Millennium II
Graphics Option Module

Installation Guide

Order Number: EK–MATRX–IG. A01

June 1997

This book introduces the Millennium II graphics option module. Use the information in this book to install the option module hardware and the software drivers, to configure the monitor, and to troubleshoot the option. You will also find technical specifications for the module in this book.

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Overview

Product Features

The Millennium II graphics option module uses 64-bit graphics engine technology, which provides superior performance with Windows, 3D, and digital video. To further accelerate 3D programs, the Millennium II has hardware-based texture-mapping and uses bus mastering. This module supports display area resolutions up to 1600 x 1200. You can also upgrade your Millennium II module with more RAM.

Millennium II is completely VGA-compatible and supports all VESA standards: VBE 2.0 (Super VGA modes), DPMS (energy saving). It provides many additional features including a high-speed, high-resolution, flicker-free display.

Drivers and Utilities

Drivers and utilities are shipped with the Millennium II Graphics Option as part of software kit QB-5L66AA, Version 1.0.

About This Manual

This manual describes the installation of the Millennium II option module for PCI bus computer systems. For more information on a particular Windows program, click on the Help button in the program screen.

Organization

This manual is organized into five chapters:

Chapter 1, "Hardware Installation," describes the hardware components and explains how to configure the PCI board and install the Millennium II option module.

Chapter 2, "Software Installation for Intel Systems," describes the software features and explains how to install the software drivers and adjust settings on Intel hardware.

Chapter 3, "Software Installation for Alpha Systems," describes the software features and explains how to install the software drivers and adjust settings on Alpha hardware.

Chapter 4, "Troubleshooting" explains how to identify the cause of a particular problem and determine corrective action.

Chapter 5, "Specifications" provides display capabilities, general specifications, and connector pinout information.

Conventions

This guide assumes that you are familiar with basic functions like click, right-click, and double-click. It also assumes that you are familiar with the basics of the operating system you are using. The following table lists the typographical conventions used in this guide.

Convention	Meaning
Warning:	A warning contains information to prevent injury.
Caution:	A caution contains information essential to avoid damage to equipment or software.
Note:	A note calls the reader's attention to important informa-tion.
`[Ctrl]/[Alt]/[Del]`	Keyboard keys are shown in square brackets, with slash signs to indicate keys to be pressed simultaneously.
`boot`	File and path names are shown in this special typeface..
1	In figures, a numbered callout labels a specific part. In text, a corresponding numbered callout explains the labeled part of the figure.
Green text	In online help, green text indicates an item you can click on to jump to related information..

Reader's Comments

DIGITAL welcomes your comments on this or any other manual.

If you have suggestions for improving particular sections or if you find any errors, please indicate the manual title, order number, and section numbers.

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1

Hardware Installation

Before You Begin

Be sure to make a backup copy of theMillennium II diskette using the DOS diskcopy command, and use the backup diskette during the installation. Installation of the hardware requires the following system components:

A 486, Pentium, or Alpha PCI computer

5.5 MB of hard disk space

A high-resolution analog RGB monitor (multi-sync recommended)

All the necessary connector cables

A flat-head or Phillips screwdriver may be necessary

Microsoft Windows NT 4.0 or later, or equivalent

_____**CAUTION** _____

Static electricity can severely damage electronic components. Take these
precautions before touching the option module or the inside of your computer:

1. Turn off all power to the equipment.

2. While the system is turned off but plugged in (grounded), touch the metal
chassis of your computer to drain the static electricity from your body. Don't let
your clothes touch any of the components while you work.

3. Do not remove the module from the anti-static bag it is shipped in until you are
ready to install it. Hold a module it by its edges, and avoid touching its circuitry.
When you remove a module from your computer, place it in an anti-static bag.

_____

Hardware Summary

The Millennium II graphics modules are PCI local bus devices. These modules are used
with the Millennium II driver to generate high-resolution, two- and three-dimensional
color graphics. Table 1-1 lists information about these graphics devices.

