Sun Expert3D™ Graphics Card Installation Guide

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This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

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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 it is not installed and used in accordance with the instruction manual, it 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.

Shielded Cables: Connections between the workstation and peripherals must be made using shielded cables to comply with FCC radio frequency emission limits. Networking connections can be made using unshielded twisted-pair (UTP) cables.

Modifications: Any modifications made to this device that are not approved by Sun Microsystems, Inc. may void the authority granted to the user by the FCC to operate this equipment.

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2. This device must accept any interference received, including interference that may cause undesired operation.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

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- Increase the separation between the equipment and receiver.
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This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

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使用者會被要求採取某些適當的對策。

Contents

Figures

Tables

Preface

This manual describes how to install the Sun Expert3D™ graphics accelerator hardware and software in a Sun Ultra™ 60 and Sun Ultra 80 computer system.

How This Book Is Organized

Chapter 1 provides an overview of the Expert3D product.

Chapter 2 describes how to install the Expert3D hardware.

Chapter 3 describes how to install Expert3D software.

Appendix A provides Expert3D features, specifications, and multiview configuration.

Using UNIX Commands

This document may not contain information on basic UNIX® commands and procedures such as shutting down the system, booting the system, and configuring devices.

See one or more of the following for this information:

- *Solaris Handbook for Sun Peripherals*
- AnswerBook2™ online documentation for the Solaris™ 2.x software environment
- Other software documentation that you received with your system

Typographic Conventions

TABLE P-1   Typographic Conventions

Typeface or Symbol	Meaning	Examples
`AaBbCc123`	The names of commands, files, and directories; on-screen computer output.	Edit your `.login` file. Use `ls -a` to list all files. `% You have mail.`
`AaBbCc123`	What you type, when contrasted with on-screen computer output.	`%` **`su`** `Password:`
AaBbCc123	Book titles, new words or terms, words to be emphasized. Command-line variable; replace with a real name or value.	Read Chapter 6 in the *User's Guide*. These are called *class* options. You *must* be `root` to do this. To delete a file, type `rm` *filename*.

Shell Prompts

TABLE P-2   Shell Prompts

Shell	Prompt
C shell	*machine_name*`%`
C shell superuser	*machine_name*`#`
Bourne shell and Korn shell	`$`
Bourne shell and Korn shell superuser	`#`

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```
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```

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Please include the part number of your document in the subject line of your email.

Expert3D Graphics Card Overview

The Sun Expert3D^{TM} graphics accelerator (FIGURE 1-1) is a high-resolution, high-performance graphics frame buffer that provides hardware texture mapping. The Sun Expert3D graphics card supports screen resolutions that include 1920 x 1200 double-buffered, z-buffered, and 1280 x 1024 stereo displays.

This document provides Expert3D graphics card installation instructions for the following Sun workstations:

- Sun Ultra 60 system
- Sun Ultra 80 system
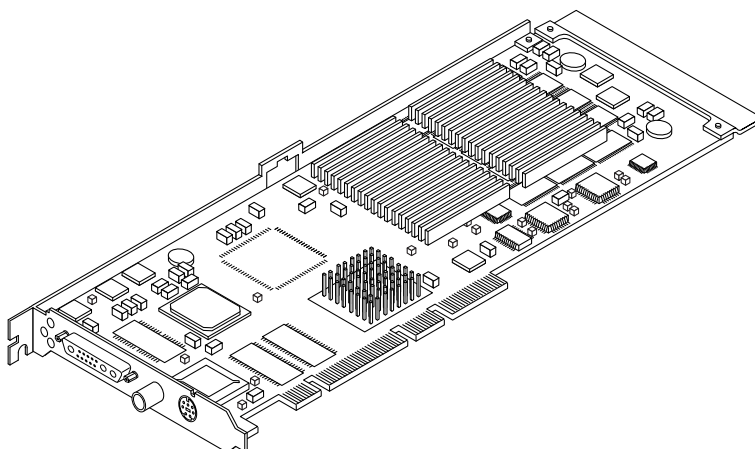
FIGURE 1-1   Sun Expert3D Graphics Accelerator

For assistance and other information not found in this document concerning the Expert3D card, see SunService^{SM} at `http://www.sun.com/service/online/`.

FIGURE 1-2 shows the Expert3D graphics card external I/O ports. The Expert3D I/O ports are described in Appendix A, "Expert3D Graphics Card Features and Specifications."
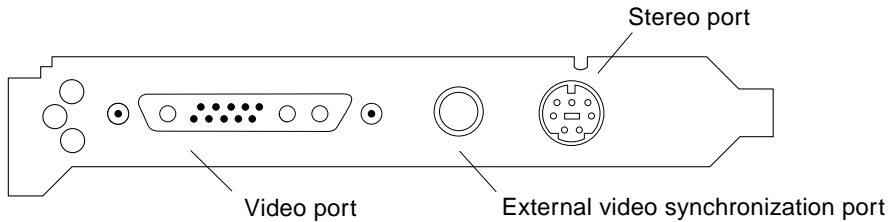
FIGURE 1-2   Expert3D External I/O Port Connectors

Installation Kit

The Expert3D graphics card installation kit includes:

- Expert3D graphics card
- Antistatic wrist strap
- Expert3D software (CD-ROM)
- Expert3D multiview cable
- *Sun Expert3D Graphics Card Installation Guide,* this document

Updated versions of Sun™ OpenGL® for Solaris™ and the latest graphics system software patches for the Expert3D graphics card are available at:

`http://www.sun.com/software/graphics/OpenGL/`

Installing the Expert3D Hardware

This chapter provides Expert3D hardware installation information.

