, and dragging the box to the desired location. The four fields labeled **Top**, **Bottom**, **Left**, and **Right** will automatically update to reflect the current settings. These fields can be edited manually for fine control of the bounding box.

The visible screen will only be updated after the **OK** button has been selected. Alternatively, you can click the **Cancel** button to avoid making any changes from this dialog box and return to the **Blur** tab.

- The **Filtering** slider controls the amount of the optical blur effect. The **Min** setting passes the image through unfiltered, while the **Max** setting provides the maximum amount of filtering in both dimensions.
- The **Fixed Pattern Noise** area of the **Blur** tab controls an additive fixed pattern noise effect. Note that this is only visible if either the **Background Blur Filter** or **Background + Inset Filter** options have been selected as described above. Controls within this box are:
 - **Height**, which controls noise pattern height in lines. A value of 0 disables the effect. Settings from 1 to 15 are possible.
 - **Width**, which controls noise pattern width in pixels. A value of 0 selects a special "whole line" mode of noise. Values from 1 to 15 select noise patterns of various pixel widths.
 - **Gain**, which controls the contrast of the noise pattern being subtracted from the base image. The **Min** setting disables fixed pattern noise, while the **Max** setting selects the maximum amount of noise possible.

The Sensor Tab

This tab controls the majority of the remaining sensor effects (on program start, all values will be read from the hardware):

