Barracuda Installation Manual

Issue: **1.0**
Date: **10/Dec/98**
Doc. Ref: **3351MAN001**
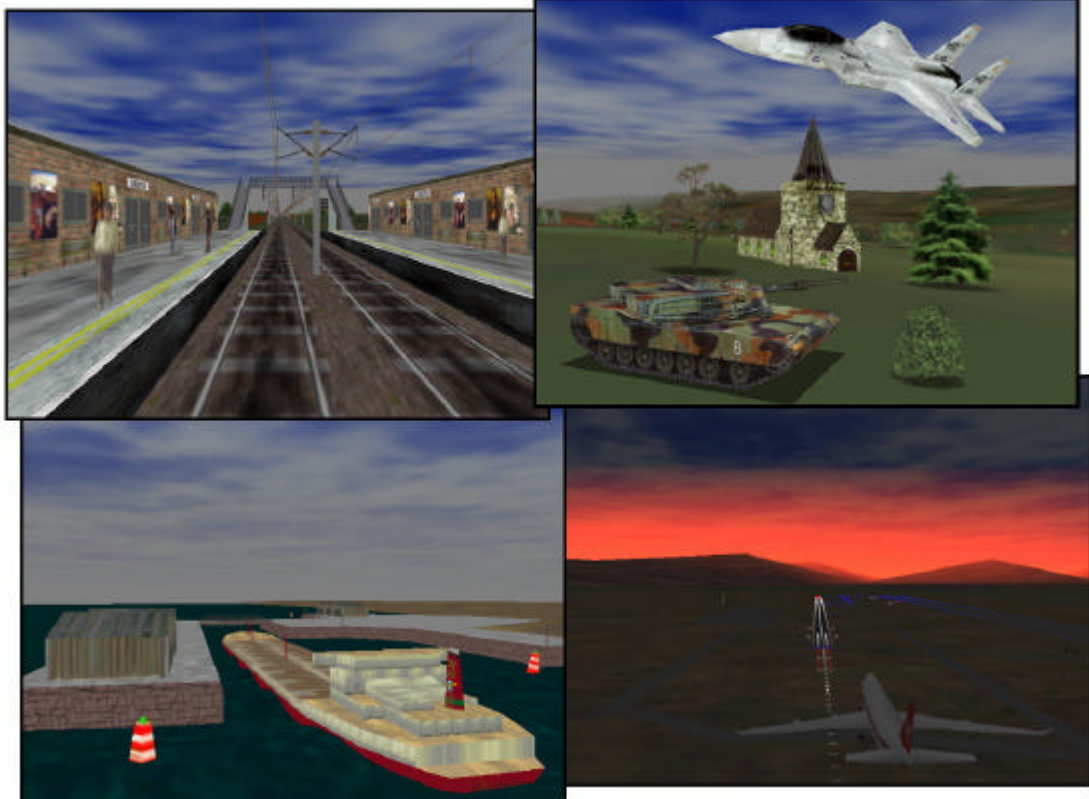Author: **PMS**

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Primary Image Ltd.

Barracuda™ Installation Manual

Issue 1.0

16 September 1998

1   Introduction

Congratulations on your decision to use Primary Image's **BARRACUDA** hardware for your graphics system. We hope your projects using this hardware run smoothly. To this end, we recommend that you read this manual fully.

We will be glad to answer any technical queries you may have, preferably via e-mail at support@primary-image.com, or by phone on +44 (0)181 339 9669 (ask for support).

A brief outline of the contents of this manual follows:

Section 2 describes the various configuration options that are available with the **BARRACUDA** hardware.

Section 3 deals with how to install the **BARRACUDA** hardware and software on your PC.

Section 4 is a trouble-shooting section in the event that you are unable to get your **BARRACUDA** hardware working.

2   Configuration Options

The **BARRACUDA** hardware offers many configuration options to satisfy different price/performance/functionality requirements. This section explains what these different options are and how they affect the system.

The options can be split into two broad categories:

- Options local to each **BARRACUDA** card.

- Options available by connecting multiple **BARRACUDA** cards together.

