Hardware Developer Handbook

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-	May 15, 1994	Draft Version
1.0	November 3, 1994	First Internal Release (B&W Cover)
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Chapter 1

Introduction

Identifying Silicon Graphics workstations and knowing what kind of interfaces they contain can be a difficult problem. It's the purpose of this document to help in that quest.

This document is organized so that information about the broad range of SGI systems is collected here in one document. Reading through the information from front to back will progress from general information about SGI systems to the more specific information about particular interfaces. Along the way terminology will be defined that will help in identifying systems, options and interfaces available. These definitions are also listed in the Glossary of Terms.

This document covers all of the "4D", Mips RISC-based systems from the original 4D/60 to the latest systems including the O2, OCTANE, Origin 200, Origin 2000, and Onyx2. The IRIS systems that contained Motorola 680X0 processors with model numbers like 1000, 1400, 2400, 3000 and 3030 are not covered here. The Cray products - with the exception of the Origin2000 - are also not covered in this document.

While the names of the systems have changed over time, all these systems are considered part of the "IRIS" family, even though IRIS is not part of the product name.

1.1 The Goals

The major goals of this document are to allow you, the reader, to do two things:

Look at a Silicon Graphics workstation, maybe type in a few commands, and determine what kind of system it is, and what options it contains.

Know what kind of interfaces are available, and on what platforms those interfaces are available.

1.2 What You'll Find

1.2.1 Platform Information

The term *platform* is used here to specify a particular set of three characteristics - the chassis the system is contained in, the number and type of processor(s), and the type of graphics subsystem (if any) the system contains. This aspect of SGI systems is seen most clearly in the Periodic Table of the IRIS's. A *platform* is the intersection of a graphics choice with a processor choice. See The Periodic Table of the IRIS's that starts on page 1-7.

When talking about the processor in a Silicon Graphics system, it is important to know whether you are talking about the "software" CPU type or "hardware" CPU type. The Periodic Table of the IRIS's shows the "hardware" CPU type - the name of the physical processor board in the system. There are some circumstances where this is different than the "software" CPU type. This is discussed in Chapter 5 - "Understanding Hardware Inventory (hinv) Output".

Inherent in determining the kind of machine is the use of one or more names. Machines are known by marketing names, engineering code names, or model numbers. Knowing what each of these names refer to will assist in defining the system in question. Names and their meanings are covered in the section on page 1-4.

1.2.2 IRIS Family Tree

Another key element in understanding SGI platforms is knowing where, historically, these platforms belong. The IRIS Family Tree has been created to answer this question. This diagram shows each major new chassis and shows which processor and graphics types were originally shipped with it. The diagram shows the year in which the platforms first shipped. These diagrams can be found starting on page 1-9.

1.2.3 Color and Marking Information

Silicon Graphics has become known for its use of bold colors on its products. This too, is a way to determine what might be inside the IRIS. On some systems badges have been used to reflect certain graphics or CPU options. The Color and Marking Chapter (page 2-1) shows how to decode these colors.

1.2.4 Chassis Tour

Knowing what a chassis looks like and where to find a particular input or output connection can be a great advantage in working with the system. For each chassis particular attention is devoted to identifying each interface and a pointer to a detailed definition of that interface. The Chassis Drawings chapter (starting on page 3-1) will help you in finding the interfaces available.

1.2.5 Interfaces

The various interfaces available on SGI platforms are documented in the Interfaces chapter. This information is truly the heart of this document and the longest section. The interfaces are grouped in categories:

- Serial Ports
- Keyboard / Mouse Ports
- Parallel Ports
- Disk Drive Interfaces
- Monitors
- Memory
- Graphics Interfaces
- Video Interfaces
- Audio Interfaces
- CPU Interfaces
- Bus Interfaces
- Backplanes and Board Slots
- Networking Connections
- I / O Panel Plates
- Drive Sleds / Modules and Drive Mounting

1.2.6 Understanding Hardware Inventory (*hinv*) Output

A great deal of information about a system's hardware can be determined by looking at the results of the 'hinv' command. This chapter takes on the task of decoding the information presented by 'hinv' and also provides a history of the processor boards used in Silicon Graphics systems, noting the difference between "hardware CPU" and the "software CPU" types.

1.2.7 The IRIX Operating System

The IRIX operating system has changed significantly over the years. This chapter is an aide to understanding the changes that have occurred in IRIX due to new systems, new CPUs, new graphics and new capabilities. It also notes which releases were used to merge functionality from previous releases.

1.2.8 Software Tools

Some information about the system is not discernible from examining the outside of the system. To aid in gathering more information about the system the chapter on Software Tools was created. This contains information on commonly known tools, such as hinv, as well as some less well known tools that can help determine the exact configuration of the system.

1.2.9 Terms, Nicknames and Code Names

Since terminology is so important, understanding how to "decode" the internally used project names into the actual names used by Marketing is crucial. There are two reasons for this:

- Since the three elements that define a platform - Graphics, CPU and Chassis - were often developed as separate projects, they would have different project names. Knowing which part of the system the code name refers to is helpful.
- Second, some of the code names - specifically for the CPU and graphics - are sprinkled throughout the software code for IRIX. To an outsider these names make little sense but are invaluable if you know how to decode them.

The Tables 1-1, 1-2 and 1-3 show the relationship between the internally used code name, the marketing name and the model numbers for SGI systems for chassis, CPU's and graphics.

Table 1-1 Chassis Names

Chassis Code Name	Chassis Type	Marketing Name	Model Numbers
"Twin Tower"	Twin Tower	Power Series	4D/60, 70, 80, 85, 120, 210, 220, 240, 280, 310, 320, 340, 380, 420, 440, 480
"Diehard"	Single Tower		
"Predator"	Rack		
"Eclipse"	PI, TFLU	Personal IRIS	4D/20, 25
"Magnum"	TFLU	Personal IRIS	4D/30, 35
"Diehard2"	Deskside	Crimson	Crimson
"Hollywood"	Desktop	Indigo	4D/RPC
"Eveready"	Deskside	Onyx/Challenge	Onyx, Challenge L
"Terminator"	Rack		Onyx, Power Challenge XL
"Fullhouse"	Desktop	$Indigo^2$	$Indigo^2$
"Guinness"	Desktop	Indy	Indy
"Moosehead"	Desktop	O2	O2
"Speedracer"	Desktop	OCTANE	OCTANE
"Speedo"	Deskside	Origin200	Origin200
"Lego"	Deskside/Rack	Origin2000/ Onyx2	Origin2000/ Onyx2

Table 1-2 CPU Names

CPU Code Name	Description	Marketing Name	Found In Model Numbers
"Lonestar"	First R400 CPU for 4D Systems	Crimson	Crimson
"Twin Peaks"	Enhanced Floating Point R4K CPU	R8000	Power Onyx, Power Challenge, Power Indigo^2
"Triton"		R5000	Indy, O2
"T5"		R10000	O2, OCTANE, Origin200, Origin2000, Onyx2

A more lengthy glossary of terms used to identify IRIS systems is provided as an appendix. This glossary includes the Marketing terminologies as well as the Engineering terminologies. Project "code names" are created long before their commercial name is chosen. Even after a product has been announced and has been shipping, members of the team who created it still refer to it by its code name.

More importantly, references to the project code names can be found throughout software header files. Indeed some of these code names are used as nomenclature for various software and hardware pieces. Not knowing what code name equates to a "real" name is like being lost in a foreign land without a magic decoder ring. Hopefully this will help.

Table 1-3 Graphics Names

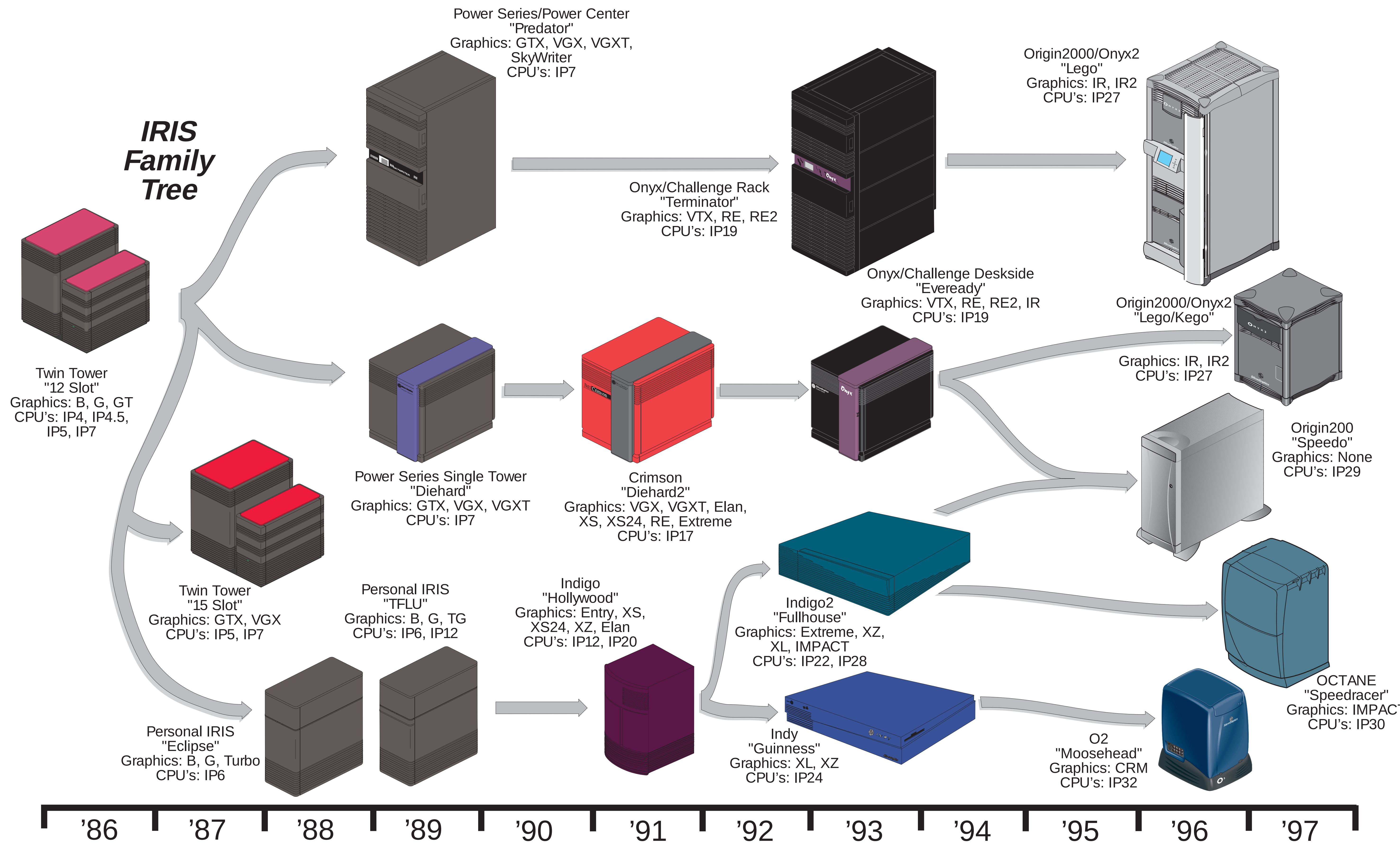
Graphics Code Name	Description	Marketing Name	Found In Model Numbers
"Clover1"	Original 4D Graphics	B, G	4D/50, 60, 70
"Clover2"	2nd Generation 4D Graphics	GT, GTX	4D/70, 80, 85, 120, 210, 220, 240, 280
"Stapuft"	3rd Generation 4D Graphics	VGX, VGXT	4D/310, 320, 340, 380, 420, 440, 480
"Venice"	4th Generation 4D Graphics	Reality Engine	4D/310, 420, 440, 480,
-	Original PI Graphics	B, G	4D/20, 25, 30, 35
-	Turbo PI Graphics	TG	4D/20, 25, 30, 35
"Da Vinci"	24 Bitplanes, No Z Buffer		4D/20, 25
"Starter"	Original Indigo Graphics	Entry Graph-ics	Indigo R3K, R4K
"Express"	Family of 2nd Generation Indigo Graphics	XS, XS24, XZ, Elan	Indigo R3K, R4K, Indy (XZ only)
"Ultra"	High End of Express Graphics Family	Extreme	Indigo^2
"Newport"	Original Indy Graphics, Low End Indigo^2 Graphics	XL	Indy, Indigo^2
"Mardi Gras"		IMPACT	Indigo^2
"Kona"	5th Generation High End Graphics	Reality Engine2	Onyx2