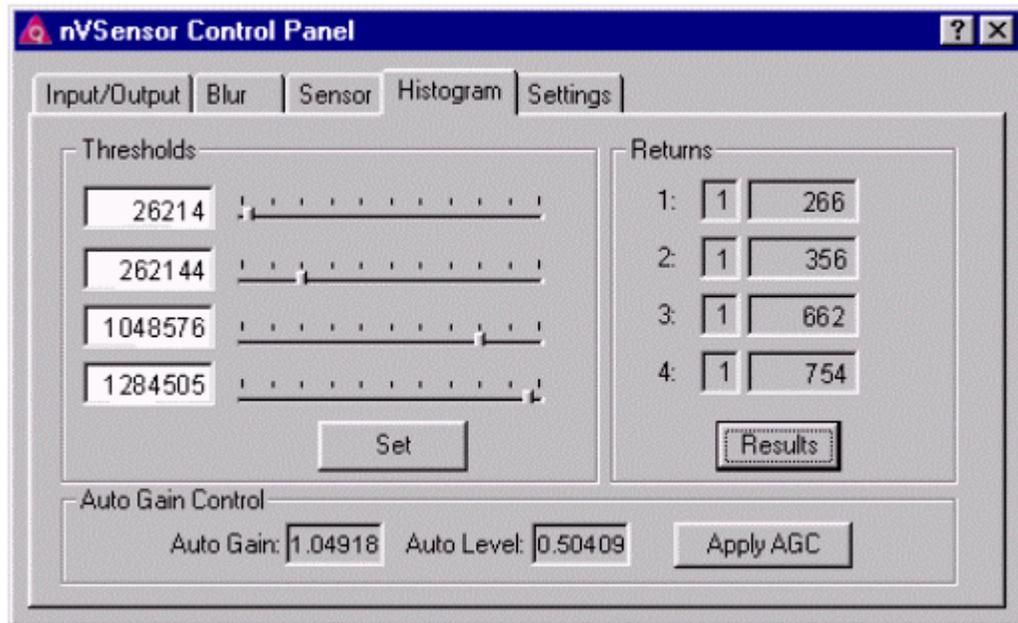


- The **Gain, Level & Polarity** area of the **Sensor** tab contains three controls that modify the image. These are intended to simulate the typical control knobs present in many sensor devices.
 - **Gain** sets the overall contrast of the image. This slider has been converted to a logarithmic scale, with 1.0 in the center, minimum on the left, and maximum on the right.
 - **Level** sets the overall brightness of the image. This slider has been converted to work with the logarithmic **Gain** slider, such that for all gain settings the leftmost **Level** setting drives the image to black, while the rightmost setting drives the image to full brightness. The nominal setting of 0.5 shown above is a good starting point. (Note that this setting interacts with the **AC Coupling Initial Value** when in **Bypass** mode as discussed below.)
 - **Invert Polarity**. When checked the display is black-hot; when unchecked the display is white-hot.
- The **Noise Settings** area of the **Sensor** tab controls the temporal noise effects. These can be used to simulate noise picked up by IR or Night Vision devices, noise in the electronics, or noise due to incomplete detector cool-down.
 - **Gain**, which can be set between 0 and 7.999, controls the intensity of a pseudo-random noise effect that is added to the signal. This noise can both brighten and darken the image.
 - **Rate**, which can be set between 0 (one pixel wide) and 15 (16 pixels wide), controls the relative width of each noise pixel.
 - **Type** selects between a simulated "Gaussian" noise curve (where the noise has a higher probability of being close to 0) and "Linear" (where the noise has equal probability of occurring across its entire range). Note that unless the noise tables have been loaded (by clicking the **Load Default Noise** button), the "Linear" selection will end up selecting no noise at all.
 - The **Hold Noise** checkbox freezes the pseudo-random noise generator for the purposes of testability or still-frame capture.

- The **Load Default Noise** button loads the two noise tables used for normal operation.
- The **Scintillation Probability** field controls how often a scintillation effect will occur. A “scintillation” is a full-brightness pixel (whose width is dependent on the **Rate** setting discussed above) that is added to the image. A setting of 0 disables all scintillation. Settings from 1 to 15 select various densities of scintillation. This effect is not modified by the **Gain** setting above, but can be frozen by the **Hold Noise** checkbox.
- The **AC Coupling** area of the **Sensor** tab provides the simulation of a capacitively-coupled signal typical of many sensor devices. The time constant of this effect, and whether it operates on the entire image or merely a small section of detectors, can be controlled. In effect, this circuit calculates a running average of the pixel intensities (based on response time) and subtracts that average from the image before it gets sent to the **Gain, Level & Polarity** controls.
 - **Response Time**, which can be set between 0 and 15, selects between 16 different time constants, with 0 providing the fastest response time.
 - **Initial Value** provides the starting value of the running average. This is only useful when the **Bypass** mode is selected (in which the initial value is constantly subtracted) or the **Initialize Every Frame** mode is active (for testability). When in the **Bypass** mode, it is suggested that the value set here is also used as a starting-point for the value of the **Level** control discussed above.
 - The **Continuous** and **4 Line Memory** radio buttons select between a mode that operates continuously on every pixel, and one that operates only on individual 4-line groups. The **4 Line Memory** mode can be used to simulate scanning arrays in which each detector requires **AC Coupling** that is independent of all other detectors. This can provide the characteristic "banding" that occurs in IR sensors, whereby pixels to the left and right of a "hot spot" are driven darker than the pixels above or below them due to the fact that the detectors are scanning different regions of the image.
 - The **Online Mode**, **Initialize Every Frame**, and **Bypass** radio buttons select between three different modes. **Online Mode** is the typical selection when **AC Coupling** effects are desired. **Initialize Every Frame** causes the simulation to restart AC Coupling with the **Initial Value** asserted at the top of every field. **Bypass** turns off the AC Coupling effect, thereby causing the **Initial Value** to be subtracted constantly from the input image.