The block diagram below shows the main components of the **BARRACUDA** hardware. Referencing this diagram may clarify some of the options.
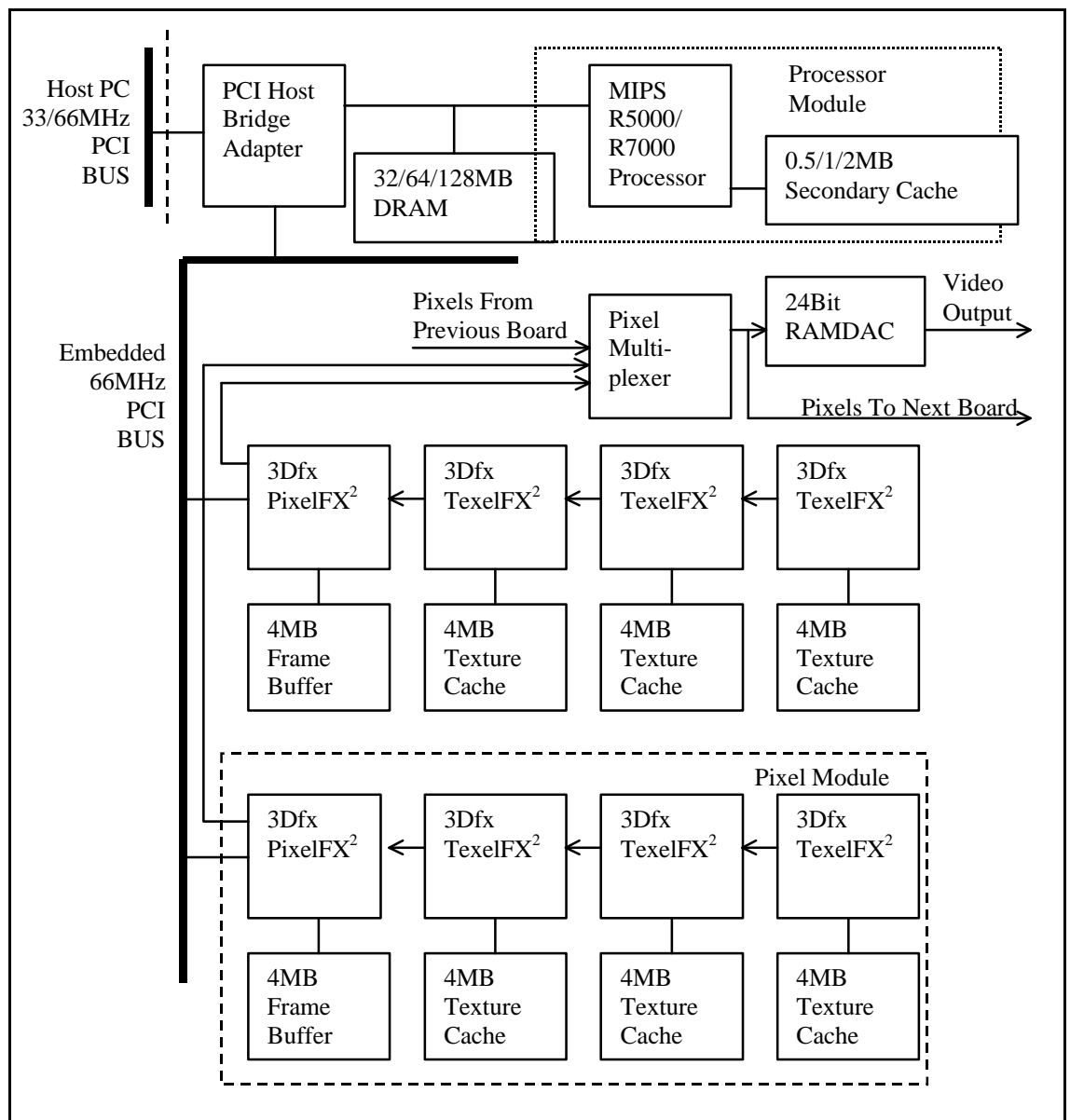
2.1   Local to each Board

The **BARRACUDA** card has two main functions to perform:

- Performing the geometry calculations: This includes database management, tree traversal, vertex transformation, lighting, and polygon setup.

- Performing the rendering: This is the process of actually rasterising the polygons into the frame buffer.

Each **BARRACUDA** has a processor module. The module may have either an R5000 or an R7000 processor for performing the geometry calculations.

A **BARRACUDA** may have either one or two Pixel Chain units for performing the rendering. Each Pixel Chain consists of one 3dfx Voodoo PixelFX^2 and from 1 to 3 3dfx Voodoo TexelFX^2's. Each Pixel Chain is capable of rendering at approximately 100Mpixels/second.