1.3 What You Will Not Find

It would be ideal if it were possible to outline every possible combination of chassis, processor and graphics that ever existed. While tempting, this is not realistic. During the history of the IRIS systems, and primarily due to the modular nature of our graphics & processor subsystems and many upgrade programs, the markings on the outside of an IRIS may not actually reflect what is inside.

XL																	Indigo^2 XL	Indy 8/24
RE												4D/310 RE	4D/4x0 RE x=2, 4, 8		Crimson/ RE			
Extreme															Crimson/ Extreme		Indigo^2 Extreme	
Elan										4D/30 Elan	4D/35 Elan			Indigo Elan	Crimson/ Elan	Indigo R4K Elan		
XZ														Indigo XZ	Crimson/ XZ	Indigo R4K XZ	Indigo^2 XZ	
XS24														Indigo XS24	Crimson/ XS24	Indigo R4K XS24		
XS														Indigo XS	Crimson/ XS	Indigo R4K XS		
Entry														Indigo	Crimson/ BLG	Indigo R4K		
VGX/ VGXT												4D/3x0 VGX[T] x=1, 2, 4, 8	4D/4x0 VGX[T] x=2, 4, 8		Crimson/VGX[T]			
VGXB							4D/2x0 VGXB x=2, 4, 8											
Base/ G/ G Turbo								4D/20 [G, TG]	4D/25 [G, TG]	4D/30 [G, TG]	4D/35 [G, TG]							
GTX/ GTXB					4D/120 GTX[B]	4D/210 GTX[B]	4D/2x0 GTX[B] x=2, 4, 8								Crimson/ GTX			
GT		4D/50 GT	4D/70 GT	4D/80, 85 GT														
GTB		4D/50 GTB	4D/70 GTB	4D/80, 85 GTB														
G	4D/60G	4D/50G	4D/70G															
B	4D/60	4D/50	4D/70															
No Graphics						4D/210S	4D/2x0S x=2, 4, 8					4D/3x0S x=1, 2, 4, 8	4D/4x0S x=2, 4, 8				Challenge M	Challenge S
	MIPS Board Set	IP4 8 MHz	IP4 12.5 MHz	IP4.5 16.7 MHz [IP4]	IP5 2 x 16.7 MHz	IP9 25 MHz	1, 2 or 4 IP7's [2] IP7 = 2x25 MHz [IP5[	IP6 12.5 MHz	IP10 20 MHz [IP6]	IP14 30 MHz [IP12]	IP14 36 MHz [IP12]	1/2[1], 1, 2, or 4 IP13's[2] IP13 = 2x33 MHz [IP7]	1, 2 or 4 IP15's [2] IP15 = 2 x 40MHz [IP7]	IP12 33 MHz	IP 17 100 MHz	IP 20 100 MHz	IP22 100 MHz	IP24 100 MHz (PC/SC) [IP22]
Processor Base	R2300	R2000								R3000					R4000			
Chassis	Twin Tower			Twin or Single Tower			Single Tower or Predator Rack	Personal IRIS				Single Tower or Predator Rack		Indigo	Diehard2	Indigo	Indigo^2	Indy

Reality Monster																			Onyx2 Reality Monster
CRM											O2	O2 R10K							
SSI																OCTANE SSI			
Maximum IMPACT	Indigo2 Max IMPACT						Power Indigo2 Max IMPACT						Indigo^2 R10K Maximum IMPACT			OCTANE Maximum IMPACT		Onyx2 MXI	
High IMPACT	Indigo2 High IMPACT						Power Indigo2 High IMPACT						Indigo^2 R10K High IMPACT			OCTANE High IMPACT			
Solid IMPACT	Indigo2 Solid IMPACT						Power Indigo2 Solid IMPACT						Indigo^2 R10K Solid IMPACT			OCTANE Solid IMPACT			
Infinite Reality (4 RMs)		Onyx Infinite Reality						Power Onyx/n Infinite Reality n=1,2,4,12						Onyx Infinite Reality 10000				Onyx2 Infinite Reality	
Infinite Reality (2 RMs)		i-station												i-station					
RE^2 (4 RMs)		Onyx/n RE^2 n=2, 4, 8, 16, 24						Power Onyx/n RE^2 n=1, 2, 4, 12						Onyx RE^2 10000				Onyx2 RE^2	
RE^2 (2 RMs)		Reality Station												Reality Station					
RE																			
VTX		Onyx/n VTX n=2, 4, 8, 16, 24																	
XL	Indigo^2 XL			Indy 8/24	Indy 8/24	Indigo2 XL				Indy 8/24									
Extreme	Indigo^2 Extreme	Onyx/n Extreme n=2,4				Indigo2 Extreme	Power Indigo2 Extreme	Power Onyx/n Extreme n=1,2											
XZ	Indigo^2 XZ			Indy XZ		Indigo2 XZ	Power Indigo2 XZ			Indy XZ									
No Graphics	Challenge M	Challenge L	Challenge XL	Challenge S				Power Challenge L	Power Challenge XL					Challenge L	Challenge XL		Origin 200	Origin 2000	
	IP 22 75 MHz	1, 2, 4, 8 or 12 IP19's[3] IP19 = 2xR4400		IP24 150 MHz [IP22]	IP 24 100 MHz [PC,SC] [IP22]	IP22 133 MHz [SC]	IP26 75 MHz	1, 2, 4 or 12 IP21's[4] IP21 = 1x75 MHz		IP24 [IP22]	IP32 180 MHz	IP32 174 MHz	IP28 195 MHz	1, 2, 4 or 12 IP25s IP25 = 1x194MHz		IP30	IP29 [IP27]	1, 2,..24 IP27's IP27 = 1x 195 MHz	
Processor Base	R4400				R4600		R8000			R5000		R10000							
Chassis	Indigo^2	Eveready/ (Deskside)	Terminator (Rack)	Indy		Indigo2		Eveready (Deskside)	Terminator (Rack)	Indy	O2		Indigo^2	Eveready (Deskside)	Terminator (Rack)	OCTANE	Origin 200	Onyx2 Desk	Onyx2 Rack


IRIS Family Tree
Twin Tower "12 Slot" Graphics: B, G, GT CPU's: IP4, IP4.5, IP5, IP7
Power Series/Power Center "Predator" Graphics: GTX, VGX, VGXT, SkyWriter CPU's: IP7
Onyx/Challenge Rack "Terminator" Graphics: VTX, RE, RE2 CPU's: IP19
Origin2000/Onyx2 "Lego" Graphics: IR, IR2 CPU's: IP27
Onyx/Challenge Deskside "Eveready" Graphics: VTX, RE, RE2, IR CPU's: IP19
Origin2000/Onyx2 "Lego/Kego" Graphics: IR, IR2 CPU's: IP27
Power Series Single Tower "Diehard" Graphics: GTX, VGX, VGXT CPU's: IP7
Crimson "Diehard2" Graphics: VGX, VGXT, Elan, XS, XS24, RE, Extreme CPU's: IP17
Origin200 "Speedo" Graphics: None CPU's: IP29
Twin Tower "15 Slot" Graphics: GTX, VGX CPU's: IP5, IP7
Personal IRIS "TFLU" Graphics: B, G, TG CPU's: IP6, IP12
Indigo "Hollywood" Graphics: Entry, XS, XS24, XZ, Elan CPU's: IP12, IP20
Indigo2 "Fullhouse" Graphics: Extreme, XZ, XL, IMPACT CPU's: IP22, IP28
OCTANE "Speedracer" Graphics: IMPACT CPU's: IP30
Personal IRIS "Eclipse" Graphics: B, G, Turbo CPU's: IP6
Indy "Guinness" Graphics: XL, XZ CPU's: IP24
O2 "Moosehead" Graphics: CRM CPU's: IP32
'86 '87 '88 '89 '90 '91 '92 '93 '94 '95 '96 '97

Chapter 2

Color and Marking

Silicon Graphics has become known for using bold colors. Knowing how to decipher these colors and other markings on the IRIS systems can assist in determining the hardware present in the system.