- "Installing Expert3D in an Ultra 60 System" on page 4
- "Installing Expert3D in an Ultra 80 System" on page 6

Note – Not all Sun workstations support an Expert3D graphics card in a 66-Mhz PCI slot. For installing an Expert3D card in a system *not* supported by this documentation, see your SunService representative or your Sun workstation platform documentation.

Before Installation

Refer to the *Solaris Handbook for Sun Peripherals* that corresponds to your operating environment. The handbook describes how to shut down the system safely before installing any internal cards and rebooting your system after installation.

Installing the Hardware

Refer to the hardware installation documentation provided with your Sun workstation for general instructions on accessing your system internal modules and handling Sun PCI graphics cards.

Installing Expert3D in an Ultra 60 System

The Expert3D graphics card connects into the 66-Mhz or 33-Mhz PCI connector on the Sun Ultra 60 motherboard. Best performance is achieved by putting the Expert3D card into the Ultra 60 66-Mhz PCI slot.

1. **Shutdown your workstation and remove the Ultra 60 enclosure.**

2. **Attach the antistatic wrist strap to your wrist and power supply.**

3. **Locate the Ultra 60 PCI 66-Mhz and 33-Mhz connectors** (FIGURE 2-1).
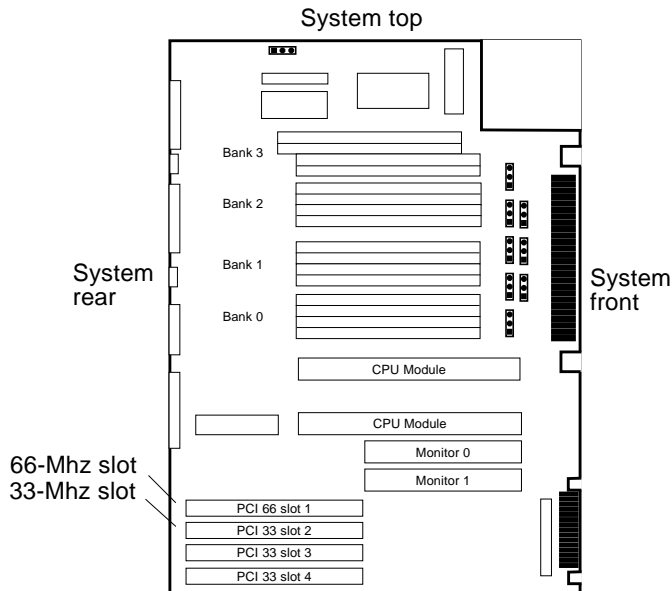
FIGURE 2-1   Ultra 60 PCI 66-Mhz and 33-Mhz Connector Locations

4. **Using a No. 2 Phillips screwdriver, remove the screw that secures the PCI slot filler panel and remove the filler panel.**

5. **Install the Expert3D graphics card.**

   a. **Position the Expert3D card into the chassis** (FIGURE 2-2).

b. Guide the Expert3D backplate bracket tab into the chassis back-panel opening; guide the opposite end of the card into the fan bracket card guide so that the card is aligned evenly with the motherboard slot.

c. At the two upper corners of the Expert3D card, push the Expert3D card straight down into the slot until it is fully seated.

d. Using a No. 2 Phillips screwdriver, replace the screw securing the Expert3D bracket tab to the system chassis.
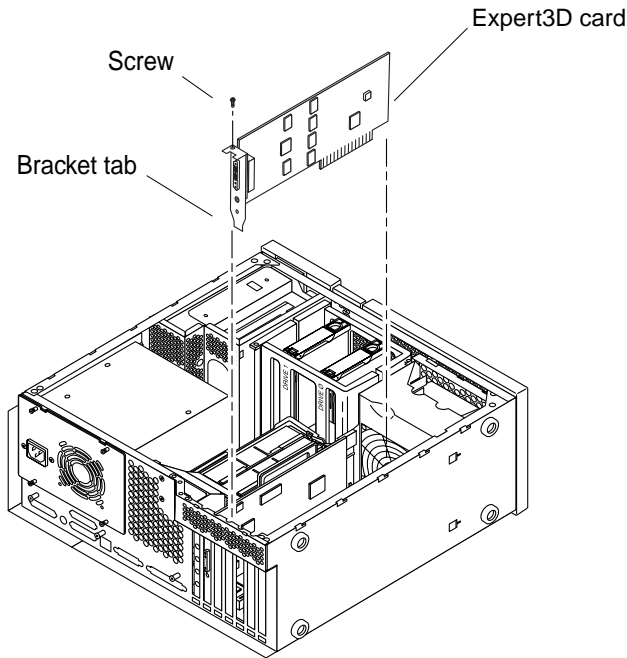
FIGURE 2-2 Installing Expert3D Graphics Card in an Ultra 60 System

6. Replace the Ultra 60 enclosure and go to Chapter 3.

Installing Expert3D in an Ultra 80 System

The Expert3D graphics card connects into the 66-Mhz or 33-Mhz PCI connector on the Sun Ultra 80 motherboard. Best performance is achieved by putting the Expert3D card into the Ultra 80 66-Mhz PCI slot.