Table 1-1 PCI Devices

Designation	Order Number	Planes	Memory
Millennium II	PB2GA–KB / SN–PB2GA–KB	8	4 MB

The configurations supported by these devices are: homogeneous multihead (two or more
devices). The Millennium device is shown in Figure 1-1.

Figure 1-1 Millennium Graphics Option Device
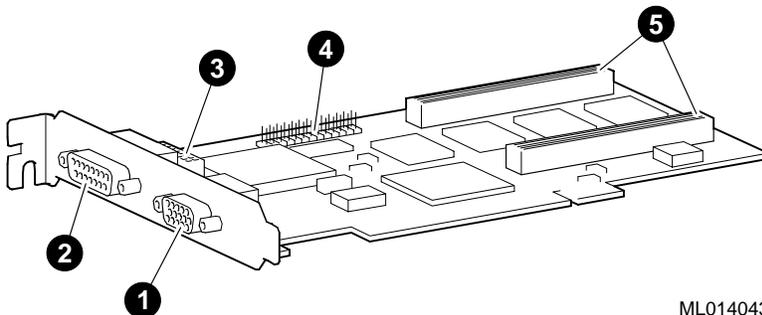
ML014043

The callouts in Figure 1-1 are defined in Table 1-2.

Table 1-2 Millennium II Device Features

Callout	Description
1	Monitor connector (blue)
2	Video cable connector to monitor (black) (Not supported by DIGITAL)
3	Access bus (Not supported by DIGITAL)
4	VGA feature connector (output only) (Not supported by DIGITAL)
5	Connectors for RAM expansion module
6	DIP switches: Switch 1 – OFF = BIOS protected ON = BIOS unprotected Switch 2 – OFF = VGA enabled ON = VGA disabled

Installing the Option Module

To install the Millennium II option module in your computer, follow these steps;

1. **Switch to the standard VGA display driver**. Refer to your Windows NT documentation for instructions.

2. **Open your computer and remove the existing graphics module**. Turn off the computer and all peripherals, such as the monitor or printer. Remove or disable any other VGA option in your system (see your hardware user manual).

3. **Choose a PCI expansion slot**. Most PCI bus computers have a combination of PCI and ISA expansion slots. Usually the PCI slots are made with plastic of a contrasting color and are shorter than other slots in your computer. Your system manual should help you identify the PCI slots.

_____**Caution** _____

Plugging the module into a non-PCI slot could damage the module, your computer, or both. Refer to your system manual for any PCI slot restrictions for graphics devices.

_____

4. **Plug in the Millennium II option module:**

a. Remove the expansion slot cover of the slot you intend to use. Save the screw to fasten the mounting bracket to the chassis after the option module is installed.

b. Making sure you are grounded, pick up the option module and orient it with the expansion slot.

c. Push the module in firmly and evenly until it is fully seated in the slot. The screw slot on the module bracket should line up with the screw hole on the back chassis of your system.

d. Replace the screw to secure the module bracket to the computer chassis.

5. **Connect the monitor**. Plug your monitor cable into the monitor connector on the Millennium II module. Figure 1-2 shows the module connectors:

❶ Monitor connector

❷ Video connector

Figure 1-2 Monitor Cable Connections

ML014039
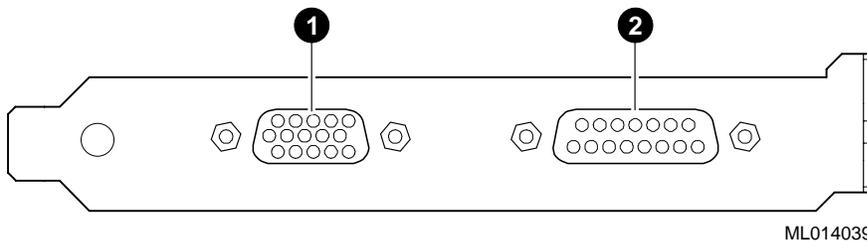
Make sure the other end of the monitor cable is properly connected to your monitor. Monitors that use BNC connectors use five connections: R, G, B, HSYNC (white or gray wire), and VSYNC (black wire). Take note of the maximum vertical and horizontal frequencies supported by your monitor and note whether there are preset frequencies. See your monitor manual for more information.