2.1 Top Hat/Skin Colors and Badges

2.1.1 Twin & Single Tower Chassis

The top hat is the piece of the chassis' skin that sits on the top of the system. The early IRIS systems used the color of the top hat to indicate the type of graphics subsystem that is in the machine. Figure 2-1 depicts the Twin & Single Tower type chassis and the location of the top hats and doors that reflect the graphics subsystem. The table shows the correlation of the color and the graphics subsystem.

For all these systems the skins were "brown" (actually, the real name of the color is "dark warm grey", but nobody thinks that's what it looks like).

In addition to the colored top hats, there are normally labels along the front of the top hat that described the systems configuration at shipment.

Table 2-1 Twin Tower Top Hat Colors

Color	Graphics Subsystem
Purple	B, G
Teal	GT
Red	GTX, GTXB
Blue	VGX, VGXT
Beige	No Graphics

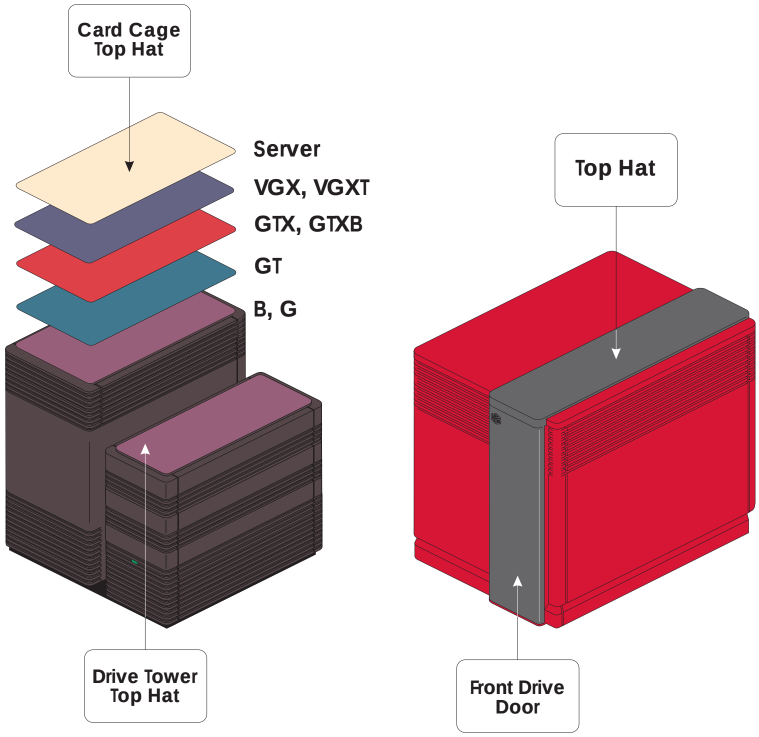


Figure 2-1 Twin and Single Tower Top Hats and Doors

2.1.2 Predator Rack Chassis

The Predator Rack did not have any skins or parts that were colored that would give away the type of (or lack of) graphics subsystem. The area at the top of the bottom door (where the CPU status panel is) would either have the nomenclature “Power Series”, “Power Center” or “Skywriter”.

The Power Series racks had either GTX, GTXB, VGX, VGXT or RE graphics. The Power Center racks had no graphics. The Skywriter is a dual pipe graphics rack where the graphics subsystem could be either VGX, VGXT or RE.

The skins for all these systems were “brown” like the Twin and Single Tower systems.

2.1.3 Personal IRIS

The Personal IRIS systems did not have any colored parts that would indicate the kind of a graphics or processor system was in the machine. The skins are “brown”.

The TFLU chassis has an additional line on the front of the system which gives away the presence of the door for the front loading disk drive. Other than this minor difference there is no difference in coloring or marking.

2.1.4 Crimson "Diehard2" Chassis

The Crimson chassis had only one color combination. The skins are bright red while the top hat and front drive door are a dark grey. The marking "IRIS Crimson" is across the front of the system.

2.1.5 Indigo

The Indigo is best known for its namesake color. Sometimes referred to as "purple boxes". From a marking point of view, the drive door has the word "Elan" on it if the system is equipped with that set of graphics. Likewise, the door would have "XS", "XS24", or "XZ" if it had those graphics subsystems. If the Indigo is a server (i.e. no graphics), it would have the words "Data Station" on the drive door.

Once the R4000 CPU was released, badges were used to differentiate between R3000 based systems and R4000 based systems. These badges (shown below) denoted both the CPU and the graphics subsystem installed. The table following shows the relationship between the badge type and the color of plastic used to mold it.

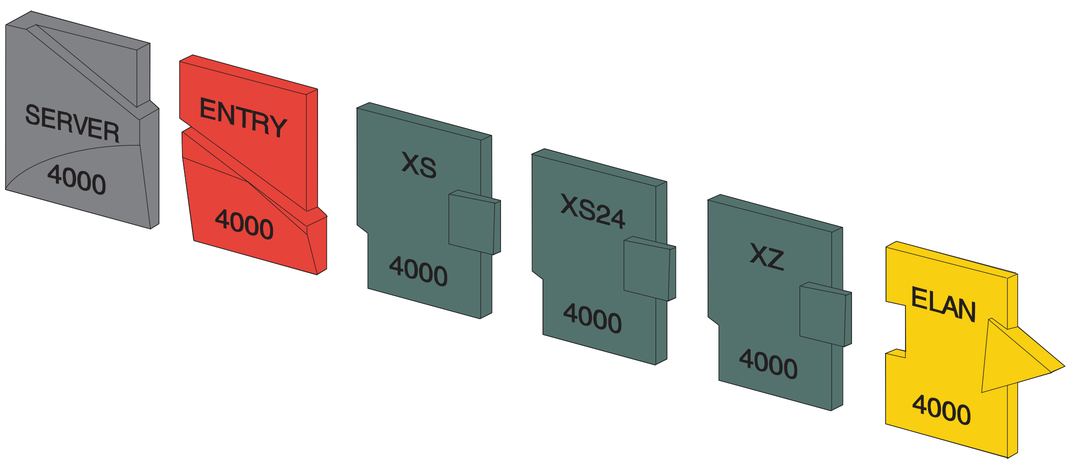


Figure 2-2 Indigo R4000 Badges

Table 2-2 Indigo Badges

Badge	Badge Plastic Color
R4000 Server	Grey
R4000 Entry	Red
R4000 XS, XS24, XZ	Green
R4000 Elan	Yellow

2.1.6 Indigo^2 Chassis

The Indigo^2 chassis skins are "green". There are three badges that denote the type of graphics subsystem (shown below) and one that denotes the use of the R8000 processor. The table following shows the relationship between the graphics system and / or CPU, the badge and the color of plastic used to mold the badge. The "Power" badge can be added to any of the graphics badges.

With the introduction of the IMPACT graphics subsystem, the skin color of the Indigo2 was changed to a "purple" color and a new badge was created to show the presence of the IMPACT graphics subsystem. The IMPACT badge is also shown in Figure 2-3.

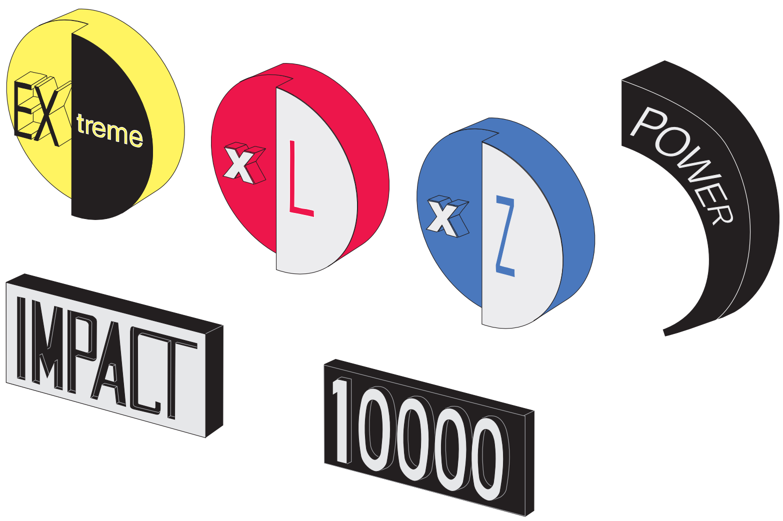


Figure 2-3 Indigo^2 Badges

Table 2-3 Indigo^2 Badges

Graphics/CPU	Badge Plastic Color/ Paint Color
Extreme	Yellow/Black
XZ	Blue/White
XL	Red/White
Power	Black/White
IMPACT	Black/Silver
R10000	Black/Silver

2.1.7 Onyx/Challenge Chassis (Rack and Deskside)

The Onyx and Challenge systems share the two types of chassis - deskside and rack.

For Onyx, the skins are black. The top hat and front drive door of the deskside machine are a deep purple. For the rack, the area surrounding the system status display has a purple marble-like overlay with the marking “Onyx” in white.

For the Challenge deskside systems the skins are black. The top hat and front drive door for the deskside systems are a blue-grey. On the rack the skins are the blue-grey while the area surrounding the system status display is a blue and black marbled overlay with the marking “Challenge” in gold.

Like the Twin and Single Tower systems a label along the front of the top hat denotes the “as shipped” configuration.

2.1.8 Indy

The Indy skin is a “granitized” blue color.

2.1.9 O2

The O2 has two colors. The main part of the unit, the “tub”, is a dark blue, while the bottom part, the “skirt”, and the top of the unit are a dark grey.

2.1.10 OCTANE

The OCTANE system is a dark green color. The skirt of the unit is a medium grey.

2.1.11 Origin200

The Origin200 system is a dark blue color.

2.1.12 Origin2000

The deskside Origin2000 systems are a dark blue color. The rack Origin2000 systems are grey with the same dark blue color.