Options available affecting the geometry calculations are:

- 266MHz R5000 or 266/300MHz R7000 (available soon) processor.

- 32Mbytes, 64Mbytes or 128Mbytes (available soon) of DRAM. About 4M Bytes of the DRAM is used by the **TEMPEST** code itself. The rest is available for 3D model databases, textures, etc.. So for very large databases you may require the 64Mbyte or 128MByte option.

Options that affect the rendering are:

- One or two Pixel Chain Units. Two Pixel Chain Units can be configured either in SLI mode or non-SLI mode by software. In SLI mode, both Pixel Chain Units work on the same polygons in parallel, each one doing alternate lines, this mode doubles the pixel fill rate to approximately 200Mpixels/second. In non-SLI mode each pixel chain unit works independently on different polygons, custom hardware merges the outputs of the two units together to achieve several effects. With two pixel chain units you can achieve **one** of the following:

    double the pixel fill rate (SLI mode),

    or generate 2 sub-pixel anti-aliasing (non-SLI mode),

    or run video modes more than 1024 pixels wide (non-SLI mode).

In the non-SLI modes the achievable Geometry rate may drop by up to 30%.

2.2 Multi-Board Configurations

Multiple **BARRACUDA** cards may be connected together in a single graphics system.

A graphics system will consist of one or more channels, where a channel is defined as the hardware required to generate a single video output. Each channel may consist of up to 8 **BARRACUDA** cards.

All the **BARRACUDA** cards in a single channel **must** be connected using the intra-channel cables. If the channels are required to be frame locked, then the master boards in each channel should be connected via inter-channel cables. This is explained in more detail in section 3.

Multiple boards in a channel can be used to achieve any one of the following effects:

- 2, 4 or 8 boards each configured in SLI mode may be used to obtain 2, 4 or 8 sub-pixel anti-aliasing respectively. Geometry and rendering rates are the same as a single board in SLI mode.

- 1, 2 or 4 boards each configured in non-SLI mode may be used to obtain 2, 4 or 8 sub-pixel anti-aliasing respectively. Geometry and rendering rates are the same as a single board in non-SLI mode.

- 2, 4 or 8 SLI configured boards may be used to generate video modes wider than 1024 pixels with 1, 2 and 4 sub-pixel anti-aliasing respectively. This has the advantage over using a single board in non-SLI mode in that the Geometry performance is not compromised and the achievable rendering rate is doubled.

- 2, 4 or 8 non-SLI configured boards may be used to generate video modes wider than 1024 pixels with 2, 4 and 8 sub-pixel anti-aliasing respectively. Geometry and rendering rates are the same as a single board in non-SLI mode.

2.3 Implementing the Different Configurations

A second Pixel Chain Unit may be added to a board as a plug in module.

All other local board options are manufacturing options, though some options may be added subsequently by returning the board for upgrade. Contact your sales representative for information on this.

2, 4 or 8 boards per channel and multiple channels should be cabled together as described in section 3.

The mode in which each channel operates is a function of the video mode, the number of boards connected in the channel, and the environment variable CGIMODEn where n is the channel number. n starts from 0 for the first channel in the system.

CGIMODEn should be set to one of the following:

ANTIALIAS   Causes modules to be configured in non-SLI so that each
                   card generates 2 sub-pixels for anti-aliasing. Thus a single
                   board channel will generate 2 sub-pixel anti-aliasing, a
                   dual board channel will generate 4 sub-pixel anti-aliasing,
                   and a quad board channel will generate 8 sub-pixel anti-
                   aliasing. The animation rate may drop by up to 25% in this
                   mode.

TTL   This option may be used when video frame locking the
                   entire graphics system to some other video source.
                   Contact your sales representative if planning to do this.
                   This option should be set if the external video source is
                   generating TTL level signals, otherwise ECL level signals
                   are expected.

These options may be used in conjunction, eg.

set CGIMODE0=ANTIALIAS TTL

The following table shows all the possible configurations. Geometry speeds are
specified relative to a single card with no module.

Hi-Resolution in the Special column refers to the use of video modes above 1024
pixels wide or with a dot clock of greater than 85 MHz.

SPAA in the Special column refers to the number of sub-pixels of anti-aliasing
provided by the configuration.