1. **Shutdown your workstation and remove the Ultra 80 enclosure.**

2. **Attach the antistatic wrist strap to your wrist and power supply.**

3. **Locate the Ultra 80 PCI 66-Mhz and 33-Mhz connectors (**FIGURE 2-3**).**
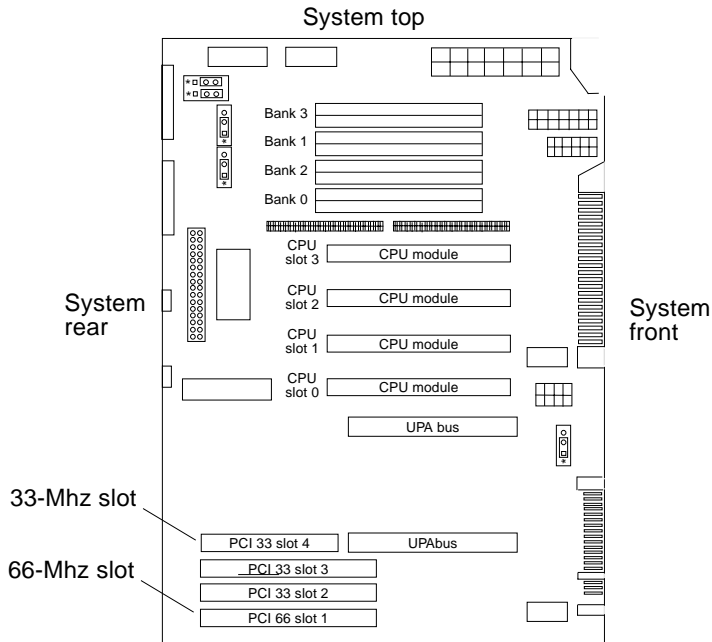
FIGURE 2-3 Ultra 80 PCI 66-Mhz and 33-Mhz Connector Locations

4. **Using a No. 2 Phillips screwdriver, remove the screw that secures the PCI slot filler panel and remove the filler panel.**

5. **Install the Expert3D graphics card.**

   a. **Position the Expert3D card into the chassis.**

b. **Lower the Expert3D connector so that it touches its associated PCI card slot on the motherboard (**FIGURE 2-4**).**

c. **Guide the Expert3D backplate bracket tab into the chassis back panel.**

d. **At the two upper corners of the card, push the card straight down into the slot until the card is fully seated.**

e. **Using a No. 2 Phillips-head screwdriver, replace the screw securing the Expert3D bracket tab to the system unit chassis.**
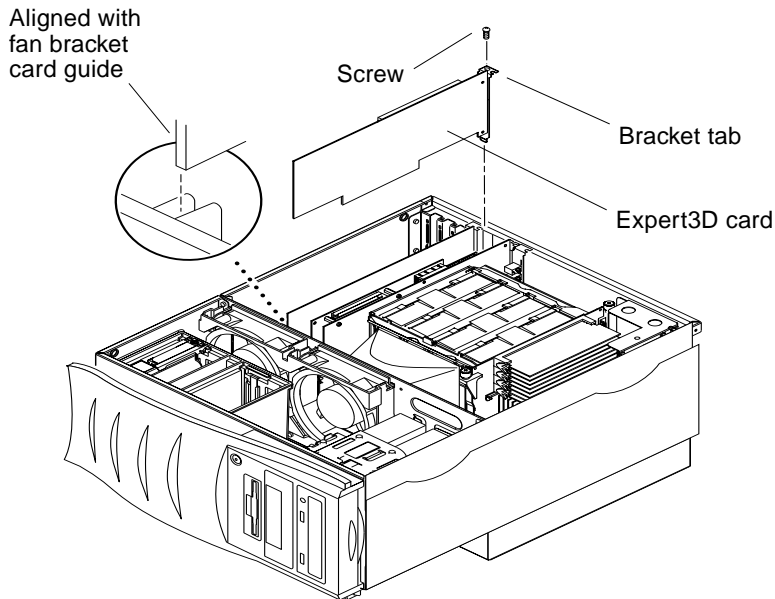
FIGURE 2-4 Installing Expert3D Graphics Card in an Ultra 80 System

6. **Replace the side access cover and go to Chapter 3.**

Installing the Expert3D Software

This chapter provides Expert3D software installation information.

Software Requirements

- Solaris 2.6 Hardware: 3/99, Solaris 7 Hardware: 8/99, Solaris 8 or a subsequent compatible version of the operating environment
- OpenWindows™ Version 3.6, 3.6.1, and 3.6.2
- 1.5 Mbytes of available disk space for Expert3D software
- 42-90 Mbytes of disk space for Sun OpenGL for Solaris (up to 90 Mbytes if 64-bit Sun OpenGL for Solaris is installed)

Note – If your system does not have the Solaris 2.6, Solaris 7, or Solaris 8 operating environment installed, you need to install it. Use the text command version of `suninstall` to install the required Solaris operating environment. Refer to the main Solaris installation manuals for this information.

Updated versions of Sun OpenGL for Solaris and the latest graphics system software patches for the Expert3D graphics card are available at:

`http://www.sun.com/software/graphics/OpenGL/.`

Note – Expert3D support is included in Solaris 8. The Solaris 8 Expert3D software on the CDROM contains enhancements and bug fixes that are not present in the Solaris 8 installation.