6. **Restart your computer.**

_____ **Note** _____

> Your option module works with a variety of VGA and high-resolution monitors.
> To take full advantage of your module, use an analog multisync RGB monitor
> that supports separate vertical and horizontal sync. The option module can
> display all VGA and better resolutions ranging from 640 x 480 to 1600 x 1200,
> at vertical frequencies ranging from 60 Hz to 120 Hz.
> Tables of monitor frequencies necessary for each supported video mode are
> provided in Chapter 4 of this manual.

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Attaching the RAM Expansion Module

If you purchase the RAM expansion upgrade module for your system, follow these steps to
install it:

1. Refer to Steps 2, 3, and 4 in the previous section to open your computer and remove
    the Millennium II graphics module from its PCI slot.

2. Refer to Figure 1-1 to locate the connectors for the RAM expansion module ❺ on the
    Millennium graphics module. Orient the RAM expansion module so that its
    connectors align with those on the graphics module and attach the expansion module.
    See Figure 1-3.

3. Reinstall the Millennium II graphics module as described in Steps 2 through 6 in the
    previous section.

Figure 1-3 Attaching the RAM Expansion Module
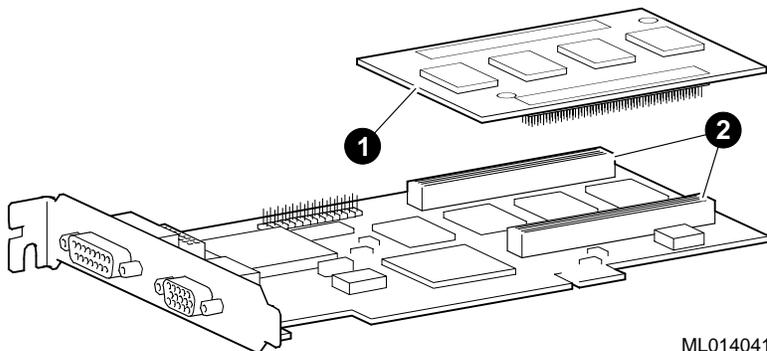
ML014041

After Hardware Installation

After you have installed the Millennium II module, you may need to change the screen
resolution and refresh rate, or identify the display driver version for troubleshooting

Hardware Installation

purposes. To access and change display settings, refer to the software installation chapter appropriate for your system: Chapter 2 for Intel systems; Chapter 3 for Alpha systems.

2

Software Installation for Intel Systems

Introduction

The Millennium II graphics option software is a set of graphics display drivers compatible with Microsoft Windows NT. This chapter describes the installation and postinstallation procedures for Millennium II devices on Windows NT Version 4.0. The drivers supporting Windows NT Version 4.0 enable you to run Millennium II 4-MB graphics devices.

Installing on Windows NT Version 4.0

The software package contains the following items:

- Software Replication License (SRL) letter

- Diskette containing 2D drivers and 3D drivers for Intel support:

System Requirements and Supported Configurations

The operating system version required is:

> Microsoft Windows NT Version 4.0) or higher for 180i and 200i DIGITAL Personal Workstations.

Table 2-1 Millennium II Components in the Intel Kit

Component Description	File Name
GDI and OpenGL display driver	`mga64.dll`
Kernel mode miniport driver	`mga64.sys`
Display Applet Property Sheet for Performance Tuning	`m_gdesk.dll`
Release notes, which can be read using the *Notepad* application	`readment.txt`

Installation Procedure

You can use either of the two installation procedures that follow to install the 2D drivers and 3D drivers from the diskette provided with this package.