2.1.13 Onyx2

The deskside Onyx2 systems are purple in color. The rack Onyx2 systems are grey with the same purple color.

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Chapter 3

Chassis Tour

This section shows in pictorial form each of the IRIS chassis styles. For each of the chassis, the I/O Panel area and other views of the systems are shown denoting major components or interfaces with references to the location of a more detailed description of that component or interface elsewhere in this document.

3.1 Twin Tower - 12 Slot

3.1.1 Front & Rear Views

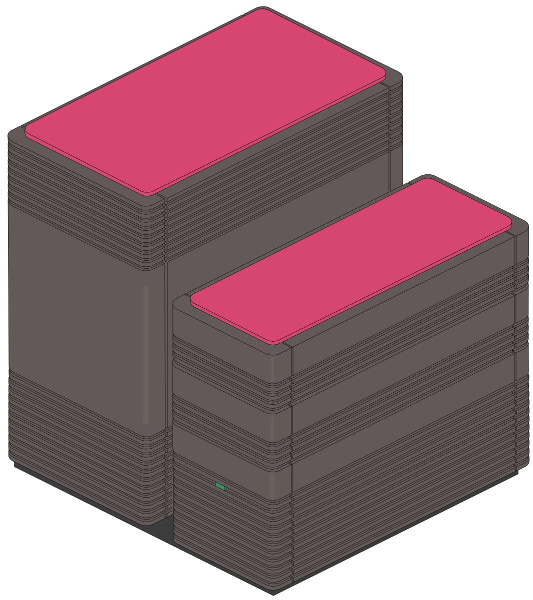


Figure 3-1 12 Slot Twin Tower Front Quarter View

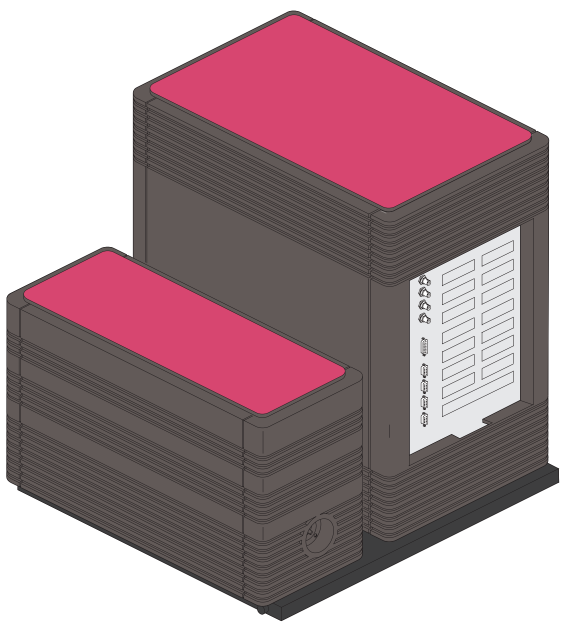