Table 2-1: **BARRACUDA** *Configuration Options*

Number of Cards	Maximum Resolution	Max Dot Clock	Special	Rendering Speed (MPixS^{-1})	Geometry Speed	Module	CGIMODEn
1	960x720[1]	85MHz	None.	100	1	None	N/A
1	1024x768	85MHz	None.	200	1	SLI	N/A
1	960x720[1]	85MHz	2 SPAA.	100	¾	Non-SLI	ANTIALIAS
1	1280x1024	150MHz	Hi-Resolution.	200	¾	Non-SLI	N/A
2	960x720[1]	85MHz	2 SPAA.	100	1	None	N/A
2	1024x768	85MHz	2 SPAA.	200	1	SLI	N/A
2	960x720[1]	85MHz	4 SPAA.	100	¾	Non-SLI	ANTIALIAS
2	1280x1024	150MHz	Hi-Resolution.	200	1	None	N/A
2	1280x1024	150MHz	Hi-Resolution.	400	1	SLI	N/A
2	960x720[1]	85MHz	4 SPAA.	100	¾	Non-SLI	ANTIALIAS
2	1280x1024	150MHz	2 SPAA, Hi-Resolution.	200	¾	Non-SLI	N/A
4	960x720[1]	85MHz	4 SPAA.	100	1	None	N/A
4	1024x768	85MHz	4 SPAA.	200	1	SLI	N/A
4	960x720[1]	85MHz	8 SPAA.	100	¾	Non-SLI	N/A
4	1280x1024	150MHz	2 SPAA, Hi-Resolution.	400	1	SLI	N/A
4	1280x1024	150MHz	4 SPAA, Hi-Resolution.	200	¾	Non-SLI	ANTIALIAS
8	960x720[1]	85MHz	8 SPAA.	100	1	None	N/A
8	1024x768	85MHz	8 SPAA.	200	1	SLI	N/A
8	1280x1024	150MHz	4 SPAA, Hi-Resolution.	400	1	SLI	N/A
8	1280x1024	150MHz	8 SPAA, Hi-Resolution.	200	¾	Non-SLI	ANTIALIAS

[1] Though this video mode is possible in this configuration, it is recommended that you do not use modes greater than 896x672 for maximum performance. This is because some of the frame buffer memory is used to FIFO commands that are sent to the Voodoo^2 chips. At these maximum resolutions no memory is available for the FIFO.

3   Installation

3.1   Hardware Installation

CAUTION: The *BARRACUDA* hardware is sensitive to damage by electrostatic discharge. Precautions should be taken whenever handling the boards. Preferably an earthed wrist-strap should be worn during the installation procedure. If this is not possible, you should touch the chassis of the PC (which should be plugged in but not turned on) prior to removing the boards from their protective bag, then avoid moving your feet until after the board is inserted in the PC.

IMPORTANT: Your *BARRACUDA* card consumes more current than is allowed by the PCI specification. For this reason additional power must be supplied to the board. You will need to connect the power from a spare disk drive power connector in your PC to the connector *P17* on each *BARRACUDA* in the system. This can be achieved using the power connectors provided. The power connectors allow for up to two *BARRACUDA*'s to be powered from a single connector from your PC's power supply. If you attempt to power more than two *BARRACUDA*'s from a single connector then you may experience problems with the Barracuda cards crashing due to voltage drops in the power connector.
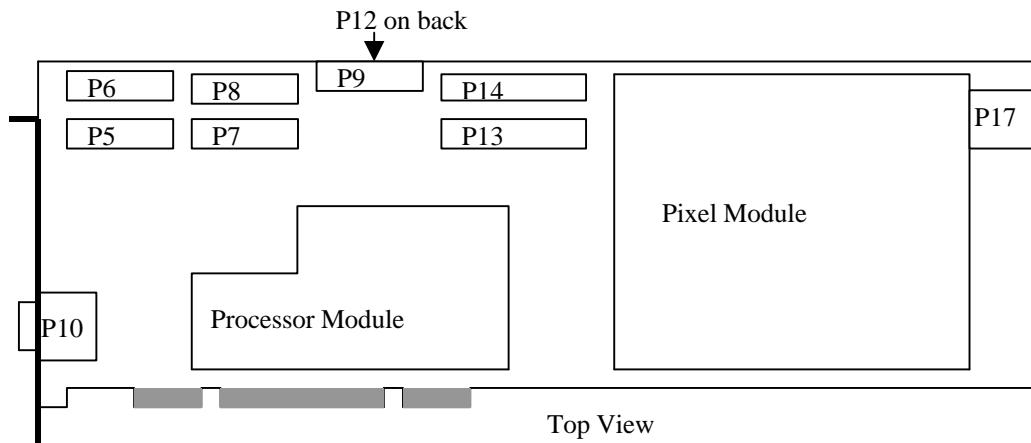
IMPORTANT: *BARRACUDA* cards require a certain degree of ventilation to prevent them from overheating. This means you should have some form of forced air cooling blowing over the *BARRACUDA* cards.