Installation Procedure One

1. Boot your system and log into Windows NT if you have not already done so.

2. Access the Display Properties dialog box in one of the following ways:

    - Right-click the Windows desktop background, then click the Properties menu item.

    - From the desktop, click on My Computer → Control Panel → Display.

3. From the Display Properties dialog box, choose the Settings tab.

4. From the Settings dialog box, click on the Display Type button to see the driver and adapter module information.

5. From the Display Type dialog box, click on the Change button.

6. From the Change Display dialog box, click on the Have Disk button. The diskette drive should appear in the "Copy manufacterer's files from:" box.

7. In the Install from Disk dialog box, you are prompted to insert the diskette into the diskette drive. Insert the diskette provided with your Millennium II module. Click on the OK button.

8. Select the Millennium II model from the list, and click on OK.

9. When the message stating that this is a third-party driver displays, click on Yes to proceed.

11. When the files have been copied to your hard disk, a dialog box indicating that the driver was successfully installed is displayed. Choose OK and remove the diskette from the drive.

12. Choose Close to close the Display Type dialog box.

13. Choose Close to close the Display application.

14. A message displays stating that you must restart your computer to use the new display driver; choose Yes to shut down and put the changes into effect.

16. After your system reboots, a message displays indicating that the default screen resolution and refresh rate are being used. For information on changing these values, refer to "Changing Display Settings" later in this chapter.

17. Adjust your software monitor settings. If this is a first-time installation, you are in 640×480 display area resolution with 256 colors, which is supported by all VGA, Super VGA, and Multisync monitors. To adjust your software monitor settings for Windows NT Version 4.0, see "Changing Display Settings" later in this chapter.

Installation Procedure Two

1. Log into Windows NT if you have not already done so.

2. Insert the diskette provided with your Millennium II module into the diskette drive.

3. From the Windows Explorer, select the diskette drive and then the Setup.exe file. The MGA NT PowerDisk Setup screen, shown in Figure 2-1, is displayed.

Figure 2-1 MGA NT PowerDisk Setup Screen
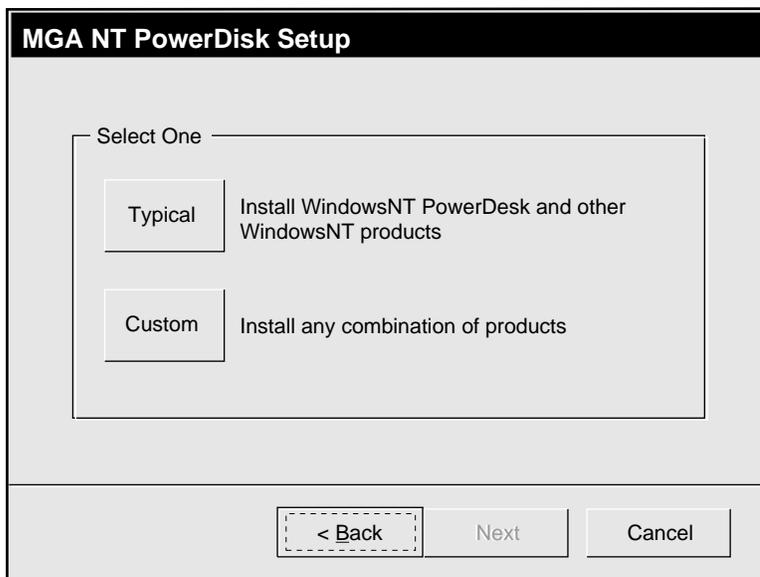
ML014040

Choose the installation type:

For a standard installation, click on Typical.
To choose the specific software you want to install, click Custom.

The setup program loads the installation facility. Click on the Next button and review the installation messages; then click on the Finish button. Remove the diskette from the drive.

3. When the message stating that this is a third-party driver displays, confirm by choosing Yes.

4. When the files have been copied to your hard disk, a dialog box indicating that the driver was successfully installed is displayed. Click on OK.