Figure 3-2 12 Slot Twin Tower Rear Quarter View

3.1.2 I/O Panel

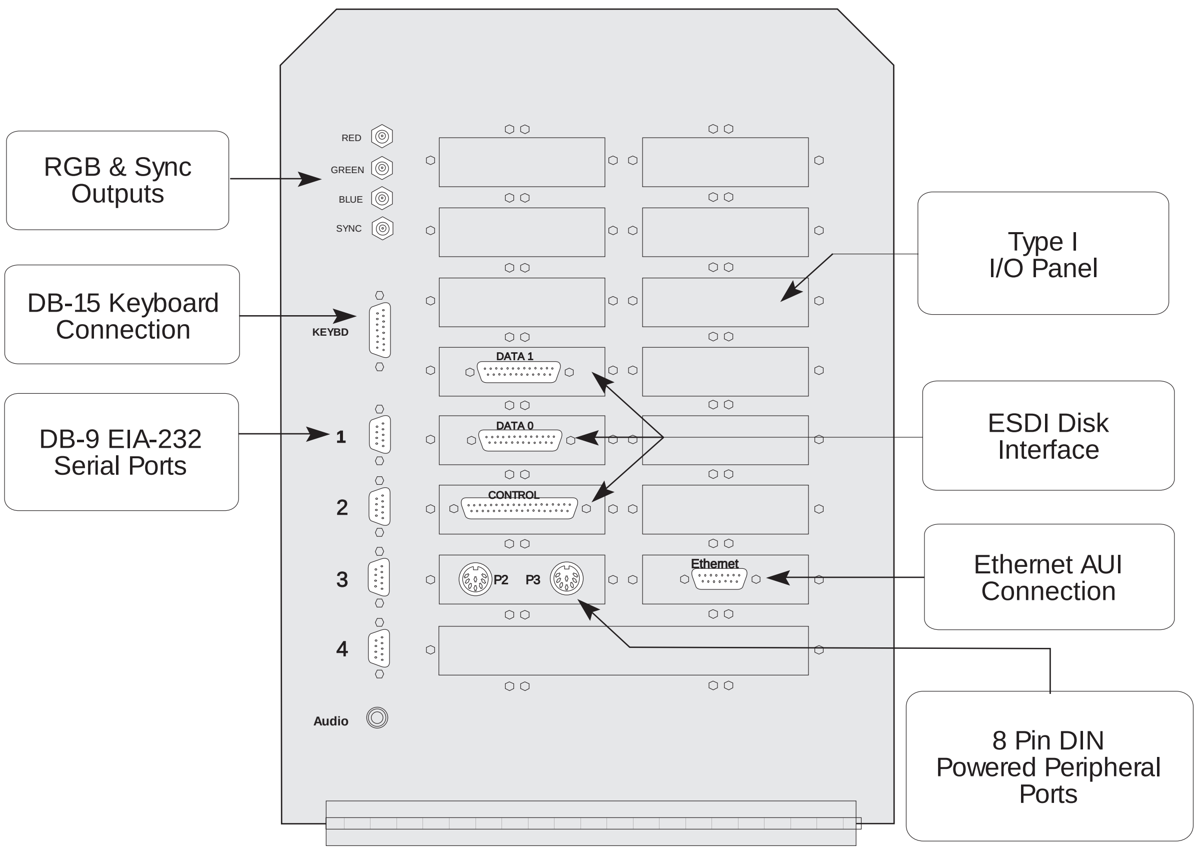


Figure 3-3 12 Slot Twin Tower I/O Panel

3.2 Twin Tower - 15 Slot

3.2.1 Front & Rear Views

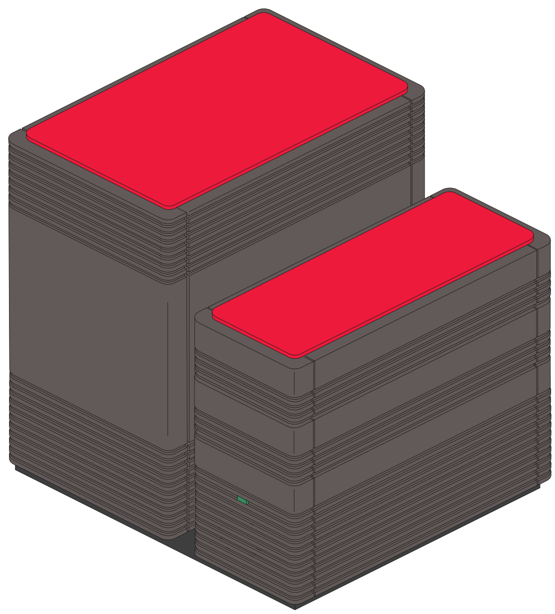


Figure 3-4 15 Slot Twin Tower Front Quarter View

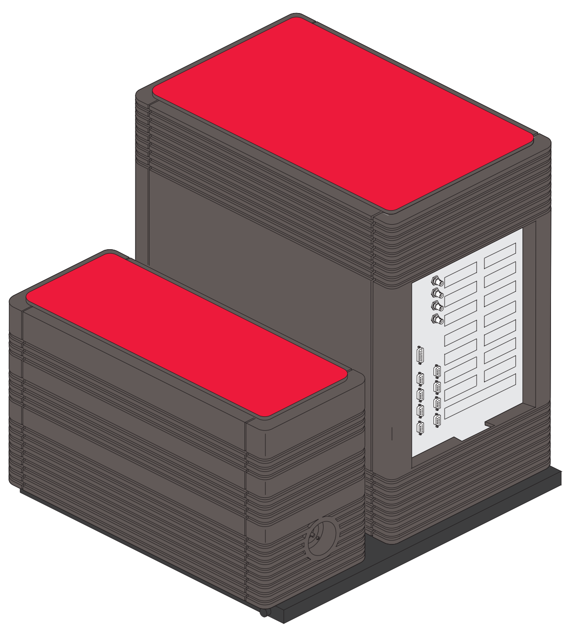


Figure 3-5 15 Slot Twin Tower Rear Quarter View

3.2.2 I/O Panel

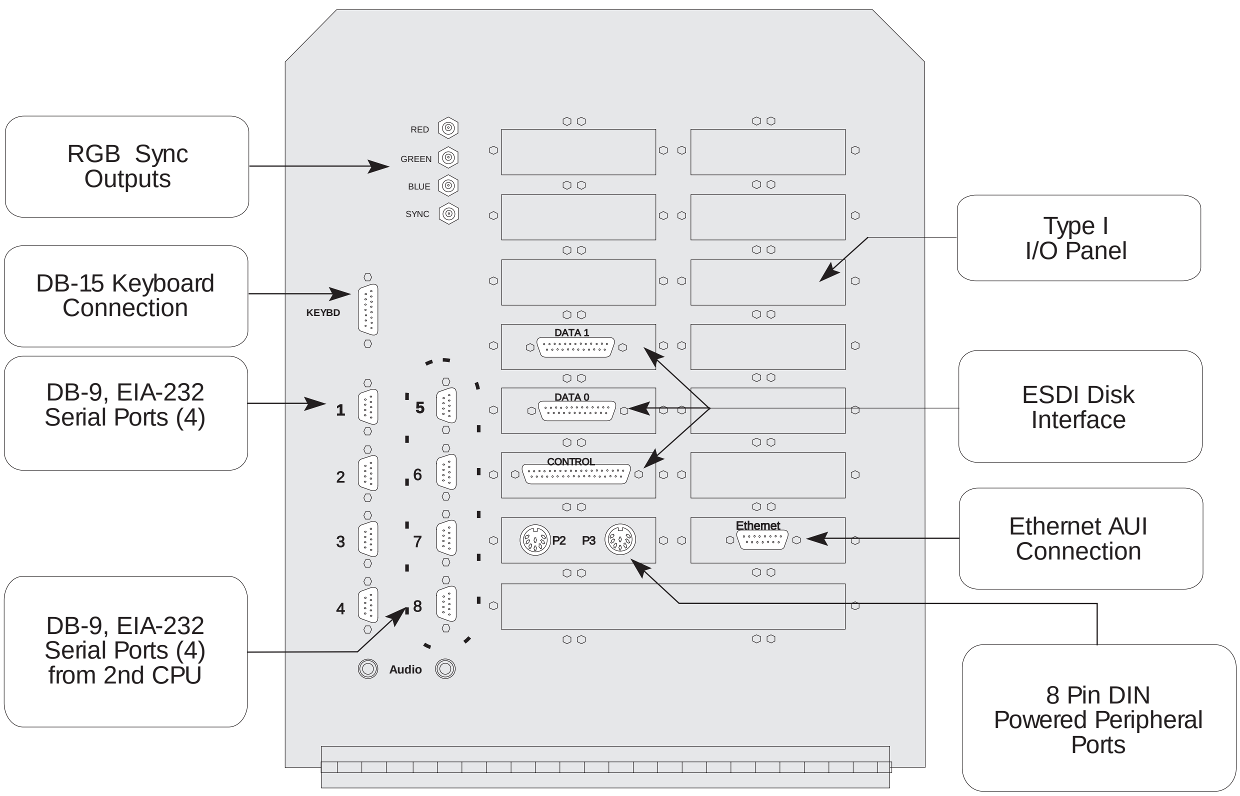


Figure 3-6 15 Slot Twin Tower I/O Panel

3.3 Single Tower - “Diehard”

3.3.1 Front & Rear Views

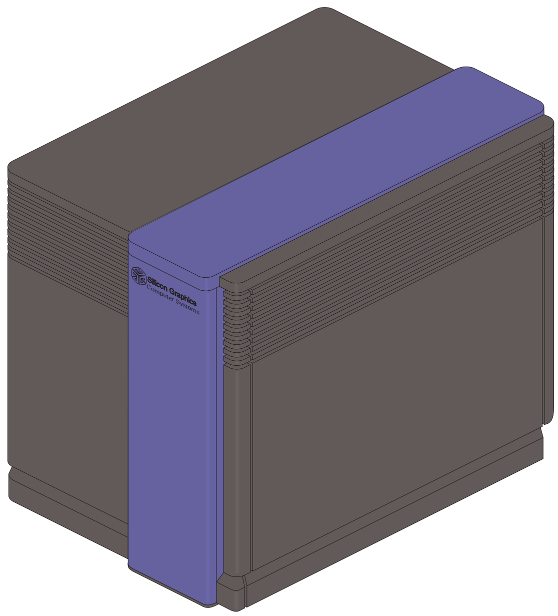


Figure 3-7 Diehard Front Quarter View

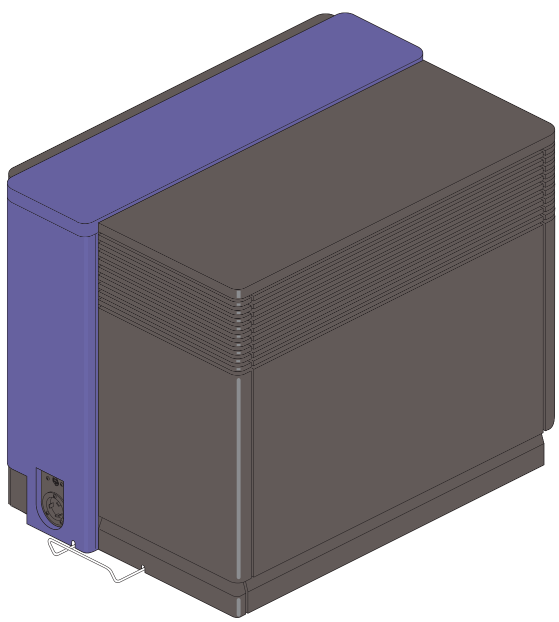
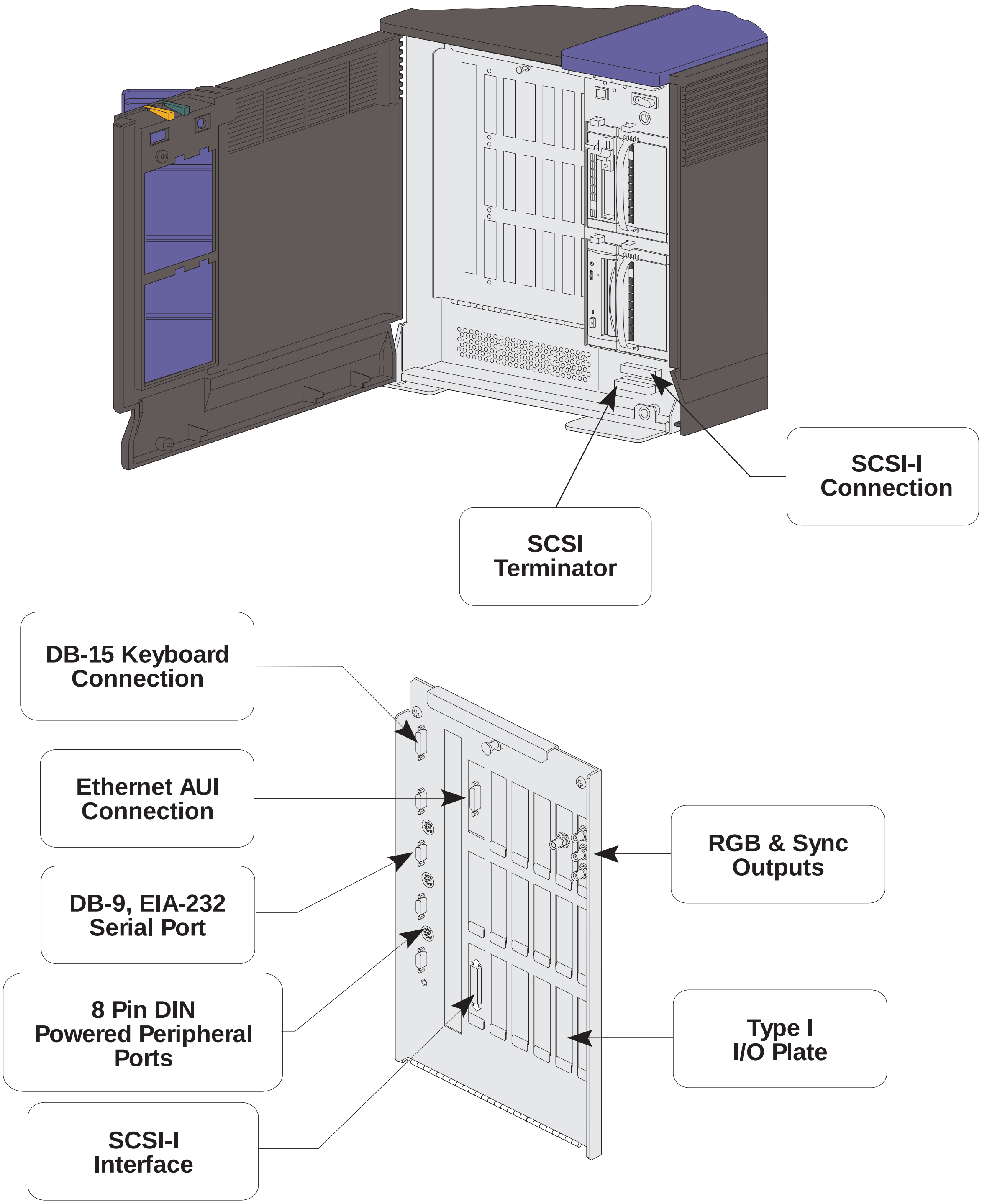