The Histogram Tab

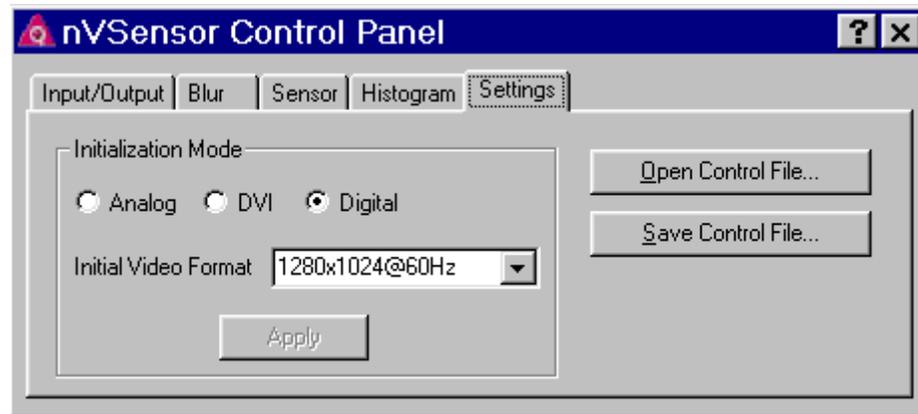
This tab can be used to enable and control special histogram collection circuitry. The main function of this feature is to provide a basis for *Automatic Gain Control (AGC)* and *Level control*. On program start, all values will be read from the hardware. The **Threshold** settings and sliders are updated whenever any changes have occurred elsewhere (for example, using other tabs in the **nVSensor Control Panel**):



- The **Thresholds** area of the **Histogram** tab allows you to control each of the four threshold compare values (you can do this by explicitly keying-in the values or by using the appropriate slider controls). The edit fields should contain absolute pixel numbers (greater than 0 and less than the maximum number of pixels in the active image). The sliders are calibrated in 1% increments. The settings shown above were chosen to be 2%, 20%, 80%, and 98%. Clicking the **Set** button causes the histogram collection hardware to begin continuous collection and analysis using the defined threshold values.
- The **Returns** area of the **Histogram** tab will show the results of the histogram analysis function performed in the hardware every time the **Results** button is clicked. The values in the left-hand column will be 1 or 0 indicating whether the result is valid or not, respectively. The right-hand column shows the relative pixel intensity returned (this is scaled between 0 and 1023 – in the pipeline after noise collection and AC coupling – but before manual gain and level). The example shown above indicates that 26,214 pixels (first threshold) were of brightness 266 (first return) or less; 262,144 pixels were of brightness 356 or less; 1,048,576 pixels were of brightness 662 or less; and 1,284,505 pixels were of brightness 754 or less. In this particular example, 1,310,720 pixels (a 1280x1024 pixel image) were the maximum available.
- The **Auto Gain Control** area of the **Histogram** tab provides a simple non-continuous simulation of automatic gain and level. After clicking the **Results** button, two values will appear in the **Auto Gain** and **Auto Level** fields. These are suggested values based on an algorithm that attempts to drive the first return value to black and the fourth return value to full brightness. Clicking the **Apply AGC** button copies these two values into the **Gain** and **Level** controls (see the **Sensor** tab discussions above) allowing you to see the effects of AGC.

The Settings Tab

This tab allows certain administrative functions to be performed. It reads the registry settings as the program first executes and displays the current **Initialization Mode**:



- ❑ As was discussed earlier in this Appendix, the **Initialization Mode** area of the **Sensor** tab allows you to specify the mode and video format with which the nVSensor will be initialized after any subsequent reboots. Make sure the **Digital** interface option is selected.
- ❑ Next select the **Initial Video Format** from among the following options:
 - 640 x 480 at 60 Hz
 - 800 x 600 at 60 Hz
 - 1024 x 768 at 60 Hz
 - 1280 x 1024 at 60 Hz
- ❑ Click the **Apply** button to save your new settings, then close the **nVSensor Control Panel** and reboot the system. After this reboot, the nVSensor will be ready to run at the selected mode and video format.
- ❑ The **Open Control File** button opens a standard Windows dialog box, which allows you to locate and load a file containing control settings that were previously saved using the **Save Control File** button (described below). This is useful for restoring the settings for the simulation of particular sensor devices.
- ❑ The **Save Control File** button opens a standard Windows dialog box, which allows all current control settings from the **Input/Output**, **Sensor**, and **Histogram** tabs to be saved in a file whose name you specify. These ".ini" files are ASCII, and thus readable, but we do not advise you to edit them manually.



Notes