5. Choose Close to close the Display Type dialog box.

6. Choose Close to close the Display application.

7. A message displays stating that you must restart your computer to use the new display driver; choose Yes to put the changes into effect.

9. After your system reboots, a message displays indicating that the default screen resolution and refresh rate are being used. For information on changing these values, refer to the next section,"Changing Display Settings."

10. Adjust your software monitor settings.   If this is a first-time installation, you are in 640×480 display area resolution with 256 colors, which is supported by all VGA, Super VGA, and Multisync monitors. To adjust your software monitor settings for Windows NT Version 4.0, see the next section,"Changing Display Settings."

Changing Display Settings

Display settings can be changed using either the Settings tab or the MGA Settings tab in the Display Properties window.

_____ **Note** _____

Once you click on the MGA Settings tab, the Settings tab is hidden until you reopen the Display Properties window.

_____

To access the Display Properties window, right-click the Windows desktop background, then click the Properties menu item or click on the Display icon in the Control Panel window.

Using the Settings window:

1. Click on the "List all modes" button and select one from the list of valid modes. Then Click on OK.

2. Click on the Test button to verify that the settings work correctly. In the Testing Mode box, click on OK to view the mode change. A test pattern will be displayed on your monitor for about five seconds.. In response to the query, "Did you see test bitmap

properly?" click on Yes. (Or, select No and repeat this step until your display is correctly displayed.) Click on the Apply button to confirm the change.

To adjust individual settings, select from the appropriate drop-down menu or adjust the appropriate slide-bar, and then test the mode change as described above.

Using the MGA Settings window:

Click on the MGA Settings tab in the Display Properties window to access the following features:

1. Desktop mode-- Select the desired icon to set up a proportional, horizontal, or vertical virtual desktop.

2. Display area-- Use the slide-bar to adjust the area dimensions.

3. Color palette, font size, and display scheme--Use the drop-down menus to adjust these property settings.

4. Advanced Settings--Click on the Advanced button to access the following features:

   - The Information property window to display MGA PowerDesk and display driver software version numbers and hardware graphics module summary information.

   - The Performance property window with settings for advanced driver performance settings:

        3D buffering

        Texture mapping

        Device bitmaps caching

        Real-time pointer shape update

        Automatic PCI bus retries

        Write-Combining on Pentium Pro

        Filtering when scaling.

   - The MGA PowerDesk property window with settings for:

     - PixelTOUCH to zoom in and pan on your view area

     - CenterWINDOW to center open windows in your view area

     - MaxVIEW to maximize windows in your view area instead of your desktop

     - CenterPOPUP to have new windows pop up in the center of your current view area

Software Installation for Intel Systems

Monitor Setup

To check your monitor settings, perform the following steps:

1. Right-click the Windows desktop background, then click the Properties menu item → MGA Monitor tab.

    If you have a Plug-and-Play monitor, make sure the Plug-and-play (DDC) option button is selected. If so, the MGA display driver *automatically* uses the correct settings for your monitor. If not, click this option button, then click Apply.

    If you do not have a Play-and-Play monitor, select the MGA Monitor option button. Select the name of your monitor manufacturer from the list. Select your monitor model from the list.

_____ **Caution** _____

If incorrect software monitor settings are applied, *some* monitors can be permanently damaged. For more information, see your monitor manual.

_____

Identifying the Display Driver Version

When reporting a problem with the drivers, you need to include the version number of the driver along with your description of the problem. To identify the version of the display driver, access the Information tab in the Advanced Display Properties window.

3
Software Installation for Alpha Systems

Introduction

The Graphics Support Services Software is a set of graphics display drivers compatible with Microsoft Windows NT. This chapter describes the installation and postinstallation procedures for Millennium devices on Windows NT Version 4.0. The drivers supporting Windows NT Version 4.0 provide OpenGL support and enable you to run Millennium II 4MB graphics devices

Installing on Windows NT Version 4.0

The software package contains the following items:

- SRL license

- Diskette containing the following software for Alpha support:

  Millennium II drivers—2D drivers and 3D drivers (OpenGL support) in the `\alpha\matrox\nt40` directory on your diskette device. (See Table 3-1.)