When the 'right-most' and 'left-most' boards are referred to, this is for when the PC is viewed from the front. If your PCI back-plane is vertical, read 'upper-most' for 'right-most' and 'lower-most' for 'left-most'.

The following instructions refer to two types of cable. These are:

- Intra-channel cables. These are used to connect together all the boards that comprise a channel. They are recognisable as a flexi-PCB cable. You will notice that the connector on the one end protrudes slightly more than the connector at the other end. A pair of connectors is required between each board in the channel.

- Inter-channel cable. These are used to connect together the clock-master card (ie. The left most card) of each channel in a multi-channel system. They are recognisable as a twisted pair cable. You will notice that the connector at one end is 14-way, whilst that at the other is 15-way.

The diagram below shows the approximate location of each of the connectors on the *BARRACUDA* card.

P12 on back

| P6 | P8 | P9 | P14 | | P17 |
| P5 | P7 | | P13 | Pixel Module | |

P10

Processor Module

Top View

The following procedure should be used to insert the boards in your system.

Step 1:   With the power off, remove the computer cover. For each **BARRACUDA** card you require in your system, you will need to locate a free PCI slot that is capable of taking a full length PCI card. Due to the length of the intra-channel connectors, there may be no more than one PCI slot between any two boards in a channel. Remove the blanking plate from each of the slots to be used. **BARRACUDA** cards are slightly higher than the PCI specification allows in order to fit all the required components. The boards are the same height as full size ISA cards so most PC's should accommodate them without a problem.

Step 2:   If any of the channels in your configuration consist of multiple cards, then you must perform the following operation before continuing. For each board apart from the left most board of each channel, you should insert the long connectors from a pair of intra-channel connectors into the connectors **P5** and **P7** on the **BARRACUDA** card. This should be done in such a way that the cables naturally protrudes up above the card. Leave the other ends free for now.

Step 3:   Insert all of the **BARRACUDA** cards firmly into the PCI slots, ensuring that each one is fully located in the slot.

Step 4:   The free ends of each of the intra-channel connectors should now be inserted into connectors **P6** and **P8** of the card to its left. As an example, the figure below shows a cross sectional view of what a 4-board channel would look like.

Step 5: Connect your monitor(s) to **P10**, the SVGA connector, of the right-most **BARRACUDA** card of each channel.
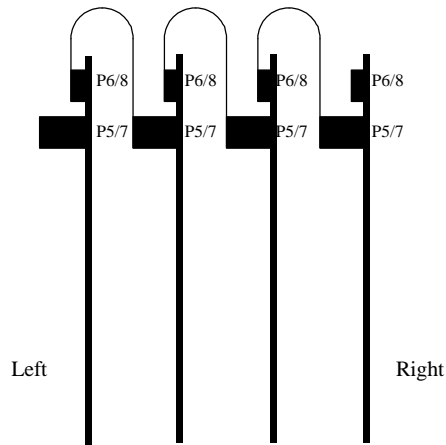

Vertical Cross-section Of a Single Channel

The following step is only required for multi-channel systems.

Step 6: Plug the 15-way connector of one of the inter-channel connectors into **P12** on the left-most card of one of the channels. Connect the other end into **P9** of the left-most card of another channel. Repeat this until all the channels are connected together in a series.

The order in which the channels are connected together using the inter-channel connectors determines which channel is channel 0, which is channel 1, etc. Channel 0 will be the channel that contains the card that has connector P9 empty. Channel 1 will be the channel that contains the card that is connected to channel 0. This continues such that the last channel is the channel that contains the card that P12 empty. This is illustrated below.
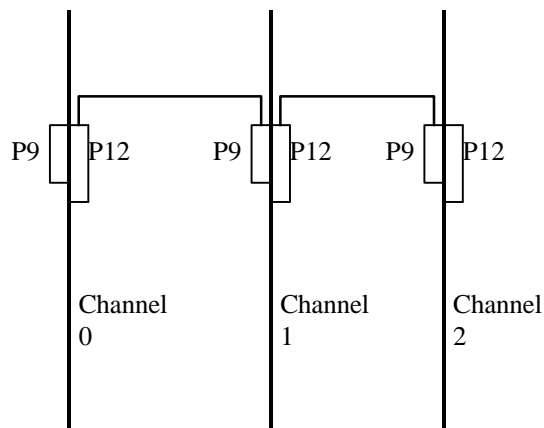
Top View of 3 channels of 1 card each

If you ever need to remove the inter-channel connectors, you should be careful NOT to extract them by pulling on the wires. Doing this may break the cable.