Figure 3-8 Diehard Rear Quarter View

3.3.2 I/O Panel

Figure 3-9 Diehard Front Drive Bays and I/O Panel



3.4 Predator Rack

3.4.1 Front & Rear View

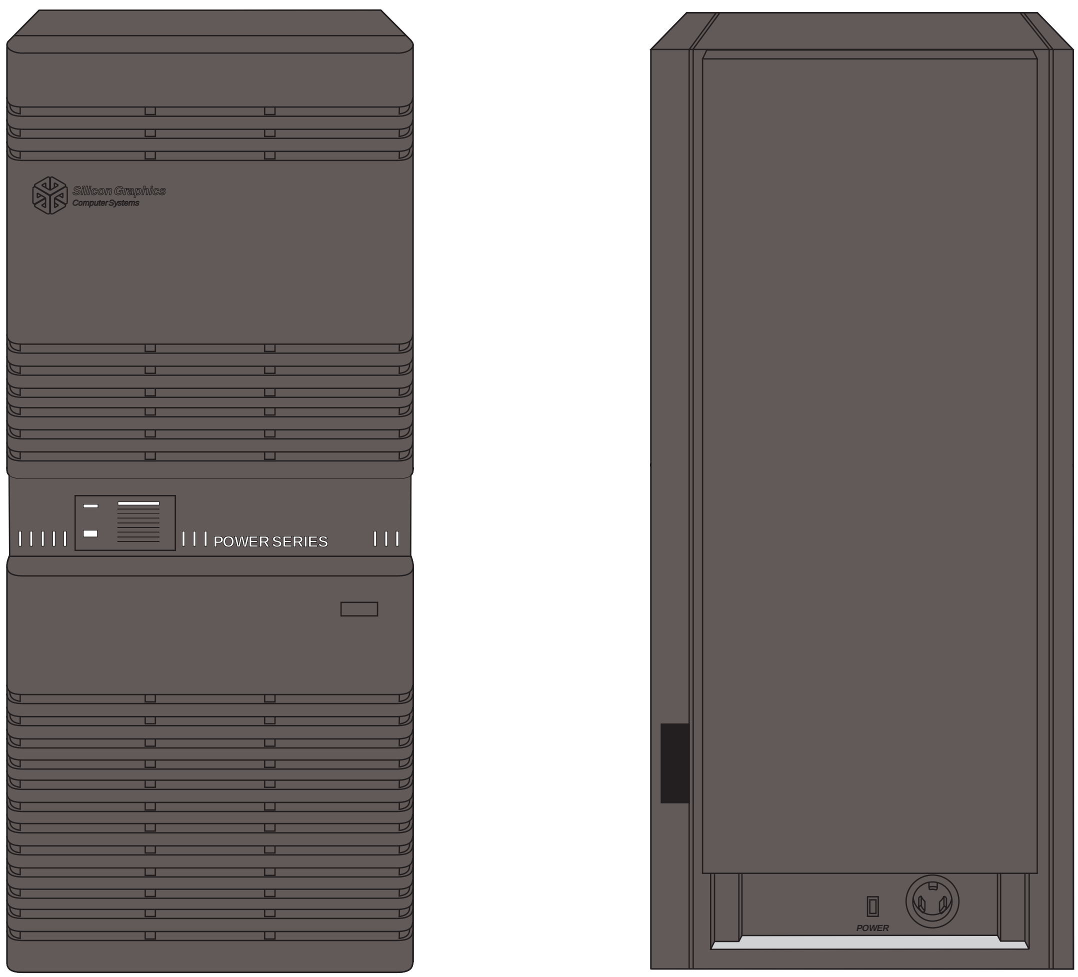


Figure 3-10 Predator Front & Rear Views

3.4.2 I/O Panel

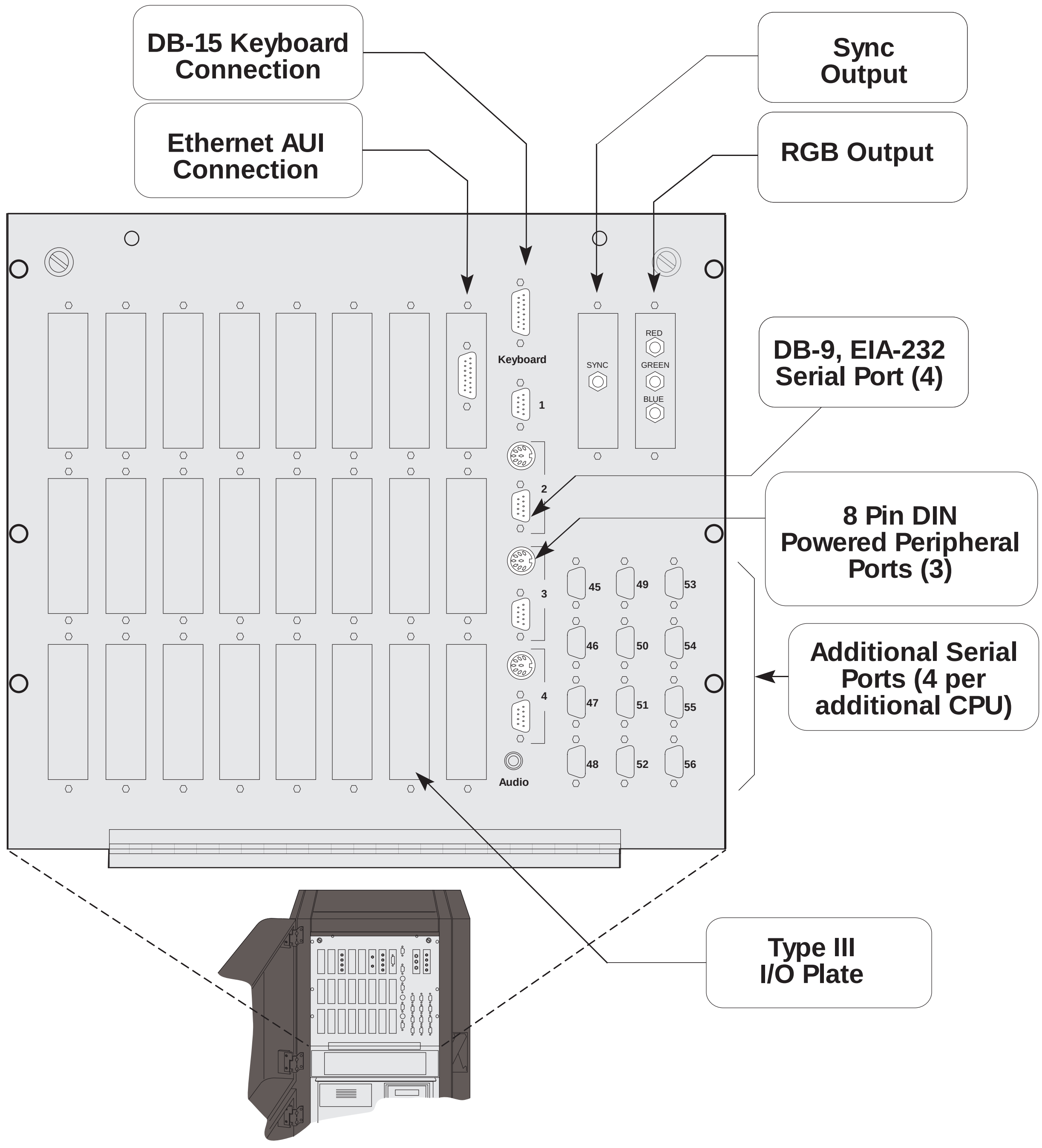


Figure 3-11 Predator I/O Panel

3.5 Personal IRIS

3.5.1 Front & Rear Views & Rear View with Side Skin Removed

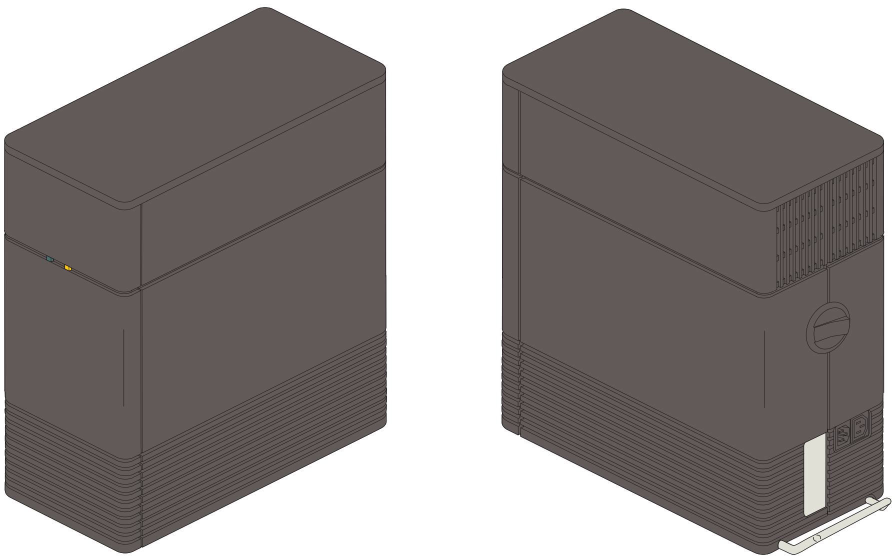


Figure 3-12 Personal IRIS Front & Rear Quarter Views

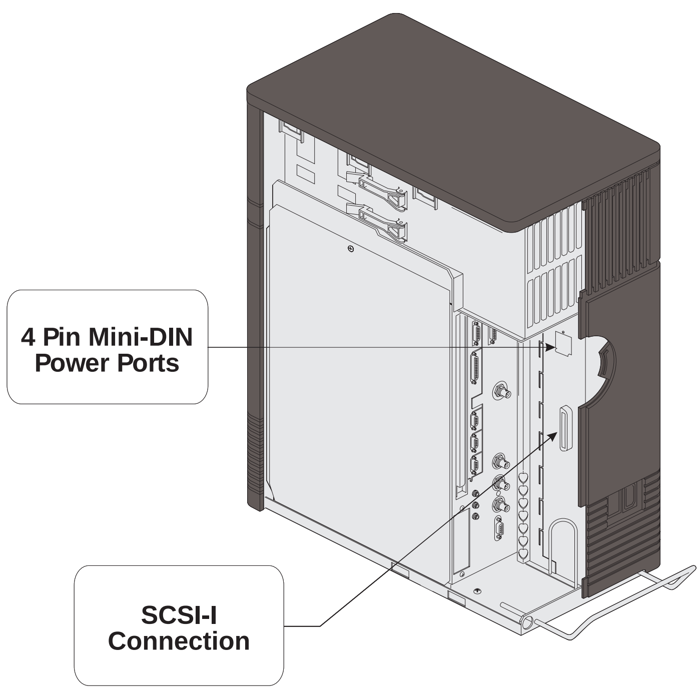


Figure 3-13 Personal IRIS Rear Quarter View Without Side Skin

3.5.2 I/O Panel - 4D/20, 25 E-Module (GR1.2 and GR1.5 Graphics Board)

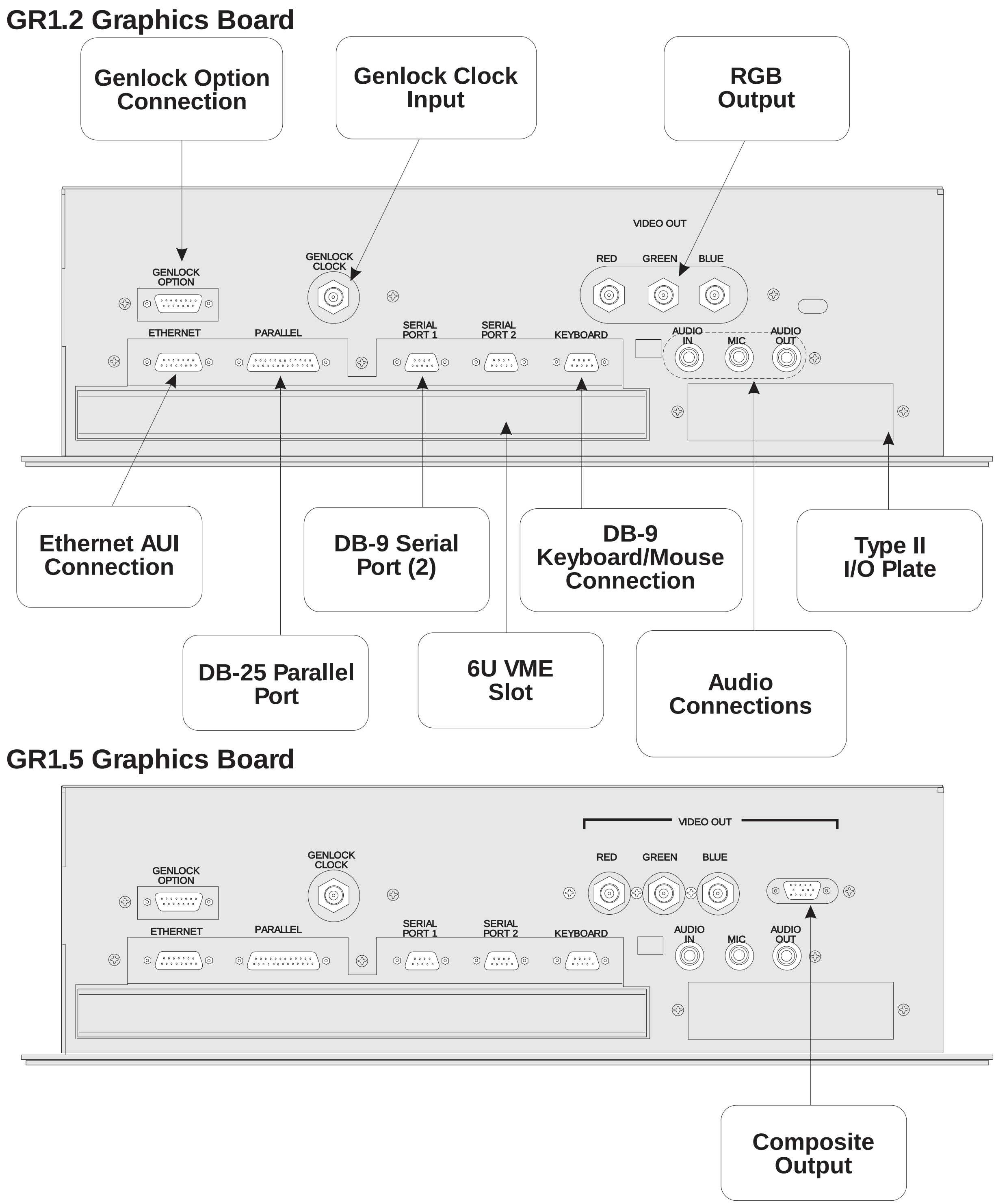


Figure 3-14 Personal IRIS I/O Panel - 4D/20, 25 with GR1.2 & GR1.5 Graphics Boards