Table 3-1 Millennium II Components in the Alpha Kit

Component Description	File Name
GDI and OpenGL display driver	`amga.dll`
Kernel mode miniport driver	`amga_mil.sys`
Display Applet Property Sheet for Performance Tuning	`amga_set.dll`
Release notes, which can be read using the *Notepad* application	`readme.txt`

System Requirements and Supported Configurations

The operating system version required is: Microsoft Windows NT Version 4.0, Service Pack 1 (SP1).

Installation Procedure

The installation of Millennium II graphics option software is divided into two parts; the parts you must execute depend on the type of installation you are performing:

- If you are installing a new version of, or upgrading, Microsoft Windows NT, you must perform Parts 1 and 2.

- If you are upgrading your software display drivers, you need only perform Part 2.

The two parts of the installation are described in the following sections.

Part 1: New Installation or Upgrade of Windows NT Only

Before installing Graphics Support Services Software during a Windows NT upgrade or new installation, you must have already installed a Millennium or Millennium II module. You can then install Windows NT as described in the Windows NT documentation.

During Windows NT installation, the system displays a hardware and software component list, similar to the one shown here:

```
            Computer:  Digital AlphaStation 200/400

                 Display:  VGA Compatible

    Keyboard:  XT, AT, or Enhanced Keyboard (83-104 keys)

                   Keyboard Layout:  US


 Pointing Device:  Mouse Port Mouse
        No Changes:  The above list matches my computer.
```

When you have completed the Windows NT installation, go to Part 2**.**

Part 2: Upgrade of Software Drivers

Regardless of the display driver you are installing or the type of installation you are performing, you must install the software drivers. In this part, you install the 2D drivers and 3D drivers (the DIGITAL accelerated OpenGL support) from the diskette provided with this package.

_____**Caution**_____

> If you are performing Part 2 *only* and are installing a new module, you must install the module at the end of this procedure (in step 17). If you are performing a new installation or upgrade of Windows NT, you must first perform the procedure described in "Part 1: New Installation or Upgrade of Windows NT Only."

_____

The software drivers are installed as follows:

1. Boot your system and log into Windows NT if you have not already done so.

2. From the desktop, choose My Computer.

3. From My Computer, choose Control Panel.

4. From Control Panel, choose Display.

5. From the Display Properties dialog box, choose the Settings tab.

6. From the Settings dialog box, choose the Display Type button to see the driver and adapter (board) information.

7. From the Display Type dialog box, choose Change.

8. From the Change Display dialog box, choose Have Disk.

9. In the Install from Disk dialog box, you are prompted to insert the diskette into the diskette drive. Insert the diskette provided with your Millennium II module.

10. Enter the path of the diskette directory containing the appropriate display driver, and choose *OK*.

    For the Millennium II drivers, the directory path is the following, where `dev:\` is the drive name (for example, `E:\` for the E drive):

    `dev:\alpha\matrox\nt40`

11. In the Change Display dialog box, the driver whose path you just defined is displayed. Confirm this choice by choosing OK.

    The driver name displayed for Millennium II drivers, from `dev:\alpha\matrox\nt40`, is: *Matrox Millennium Video Accelerator*

12. When the message stating that this is a third party driver displays, confirm by choosing Yes.

13. When the files have been copied to your hard disk, a dialog box indicating that the driver was successfully installed is displayed. Choose OK and remove the diskette from the drive.

14. Choose Close to close the Display Type dialog box.

15. Choose Close to close the Display application.

16. When a message stating that you must restart your computer to use the new display driver displays, choose Yes.

17. Shut down your system so that you can install the Millennium II module. Then reboot your system to access the new display driver.

Changing Display Settings

After your system reboots, a message displays indicating that the default screen resolution and refresh rate are being used. After installing the Millennium II module, you can change these and other display settings from the Display Properties window.