Expert3D Software Package

Sun Expert3D software is delivered unbundled on a CD-ROM provided with your installation kit.

Software Package Locations

TABLE 3-1 lists the directory locations of the Expert3D software packages.

TABLE 3-1   Location of Expert3D Software Packages

Expert3D Software Packages	Directory Location
Solaris 2.6 software	`/cdrom/cdrom0/Expert3D/Solaris_2.6/Product/`
Solaris 7 software	`/cdrom/cdrom0/Expert3D/Solaris_7/Product/`
Solaris 8 software	`/cdrom/cdrom0/Expert3D/Solaris_8/Product/`

Expert3D Software Package Names

TABLE 3-2 lists the Expert3D software package names and descriptions.

TABLE 3-2   Solaris 2.6, Solaris 7, and Solaris 8 Software Package Names

Package name	Description
`SUNWifb.u`	64-bit device driver for the PCI Bus Sun Expert3D (IFB) graphics accelerator
`SUNWifbcf`	Configuration utility for the PCI Bus Sun Expert3D (IFB) graphics accelerator
`SUNWifbmn`	Manual pages for the PCI Bus Sun Expert3D (IFB) graphics accelerator (not applicable to Solaris 8 operating environment)
`SUNWifbr`	Boot-time device initialization support for the PCI Bus Sun Expert3D (IFB) graphics accelerator
`SUNWifbw`	X server loadable module for the PCI Bus Sun Expert3D (IFB) graphics accelerator
`SUNWifbx.u`	64-bit device driver for the PCI Bus Sun Expert3D (IFB) graphics accelerator (Solaris 7 and Solaris 8 software only)

TABLE 3-2   Solaris 2.6, Solaris 7, and Solaris 8 Software Package Names

Package name	Description
SUNWifbvt	SunVTS for Sun Expert3D (IFB)
SUNWifbvx	64-bit SunVTS for Sun Expert3D (IFB)

Note – If SunVTS™ is installed in your system, the installation script adds Expert3D to your system VTS framework.

Sun OpenGL for Solaris Software

The Expert3D graphics card is supported in both Sun OpenGL Version 1.1.2 for Solaris and Sun OpenGL Version 1.2 for Solaris operating environments.

Software Package Locations

TABLE 3-3 lists the directory locations of the Sun OpenGL for Solaris software packages.

TABLE 3-3   Location of Sun OpenGL for Solaris Software Packages

Sun OpenGL for Solaris Software Packages	Directory Location
Sun OpenGL 1.1.2 for Solaris, Solaris 2.6 software	/cdrom/cdrom0/OpenGL/1.1.2/Solaris_2.6/Product/
Sun OpenGL 1.1.2 for Solaris, Solaris 7 software	/cdrom/cdrom0/OpenGL/1.1.2/Solaris_7/Product/
Sun OpenGL 1.1.2 for Solaris, Solaris 8 software	/cdrom/cdrom0/OpenGL/1.1.2/Solaris_8/Product/
Sun OpenGL 1.2 for Solaris, Solaris 2.6, Solaris 7, and Solaris 8 software	/cdrom/cdrom0/OpenGL/1.2/Product/

Sun OpenGL for Solaris Software Package Names

TABLE 3-4 lists the Sun OpenGL for Solaris software package names and descriptions.

TABLE 3-4   Sun OpenGL Version 1.2 and 1.1.2 for Solaris Package Names for Solaris 2.6, Solaris 7 and Solaris 8 Software

Package name	Description
SUNWafbgl	Sun OpenGL for Solaris Elite3D support
SUNWafbgx	Sun OpenGL for Solaris 64-bit Elite3D support
SUNWffbgl	Sun OpenGL for Solaris Creator graphics (FFB) support
SUNWffbgx	Sun OpenGL for Solaris 64-bit Creator graphics (FFB) support
SUNWgldoc	Sun OpenGL for Solaris documentation and man pages
SUNWgleg	Sun OpenGL for Solaris utilities and example programs
SUNWglh	Sun OpenGL for Solaris header files
SUNWglrt	Sun OpenGL for Solaris Runtime Libraries
SUNWglrtu	Sun OpenGL for Solaris Platform Specific Runtime Libraries
SUNWglrtx	Sun OpenGL for Solaris 64-bit Runtime Libraries
SUNWifbgl	Sun OpenGL for Solaris Sun Expert3D graphics support
SUNWifbgx	Sun OpenGL for Solaris 64-bit Sun Expert3D graphics support

Sun OpenGL for Solaris Patches

TABLE 3-5 lists the Sun OpenGL Version 1.2 for Solaris patches required for Solaris 2.6, Solaris 7 and Solaris 8 operating environments.

TABLE 3-5   Sun OpenGL Version 1.2 for Solaris Patches

Solaris Release	Patch	Directory Location
Solaris 2.6	108131-04 108132-04	/cdrom/cdrom0/OpenGL/1.2/Solaris_2.6/Patches
Solaris 7	108131-04 108132-04	/cdrom/cdrom0/OpenGL/1.2/Solaris_7/Patches
Solaris 8	108131-04 108132-04	/cdrom/cdrom0/OpenGL/1.2/Solaris_8/Patches

TABLE 3-6 lists the Sun OpenGL Version 1.1.2 for Solaris patches required for Solaris 2.6, Solaris 7, and Solaris 8 operating environments.