3.5.3 I/O Panel - 4D/30, 35 E-Module With GR1.5 Graphics Board

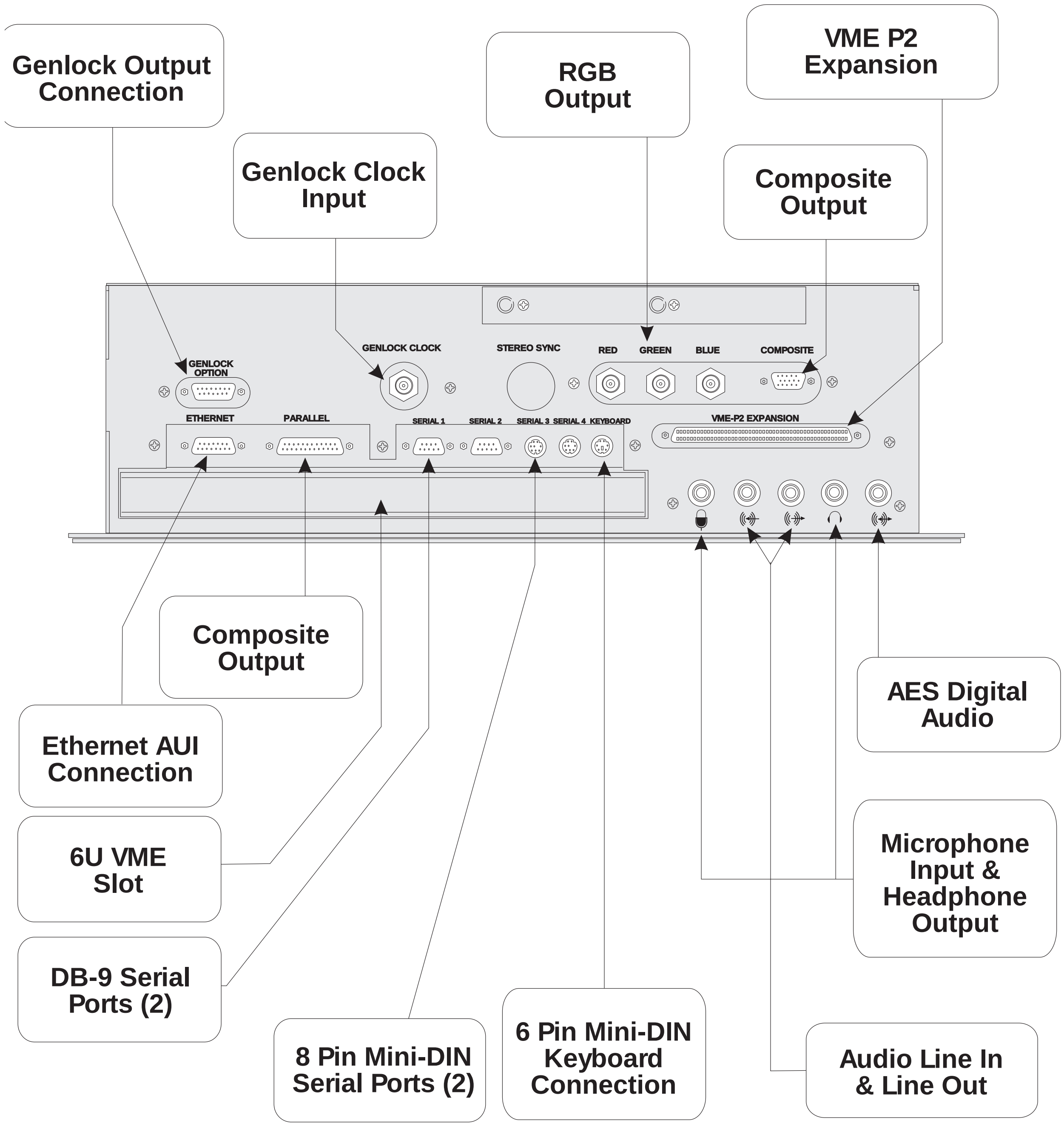


Figure 3-15 Personal IRIS I/O Panel - 4D/30, 35 with GR1.5 Graphics Board

3.5.4 I/O Panel - 4D/30, 35 E-Module With Elan Graphics Board

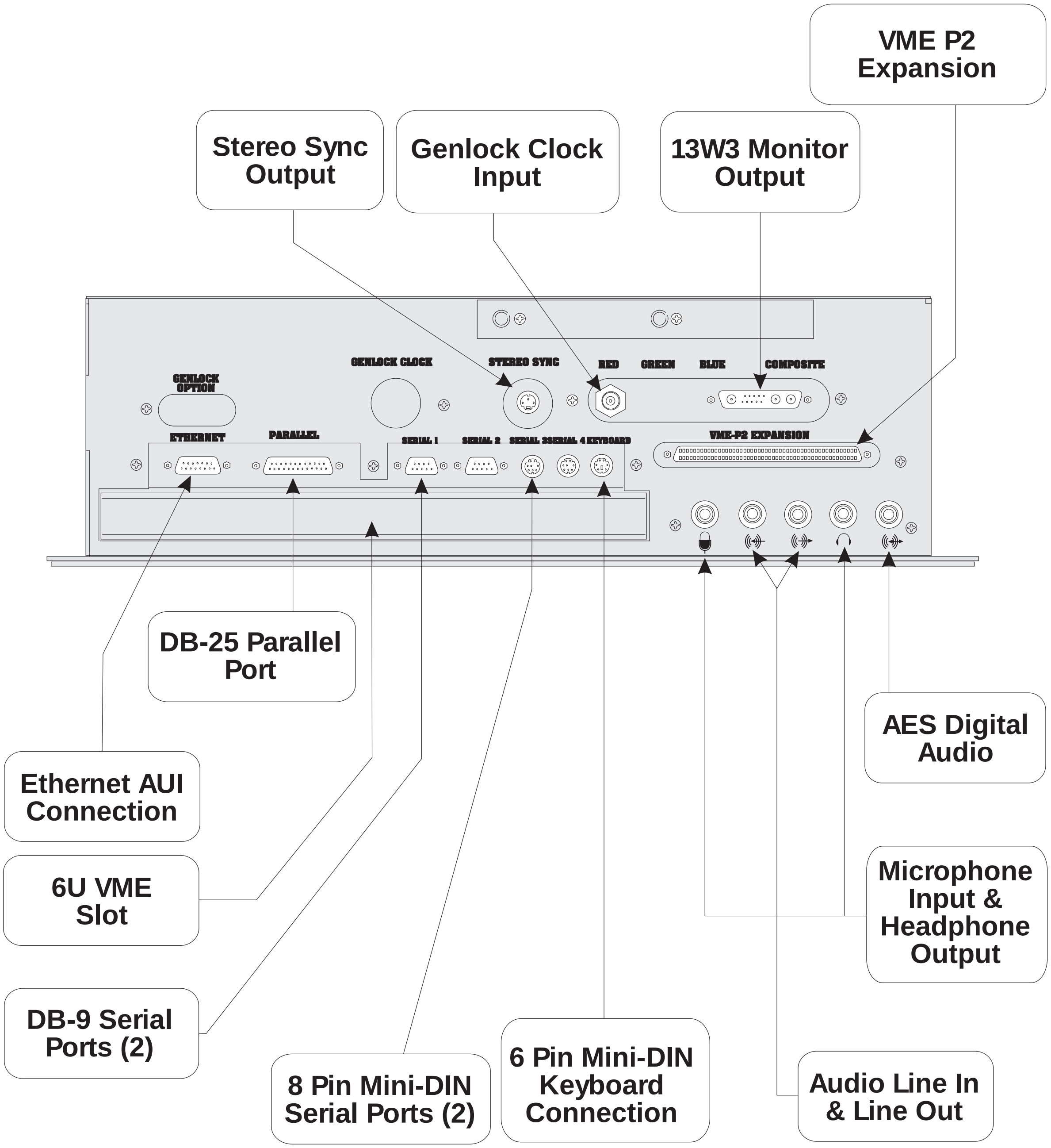


Figure 3-16 Personal IRIS I/O Panel - 4D/30, 35 with Elan Graphics Board

3.6 Personal IRIS - TFLU Chassis

This chassis is fundamentally similar to the original Personal IRIS chassis. The main difference is the fact that the system drive is no longer fixed in place inside the chassis, but accessible from the front via a removable skin piece. The drive is mounted on a drive sled for easy installation and removal. Once the Totally Front Loading Unit (TFLU) chassis was introduced, all Personal IRIS shipments were made with this new chassis.