3.2   Driver Installation

You should install the ***BARRACUDA*** hardware as described in section 3.1 before installing the drivers.

Driver installation is performed differently dependant upon whether you are using Windows 95/98 or Windows NT. These are covered in the next two sub-sections.

Generally you would perform the installation directly from the '***TEMPEST*** Development Kit' CD, the instructions below assume this to be the case. If the target PC does not have a CD Drive then installation from floppy disk is also possible. On a PC with a CD Drive, copy the directories 'Win95' and 'WinNT' (ensuring that you preserve the directory structure) onto a blank floppy disk. Use this disk instead of the CD when performing the installation on the target PC.

3.2.1   Windows 95 Driver Installation

The following instructions apply to Windows 95, OSR2 (OEM Systems Release 2 of Windows 95, some PC's are shipped with this version pre-installed) and Windows 98.

Windows 95 should detect the presence of the ***BARRACUDA*** the first time you turn on the machine after fitting the boards. If you have any problems during the installation, refer to section 4 on trouble-shooting. The following steps should be performed.

Step 1:   Windows will display a message box saying that it has detected new hardware. It will say that it is a PCI Multi Media Video Device. It will prompt you with a message saying that you must install a driver for it. Click the 'Have Disk…' button. A box will appear asking where the drivers are located. Insert the '***TEMPEST*** Development Kit' CD into your CD Drive. Enter the directory

[DRIVE LETTER]:\Win95

Where *[DRIVE LETTER]* is the letter of your CD Drive.

Press return. Windows will then list the drivers on the CD that match the device it has found. There should be only one of these, so select it.

Windows will copy the relevant drivers and update its registry. You will then be told that you must shut down and restart in order to use the driver. Click cancel on this so that the PC will not restart.

Step 2:   If you have installed more than one ***BARRACUDA*** card, Windows will install all the other cards automatically.

Step 3:   Shut down and restart.

The set-up procedure installs the file *PIMEMMAP.vxd* into the directory *%WINROOT%\system*. The registry will also be updated to cause the driver to be started when the system boots.

3.2.2 Windows NT Driver Installation

The following instructions apply to both Windows NT version 3.51 and version 4.0.

Insert the '***TEMPEST*** Development Kit' CD into the PC's CD Drive.

Either from a DOS prompt, the File Manager, or the Explorer, run the following:

[DRIVE LETTER]:\WinNT\i386\setup.exe

Where *[DRIVE LETTER]* is the letter of your CD Drive.

This will copy the drivers *PIMAPMEM.sys* and *PIGENPRT.sys* into the directory *%WINROOT%\system32\drivers* and update the registry to cause these drivers to be started at boot up.

You should then shut down and restart your PC.

4 Trouble-Shooting

4.1 Installation Problems

The following Q&A sections will try to help you overcome any installation problems.

4.1.1 Windows 95 did not prompt me for new drivers when I first installed my Barracuda card.

Check that you have attached the auxiliary power cable to all of the Barracuda cards in the system. See section 3.1. If you have not, then power down the system, install the power connectors and reboot.

If the power connectors are installed and Windows 95 did not detect the Barracuda card at all, and thus did not prompt you to install the driver, then you must install the driver manually. To do this:

Click on **Start->Settings->Control Panel**.

Double click on **Add New Hardware**.

Click on **Next.**

Click on **No** when prompted if you want Windows search for new hardware.

Click on **Next**.

Double click on **Sound, video and Game Controllers.**

Click on **Have Disk**

Insert the '**TEMPEST** Development Kit' CD into your CD Drive. Enter the directory

[DRIVE LETTER]:\Win95

Where *[DRIVE LETTER]* is the letter of your CD Drive.

Click on **OK**.

Double click on **Barracuda Processor PCI Bridge**.