TABLE 3-6   Sun OpenGL Version 1.1.2 for Solaris Patches

Solaris Release	Patch	Directory Location
Solaris 2.6	106735-11	`/cdrom/cdrom0/OpenGL/1.1.2/Solaris_2.6/Patches`
Solaris 7 (32-bit)	107104-06	`/cdrom/cdrom0/OpenGL/1.1.2/Solaris_7/Patches`
Solaris 7 (64-bit)	107105-06	`/cdrom/cdrom0/OpenGL/1.1.2/Solaris_7/Patches`
Solaris 8 (32-bit)	107104-06	`/cdrom/cdrom0/OpenGL/1.1.2/Solaris_8/Patches`
Solaris 8 (64-bit)	107105-06	`/cdrom/cdrom0/OpenGL/1.1.2/Solaris_8/Patches`

The Expert3D installation script installs these patches automatically, if required. You can manually install or remove these patches by using `installpatch` and `backoutpatch` for the Solaris 2.6 operating environment, or `patchadd` and `patchrm` for the Solaris 7 and Solaris 8 operating environments.

■ To add a patch in the Solaris 2.6 operating environment, type:

```
# installpatch patchnumber
```

■ To add a patch in the Solaris 7 and Solaris 8 operating environment, type:

```
# patchadd patchnumber
```

Installing Expert3D Software

Install the Expert3D software from the CD-ROM provided with your installation kit.

1. **After installing the Expert3D card into your system, boot your system at the** `ok` **prompt:**

```
ok boot -r
```

2. **Log in as superuser.**

3. **Insert the CD-ROM into the drive.**

4. **Mount the CD-ROM drive.**

   ■ If the drive is already mounted, type the following, and go to Step 5:

   ```
   # cd /cdrom/cdrom0
   ```

   ■ If the CD-ROM is not already mounted, type:

   ```
   # mount -F hsfs -O -o ro /dev/dsk/c0t6d0s0 /cdrom
   # cd /cdrom
   ```

   Note – The CD-ROM device may be different on your system. For example, `/dev/dsk/c0t2d0s2`.

5. **To install the software, as superuser, type:**

   ```
   # ./install
   ```

   The following is displayed:

   ```
   # ./install
   *** Checking if Sun Expert3D support is already installed...
   *** Checking if fbconfig is already installed...
   *** Checking if Sun OpenGL is installed...

   Select one of the following Sun OpenGL installation options:
   1) Install Sun OpenGL 1.1.2
   2) Install Sun OpenGL 1.2
   3) Do not install Sun OpenGL
   Select an option:
   ```

   The installation program checks if Expert3D software is already installed. If a version of Expert3D software is installed, the program checks to determine the version.

   ■ If a version of Expert3D software is already installed and it is lower than the version you are installing from the CD-ROM, then the program prompts you to confirm an upgrade to the latest release. It then installs the latest version.

■ If the same version of Expert3D software is already installed, the program checks that it is fully installed and displays the following:

```
# ./install
*** Checking if Sun Expert3D support is already installed...
*** Checking if fbconfig is already installed...
*** Checking if Sun OpenGL is installed...
*** Checking if Sun OpenGL 1.2 support for Sun Expert3D is installed...

All required software for Sun Expert3D and Sun OpenGL support is already
installed. No software will be installed at this time.
```

■ If a higher version of Expert3D software is already installed, the program does not select Expert3D software installation.

The installation program also displays similar prompts when checking for fbconfig and Sun OpenGL for Solaris versions. If Sun OpenGL for Solaris 1.1.2 is fully installed on your system, the program checks for required patches. If no patches are found, the program installs the appropriate patches during the installation process.

6. **Select the appropriate Sun OpenGL for Solaris version.**

Option 2 is selected for this example:

```
*** Checking if Sun OpenGL 1.2 support for Sun Expert3D is installed...

About to take the following actions:
- Install Sun Expert3D support for Solaris 7
- Install fbconfig
- Install Sun OpenGL 1.2
- Install Sun OpenGL 1.2 support for Sun Expert3D

To cancel installation of this software, press 'q'.
Press any other key to begin installation:
```

7. **Press any key and Return to start installation.**

   Once complete, the following is displayed and the program provides a directory for locating a file log of the installation process. It also provides configuration and reboot instructions.

```
*** Installing Sun Expert3D support for Solaris 7...
*** Installing fbconfig...
*** Installing Sun OpenGL 1.2...
*** Installing Sun OpenGL 1.2 support for Sun Expert3D...
*** Installation complete.

To remove this software, use the 'remove' script on this CDROM, or
the following script:
        /var/tmp/expert3d.remove

A log of this installation can be found at:
        /var/tmp/expert3d.install.1999.09.27

To configure a Sun Expert3D accelerator, use the fbconfig
utility. See the fbconfig(1m) and SUNWifb_config(1m) manual
pages for more details.

*** IMPORTANT NOTE! ***
This system must be rebooted for the new software to take effect.

Shutdown the system using the shutdown command and then reboot the
system using the 'boot -r' PROM command at the 'ok' prompt. See
the shutdown(1M) and boot(1M) manual pages for more details.
```

8. **Shutdown the system after Expert3D software is installed:**

```
# shutdown
```

   See the shutdown(1M) and boot(1M) manual pages for more details.