_____ **Note** _____

Before changing the display mode, verify that your monitor can handle the new values (see your hardware monitor documentation.
_____

To access the Display Properties window, right-click the Windows desktop background, then click the Properties menu item or click on the Display icon in the Control Panel window.

1. Click on the "List all modes" button and select one from the list of valid modes. Then Click on OK.

2. Click on the Test button to verify that the settings work correctly. In the Testing Mode box, click on OK to view the mode change. A test pattern will be displayed on your monitor for about five seconds.. In response to the query, "Did you see test bitmap properly?" click on Yes. Click on the Apply button to confirm the change.

To adjust individual settings, select from the appropriate drop-down menu or adjust the appropriate slide-bar, and then test the mode change as described above.

Identifying the Display Driver Version

When reporting a problem, you need to include the version of the driver along with your description of the problem.

To identify the version of the display driver, follow these steps:

1. Select Start, Programs, and Windows NT Explorer to view the files currently installed on your machine.

2. To ensure that all files are listed, select View, Options, and the View tab, and verify that the Show all Files box is selected. Click on OK.

3. Locate the `amga.dll` file in the list.
   This file is typically found in the `%SystemRoot%\system32` directory.

4. Click once on the file name to highlight it.

5. From the File Menu, choose Properties.

6. In the Properties dialog box, choose the Version tab.
   The Version dialog box displays driver information, including the version and date.

OpenGL Acceleration

OpenGL functionality is available with the OpenGL display driver provided on the Microsoft Windows NT CD–ROM. In addition to this generic OpenGL driver, you have access to the accelerated OpenGL driver as a part of the Millennium II driver. OpenGL acceleration is provided using Mini Client Driver (MCD) architecture and is the default OpenGL acceleration upon installation of the Millennium II driver.

4

Troubleshooting

Introduction

Use the tables in this chapter to identify the cause of a problem and determine the action to take. Each table provides guidelines for dealing with a specific type of problem.

Boot Problems

Table 4-1 Boot Problems

Problem	Cause	Action
Computer does not boot after the Millennium II module is installed.	Computer may not properly detect the addition or change of an internal PCI module.	Reset the computer CMOS, usually by resetting a switch or jumper on the system board. Check your system manual or contact system vendor.
	Another graphics adapter may already be installed in your computer. If a graphics adapter is built in to the system board, your system may not have automatically disabled it when you installed your module.	Remove the existing graphics module from its expansion slot. Check your computer manual for instructions on how to disable the built-in graphics adapter.

Troubleshooting

Screen Image Problems

Table 4-2 Screen Image Problems

Problem	Cause	Action
Wrong color balance, screen image off-center, or no picture at all.	Monitor video controls may be improperly set.	Adjust your monitor controls (brightness, contrast, and so on.). For more information, see your monitor manual.
	Monitor connections improperly made. If your monitor uses BNC connectors, one or more connection settings may be incorrect.	Check that the monitor power cable, the 15-pin connector to the Millennium II module, and the 15-pin connector to the monitor are firmly in place. If your monitor uses BNC connectors, make sure the Red, Green, Blue, HSYNC (white or gray wire) and VSYNC (black wire) connectors are plugged in correctly and are firmly in place. (See figure.) Set each of the RGB input switches on the back of your monitor to 75 ohms, and the sync switches to "external."
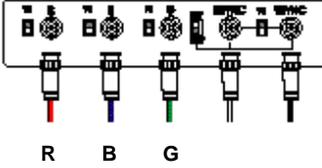
Table 4-2 Screen Image Problems (continued)

Image is garbled (e.g., rolling or overlapping images or blank screen) after startup screen display or after display settings are changed.	Display driver may be trying to use settings your monitor does not support. May happen if a monitor was never selected in the software.	Restart the computer by pressing [Ctrl] [Alt] [Del] →[Tab] →[Tab] →[Enter] →[↓] →[Enter]. From the startup menu, choose VGA mode, and click OK. Right-click in the background, then click the Properties menu item and the Settings tab. Click OK. Adjust the display area slider to its lowest settings, then click OK. Restart the computer normally. Using the monitor property sheet, select a monitor and adjust display settings. See online Help for more information.