Click on **Next**.

Click on **Finish**.

This will copy the Barracuda drivers to the *windows\system* directory and update the registry so that the drivers are started on power up.

You should now restart the PC.

4.1.2   I have installed the drivers, but none of the Barracuda demos will work.

Check that you have attached the auxiliary power cable to all of the Barracuda cards in the system. See section 3.1. If you have not, then power down the system, install the power connectors and reboot.

If this is not the problem then you should run the utility *DETECT.exe* from the directory *\tempest\utils.* This program will scan the PCI bus and check each Barracuda card found for valid configuration. If any Barracuda card is set up incorrectly by the BIOS then this will be reported. If no errors are reported, and the number of cards detected matches the number of Barracuda cards in your PC, then the cards are set up correctly. Otherwise see section 4.1.3.

4.1.3   I have run *DETECT* and it has reported that the Barracuda cards are not correctly set up or does not report the correct number of cards.

If this occurs then it means that your PC's BIOS has not set up the PCI system correctly. This problem is most common in multi-board systems which have multiple PCI buses. Many BIOS's do not correctly set up multi PCI bus systems due to bugs in the BIOS software.

If you are using Windows 98 or OSR2 release of Windows 95 then you can force windows to set up the PCI bus when it starts up. Windows will generally make a better job of it than the BIOS. To do this follow this procedure:

Click on **Start->Settings->Control Panel**.

Click on **System**.

Select the **Device Manager** tab.

Click on the **+** symbol adjacent to **System Devices**.

Double click on **PCI Bus**.

Select the **Settings** tab.

Under **Device Enumeration** select the **Use Hardware** button.

Select the **Override Bridges** button.

Click on **OK**.

Reboot the machine.

If detect still does not report the correct number of cards, or if you are running Windows NT or Windows 95 original version then read on.

Primary Image supplies a utility called GALCONF that may be used to fix PCI to PCI bridges that have been incorrectly set up. This is the most common reason for PCI problems. Before running the utility you should ensure that there are no devices

except for Barracuda or Piranha cards on any PCI bus that contains a Barracuda or Piranha card, or in any PCI bus that is in the PCI bus hierarchy back up to bus 0.

GALCONF.exe is located in the *\tempest\utils* directory on the '**TEMPEST** Development Kit' CD. If you run it with no options then you will get a warning message to inform you that the utility may generate side effects, and thus all other applications should be shutdown before running it. You can use the *nowarn* command line parameter to suppress this warning message.

GALCONF will scan the PCI bus to determine what PCI memory resources are currently being used by other devices, such as Graphics Cards, etc. It will then determine the largest contiguous range of memory that is currently unused by other devices. Finally, it configures all the Barracuda's and Piranha's in the PC to use that memory range.

By default, *GALCONF* assumes that the BIOS has at least configured the bus numbers of all the busses in the system. If, when you run *GALCONF*, you get the message:

!!! The BIOS has not correctly configured all the busses in your system.

!!! You should re-run this utility with the 'bus' option

Then it means that your BIOS has made no attempt to configure any PCI to PCI bridge chips. In this case, you should use the command line option *bus* when invoking *GALCONF*.

After running *GALCONF* you should run *DETECT* again to check that all the Barracuda and Piranha cards are now configured correctly. If this still does not work then see section 4.1.5.

Once you have determined the correct settings for GALCONF, you will need to run it up each time you restart your computer. You could place a shortcut to GALCONF in your start up folder so that GALCONF gets invoked automatically each time you start up windows. If you wish to start up your application automatically when the PC boots you should take special care to ensure that GALCONF is run before the application starts. The easiest way to do this is to put a shortcut to a batch file in the start up folder. The batch file should run GALCONF followed by your application. If you simply put both GALCONF and your application in your start up folder, then they could get executed in any order.

4.1.4   When I run a Barracuda application, I get a dialogue box telling me that a driver is not installed.

You have not installed the Barracuda device drivers correctly. For Windows 95 see section 4.1.1. For Windows NT, see section 3.2.2.

4.1.5   If all else fails.

If you have carefully followed the advice given in the previous sections, but you still cannot get any Barracuda application to run, then you should contact Primary Image's Technical Support, preferably via e-mail (support@primary-image.com). Please include a full description of what you have tried. Also attach the verbose

output of *DETECT* (/v option). This can be done most easily by dumping the output to a file,

eg.   *detect /v > detect.out*