9. **Reboot the system at the** ok **prompt to complete the installation:**

```
ok boot -r
```

Removing Expert3D Software

1. **To remove Expert3D software, type:**

```
# ./remove
```

The following list of options is displayed.

```
# ./remove
1) Remove Sun Expert3D support
2) Remove fbconfig
3) Remove OpenGL
4) Remove Sun Expert3D, fbconfig, and OpenGL
5) Quit
Select an option:
```

2. **Select 4 to remove all packages.**

The following then is displayed:

```
About to take the following actions:
- Remove Sun Expert3D support
- Remove fbconfig
- Remove OpenGL
Press 'q' to quit, or press any other key to continue:
```

3. **Press any key and Return to start the removal process.**

Once complete, the following is displayed and the program provides a directory for locating a log of the removal process:

```
*** Removing packages...
*** Done. A log of this removal can be found at:
        /var/tmp/expert3d.remove.1999.09.27
```

Multiple Frame Buffer Configuration

To run more than one frame buffer, you need to modify your
`/etc/dt/config/Xservers` file. The Expert3D device is identified as `ifb`*x* (for
example, `ifb0` and `ifb1` for two Expert3D devices). To do this:

1. **Become superuser and open the** `/etc/dt/config/Xservers` **file.**

```
# cd /etc/dt/config
# vi Xservers
```

2. **Modify the file by adding the device locations for the applicable frame buffers being used.**

   The following example shows the `Xservers` configuration file modified for one Creator card and two Expert3D cards:

```
:0 Local local_uid@console root /usr/openwin/bin/Xsun :0 -dev /dev/fbs/ffb0
-dev /dev/fbs/ifb1 -dev /dev/fbs/ifb0 -nobanner
```

See "Expert3D Multiview Ports" on page 27 for frame locking multiple Expert3D graphics cards in a single system.

Expert3D as Default Console Display

To set the Expert3D graphics card as the default monitor console display:

1. **At the** `ok` **prompt, type:**

```
ok show-displays
```

The following is an example of what is displayed:

```
a) /PCI@@l1, 2000/SUNW,Expert3D@1
b) /PCI@@l5, 2000/SUNW,afb@1
q) NO SELECTION
```

2. **Select the graphics card you want to be the default console display.**

In this example, you would select `a` for the Expert3D card.

3. **Set the device you selected to be the console device.**

```
ok setenv output-device <Control -Y> <ENTER>
```

4. **Reset the output-device environment:**

```
ok reset
```

5. **Connect your monitor cable to the Expert3D card on your system back panel.**

6. **Create an alias name for the Expert3D device (optional):**

You can simplify future OpenBoot PROM commands by creating an alias for the Expert3D device. To do this,

a. **Select the Expert3D device from the** `show-displays` **menu.**

b. **Name the Expert3D device (this example names the device as screen1).**

```
ok nvalias screen1 <Control -Y> <ENTER>
```

c. **Store the name as the alias.**

```
ok nvstore
```

d. **Verify the alias.**

```
ok devaliases
```

The selected alias is then displayed.

You can now refer to `screen1` for the Expert3D device. For example,

```
ok setenv output-device screen1
```

Expert3D Man Pages

The Expert3D man pages allows you to query frame buffer attributes such as screen resolutions and visual configurations.

The `fbconfig(1M)` man page is used for configuring Sun graphics accelerators. The `SUNWifb_config(1M)` man page contains Expert3D device-specific configuration information.

Use the `help` option to display the attributes and parameters information of the man page.

● **To access the** `fbconfig` **man page, type:**

```
# man fbconfig
```

● **To access the** `SUNWifb_config` **man page, type:**

```
# man SUNWifb_config
```

Changing the Monitor Screen Resolution

For most installations, the Expert3D automatically configures itself to the proper screen resolution and refresh rate for your monitor. However, if it is not a Sun monitor connected to the Expert3D, the monitor may have the wrong screen resolution. To change the screen resolution, use the `fbconfig` and `SUNWifb_config` utilities.

Expert3D Graphics Card Features and Specifications

This appendix provides features and specifications for the Expert3D graphics accelerator. It also describes how to configure multiple Expert3D cards in a single system.

Expert3D Features

- Geometry acceleration
    - Model view matrix transformation of vertex and normal coordinates
    - Texture matrix transformation of texture coordinates
    - Full lighting calculations with up to 24 light sources
    - Up to six user clip planes
    - Perspective transformation
    - Viewport transformation
    - View volume clipping
    - Image processing

- OpenGL operations

  - Points (2D, 3D, wide)
  - Vectors (2D and 3D lines and line strips; wide, stippled)
  - Polygons (triangles, triangle strips, quads, quad strips, polygons, point/line polygon mode)
  - Antialiased points, vectors, and polygons
  - Image support (multiple formats, zoom, bilinear scaling, color matrix, color tables)
  - Alpha operations
  - Scissoring
  - Window clipping
  - Masking
  - Fogging (linear, exponential, exponential^2, user-defined)
  - Texture mapping (point, bilinear, trilinear, multiple internal formats)
  - Stencil operations
  - Dithering
  - Rich set of blending operations
  - Fast window clears
  - Fast window-mode double buffering
  - Frame-sequential stereo support

- Extensive support of OpenGL extensions

  - Imaging extensions such as pixel buffer, color table, color matrix, and convolution
  - Blend extensions such as blend color, blend minmax, and blend function separate
  - Fog extensions (fog function, fog offset)
  - Texture extensions (edge clamp, border clamp, LOD clamp, generate mipmap)
  - Texture color table
  - Pixel texture
  - Post-texturing specular
  - Stencil operation wrap