Device Problems

Table 4-3 Problems with Other Devices after Installation

Problem	Cause	Action
Problems with other devices (e.g., sound card output distorted, fast modem data loss) after Millennium II module is installed.	Your computer may require that software wait for hardware to be ready to receive new data.	Right-click the Windows NT background, then click the Properties menu item → Settings tab → PowerDesk button → Performance tab. Clear the "Use automatic PCI bus retries" check box. Click OK → OK → Yes to accept the changes and restart your computer.

5

Specifications

Supported Display Capabilities

The following tables show supported display area resolutions and refresh rates based on the amount of memory on your graphics module and the current color palette.

Table 5-1 Maximum Display Area Resolutions

Memory	Color Palette	Max. Display Area	Max. 3D Display Area*
4 MB	256 colors (8-bit)	1600 x 1200	---
	High color (15/16-bit)	1600 x 1200	1152 x 864
	True color (24-bit)	1280 x 1024	---
	True color (32-bit)	1152 x 864	800 x 600

*Double-buffering, without z-buffering.

Specifications

Table 5-2 Refresh Rate Ranges

Dislay Area Resolution	Horizontal Refresh Rate	Vertical Refresh Rate
640 x 480	31-102 KHz	60-200 Hz
800 x 600	38-114 KHz	60-180 Hz
1024 x 768	48-113 KHz	60-140 Hz
1152 x 864	54-110 KHz	60-120 Hz
1280 x 1024	64-107 KHz	60-100 Hz
1600 x 1200	75-113 KHz	60-90 Hz*

*Highest refresh rate at 1660 x 1200 with true color is 72 Hz.

**Not supported by VESA standard refresh rates.

Supported VESA Modes

The Millennium II video BIOS supports DOS VESA Super VGA programs as indicated in
Table 4-3.

Table 5-3 Supported VESA Modes

Dislay Area Resolution	16 Colors	256 Colors	32 K Colors	64 K Colors	16.8 M Colors
640 x 480		100			
640 x 480		101	110	111	112
800 x 600	102	103	113	114	115
1024 x 768		105	116	117	118
1280 x 1024		107	119	11A	
1600 x 1200		11C	11D	11E	

Hardware Specifications

General Specifications	
Description	230 MHz RAMDAC with 4 MB graphics memory
Memory upgrade	4-MB memory upgrade
Features	64-bit VGA-compatible drawing engine
	External RAMDAC (230 MHz)
	Separate sync monitors only
	Supports PCI bus version 2.1 at clock speeds up to 33 MHz
Default Settings	
Boot video mode/resolution	VGA Mode 3 (80 characters, 25 lines)
Memory map	System-determined
Electrical Specifications	
Operating voltage and current	Operating voltage of 5.00 V± 5%
	0.9 a typical with no module
	1.4 A with 4 MB

Video Specifications	
Description	Video follows the PS/2 standard, with no sync on RGB, and no blanking pedestal.
Black or blank	0.0 V;
White	0.700 V
Five connections to a monitor that uses BNC connectors	R,G,B, HSYNC (white or gray wire), and VSYNC (black wire).
Mechanical Specifications	
Technology	Hybrid of through-hole and surface mount on a glass/epoxy board
Module physical dimensions (excluding bracket)	16.7 x 9.5 x 1.2 cm
Environmental Specifications	
Min./max. ambient operating temps.	0° to 55° C
Min./max. storage temps.	-40° to 75° C
Max. altitude for operation	3,000 meters
Max. altitude for transport	12,000 meters
Operating humidity	20% to 80% relative humidity (non-condensing)
Storage humidity	5% to 95% relative humidity (non-condensing)