Additional Expert3D Features

- 8 MBytes of SDRAM DirectBurst memory
- 64 MBytes onboard SDRAM texture memory with full mipmapped trilinear interpolated texture processing
- 10-bit gamma correction
- Hardware cursor
- Stereoscopic viewing support (interlaced or frame sequential)
- Display Data Channel (DDC) monitor support for bidirectional communication
- Display Power Management Signaling (DPMS) to enable monitor's power-saving mode
- High-speed, full-featured DMA over the PCI-64 bus
- Multiscreen support using multiple cards in a single workstation
- Frame locking of the video timing to an external timing source
- Multiview functionality for frame locking and rate locking of multiple workstations
- Two video lookup tables

Expert3D Specifications

The Expert3D graphics accelerator is a full-length PCI graphics card with internal internal I/O ports for multiviewing and external I/O ports for external video synchronization and stereo capabilities.

Internal I/O Ports

The internal I/O ports (Multiview In and Multiview Out) are accessible only inside the workstation chassis and are used for cable connections from one Expert3D card to another. See "Expert3D Multiview Ports" on page 27.

External I/O Ports

The external I/O ports are accessible through the I/O connectors on the Expert3D card backplate (FIGURE A-1).
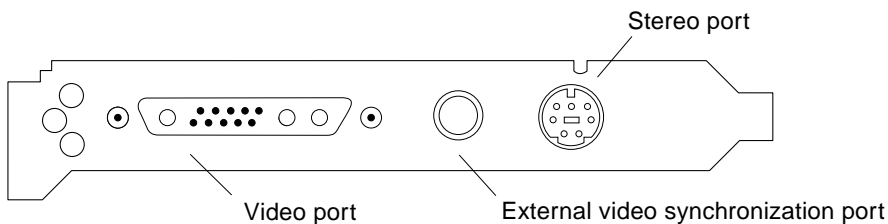
FIGURE A-1 Expert3D Connectors

The Expert3D graphics card has the following external I/O ports:

- Video output port
- Stereo output port
- External video synchronization port

Video Output Port

The video output port is a 13W3 connector that connects the workstation monitor.

TABLE A-1   Expert3D Video Output Port

Pin	Signal
A1	Red analog video
A2	Green analog video
A3	Blue analog video
1	DDC SCL (serial clock)
2	DDC power (5.0V) (Fused, will supply up to 300mA, limited to 1.0A.)
3	No connection
4	Ground (DDC return)
5	Composite sync
6	DDC SDA (serial data)
7	Vertical sync
8	No connection
9	No connection
10	Ground (sync return)

Stereo Output Port

FIGURE A-2 and TABLE A-2 shows the Expert3D stereo connector and pinout signals.
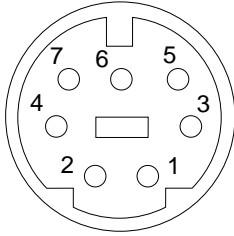
FIGURE A-2   Expert3D 7-Pin DIN Female Stereo Connector

TABLE A-2   Expert3D Stereo Output Port

Pin	Signal
1	Ground
2	5.0V (Fused, will supply up to 300mA, limited to 1.0A.)
3	12.0V (Fused, will supply up to 300mA, limited to 1.0A.)
5	Stereo sync
6	No connection
7	No connection

External Video Synchronization Port

The external video synchronization port uses a 75 Ohm BNC male connector. A 75 Ohm coax cable terminated with a female BNC connector is needed to connect to this port and provide a periodic signal to which the display system attempts to lock its vertical refresh rate.

The supported formats are:

- NTSC composite video
- PAL composite video
- TTL, LVTTL, or CMOS level compatible periodic signal (50 Hz-180 Hz), with a minimum low or high pulse or 100ns (TBV)

Expert3D Multiview Ports

The Multiview In and Multiview Out ports use a polarized 10-pin dual-in-line header. These ports allow frame locking and rate locking of multiple Expert3D cards in a single workstation in order to display synchronous multi-screen applications. Cards are daisy-chained together, using the multiview cable supplied in the Expert3D x-option kit, by connecting the Multiview Out port of one card to the Multiview In port, and is designated as the master card. The last card in the chain has no connection to the Multiview Out port.

TABLE A-3   Expert3D Multiview In Port and Multiview Out Port Pinout

Pin	Multiview In Port Pinout Signal	Multiview Out Port Pinout Signal
1	Ground	Ground
2	Done Output	Done Input
3	Ground	Ground
4	Release Input	Release Output
5	Ground	Ground
6	Sense Input	Sense Loopback
7	Ground	Ground
8	Ground	Sense Loopback
9	Ground	Ground
10	Pixel Align Input	Pixel Align Output

Frame Locking Multiple Expert3D Graphics Cards

You can frame lock only two Expert3D graphics cards for multiviewing in Ultra 60 and Ultra 80 systems.

- When rebooting your system after installing the Expert3D software, the Solaris operating system places *all* Expert3D cards in the system in master mode. Use `fbconfig` to set the slave Expert3D cards.

- There can only be *one* master Expert3D card in a system.

- You must choose a resolution supported by Expert3D and assure that each Expert3D monitor in frame lock is set to that resolution.

- Refer to the `boot -r` man page for device location and device numbering information for how devices are numbered based on their physical location. You may select any device (that is, `ifb0` or `ifb1`) to be the master Expert3D device.
- To configure multiple Expert3D cards for multiviewing through frame locking:

1. **Select an Expert3D card to designate as master for the Expert3D graphics cards.**

   One solution for designating an Expert3D to be the master is to use the Expert3D that serves as the boot/console head for that system.

2. **Make sure that each Expert3D installed has the same monitor resolution as the Expert3D in master mode.**

   If the resolution on each Expert3D graphics card is not the same, you must change it to match the Expert3D card in master mode.

   To check the resolution of an Expert3D card, use the `fbconfig` command. For example:

   ```
   % fbconfig -dev /dev/fbs/ifb0 -prconf
   ```

   You must repeat this command for each Expert3D card in the system.

   The `fbconfig` command displays the current monitor resolution setting. It also displays additional information such as whether the Expert3D is a master or slave.

   If you need to change the resolution of an Expert3D card, use the `fbconfig` command. For example:

   ```
   % fbconfig -dev /dev/fbs/ifb1 -res 1280x1024x76 now nocheck
   ```

3. **Connect the frame lock multiview cable to each Expert3D graphics card** (FIGURE A-3)**.**

   a. **Connect the top of the multiview frame lock cable assembly to the multiview-out J2 connector of the master Expert3D card.**

   b. **Connect the other end of the multiview frame lock cable to the multiview-in J1 connector of the slave Expert3D card.**
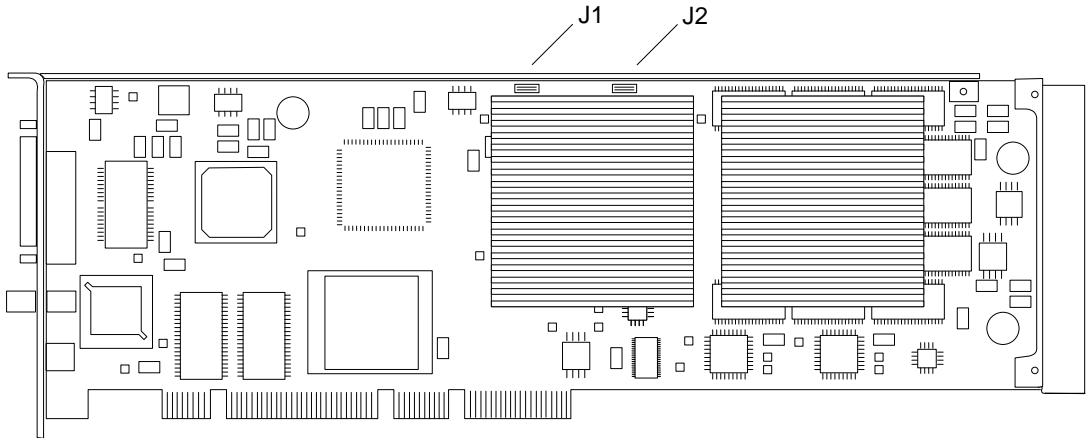
FIGURE A-3   Expert3D Multiview-In and Multiview-Out Connectors

4. **From the master Expert3D graphics card display window, configure the other Expert3D graphics card in slave mode.**

   To do this, use the fbconfig command.

   ```
   % fbconfig -dev /dev/fbs/ifb1 -slave on
   ```

   You must configure each card separately.

   In order to reconfigure your Expert3D graphics card from slave mode back to master mode, do one of the following:

   - Power cycle the system.
   - Use the fbconfig command. For example:

   ```
   % fbconfig -dev /dev/fbs/ifb1 -slave off
   ```

   You must configure each card in slave mode separately.

Your system is now ready for frame lock and buffer swap synchronization software applications.

Expert3D Screen Resolutions and Video Formats

TABLE A-4 lists the monitor screen resolutions and video formats supported by the Expert3D graphics accelerator:

TABLE A-4   Expert3D Screen Resolutions and Video Formats

Resolution and refresh rate (Hz)	Interlaced	Stereo	Composite	VESA
$640 \times 480 \times 60$				yes
$640 \times 480 \times 60$	yes			
$768 \times 575 \times 50$	yes			
$960 \times 680 \times 108$		yes		
$960 \times 680 \times 112$		yes		
$1024 \times 768 \times 60$			yes	
$1024 \times 768 \times 70$				
$1024 \times 768 \times 75$				yes
$1024 \times 768 \times 77$				
$1024 \times 800 \times 84$			yes	
$1152 \times 900 \times 66$			yes	
$1152 \times 900 \times 76$			yes	
$1280 \times 800 \times 76$				
$1280 \times 1024 \times 60$				yes
$1280 \times 1024 \times 67$			yes	
$1280 \times 1024 \times 75$				yes
$1280 \times 1024 \times 76$			yes	
$1280 \times 1024 \times 85$				yes
$1280 \times 1024 \times 112$		yes		
$1440 \times 900 \times 76$			yes	

TABLE A-4 Expert3D Screen Resolutions and Video Formats *(Continued)*

Resolution and refresh rate (Hz)	Interlaced	Stereo	Composite	VESA
1600 × 1000 × 66				
1600 × 1000 × 76			yes	
1600 × 1200 × 75				yes
1600 × 1280 × 76			yes	
1792 × 1344 × 75				yes
1920 × 1080 × 72			yes	
1920 × 1200 × 70				
1920 × 1200 × 75				