Since the E-Modules used in the TFLU chassis and the original chassis are the same, their I/O panels (shown in the previous section) will not be repeated here.

3.6.1 Front & Rear View

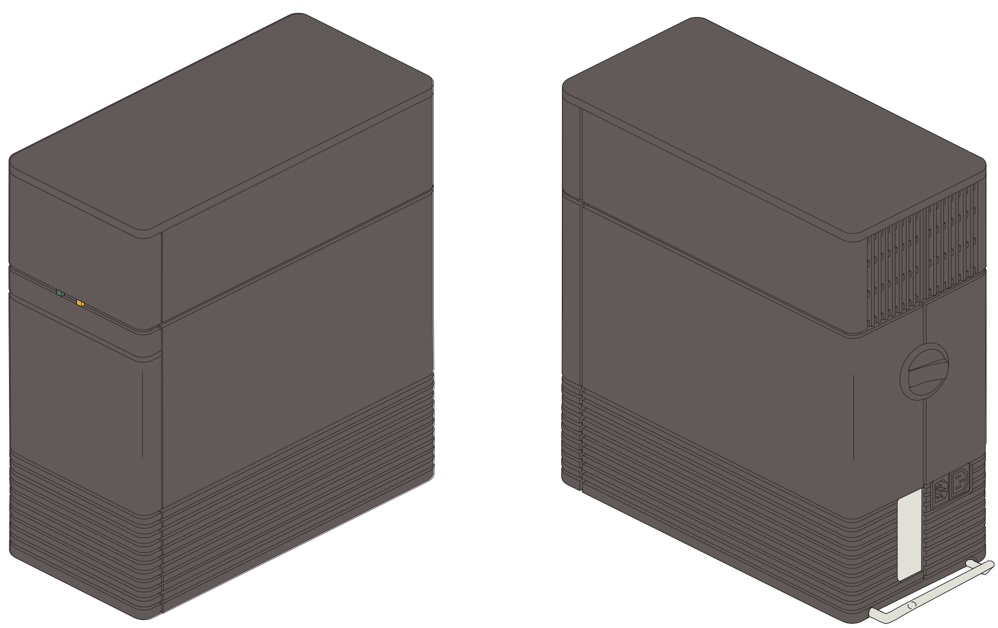


Figure 3-17 Personal IRIS TFLU Chassis - Front & Rear Quarter Views

3.7 Single Tower - “Diehard2”

3.7.1 Front & Rear Views

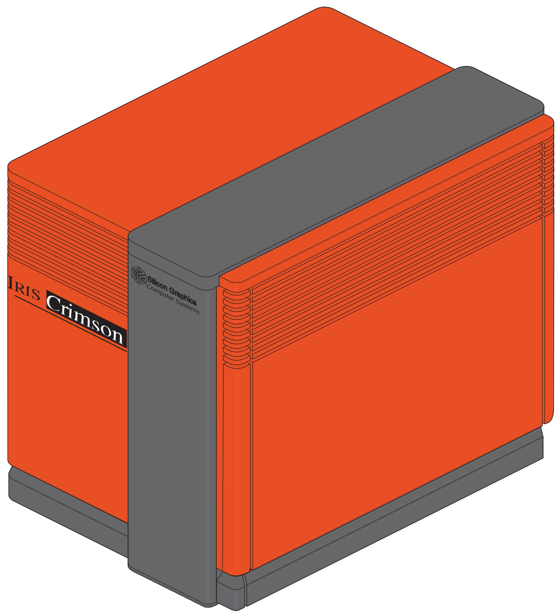


Figure 3-18 Diehard2 Front Quarter View

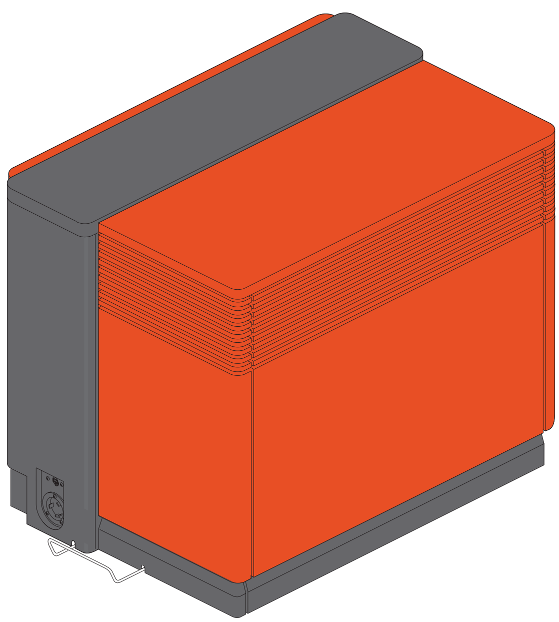


Figure 3-19 Diehard2 Rear Quarter View

3.7.2 Drive Bays

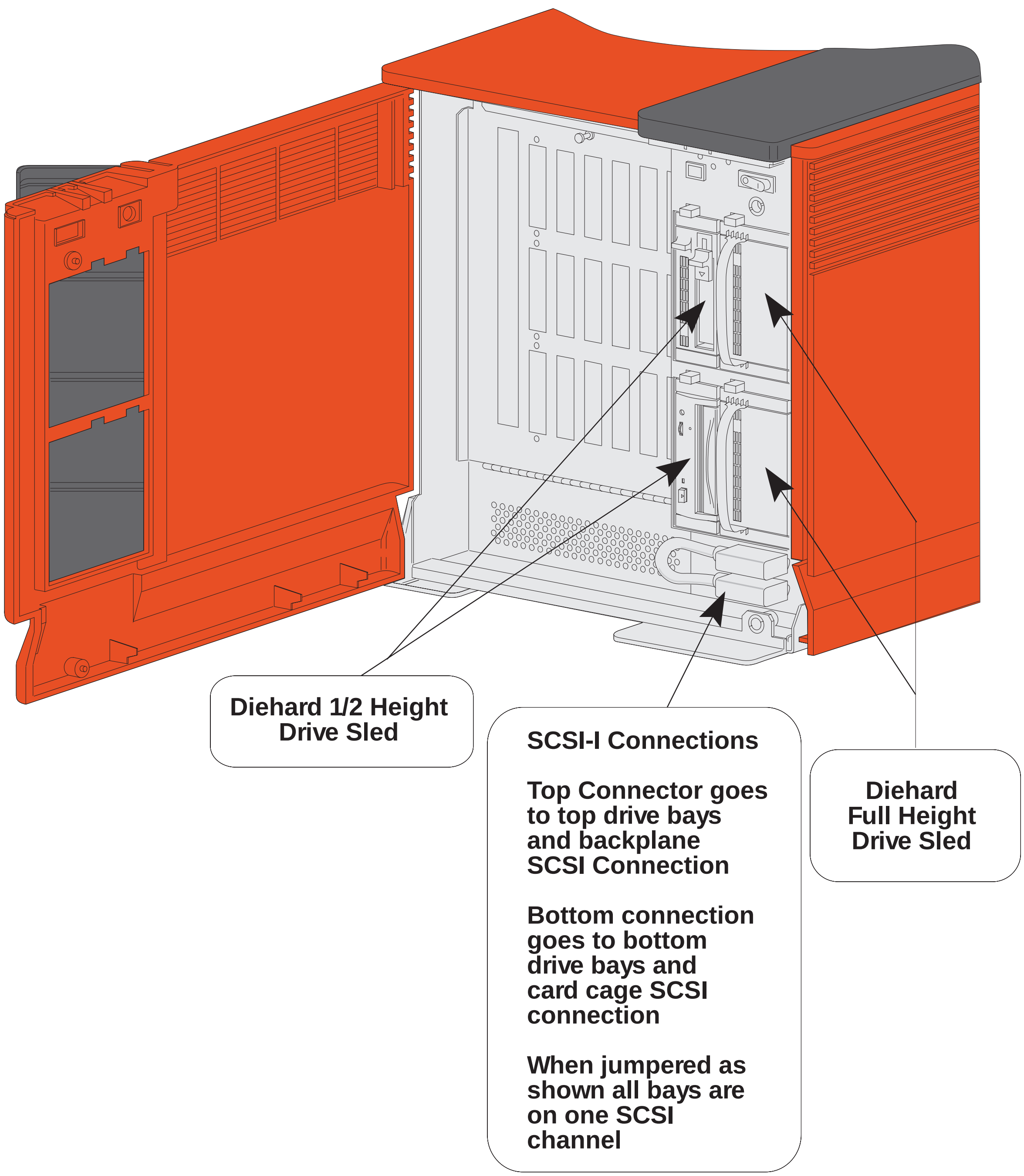


Figure 3-20 Diehard2 - Drive Bays

3.7.3 I/O Panel - Starter, XS, XS24, Elan

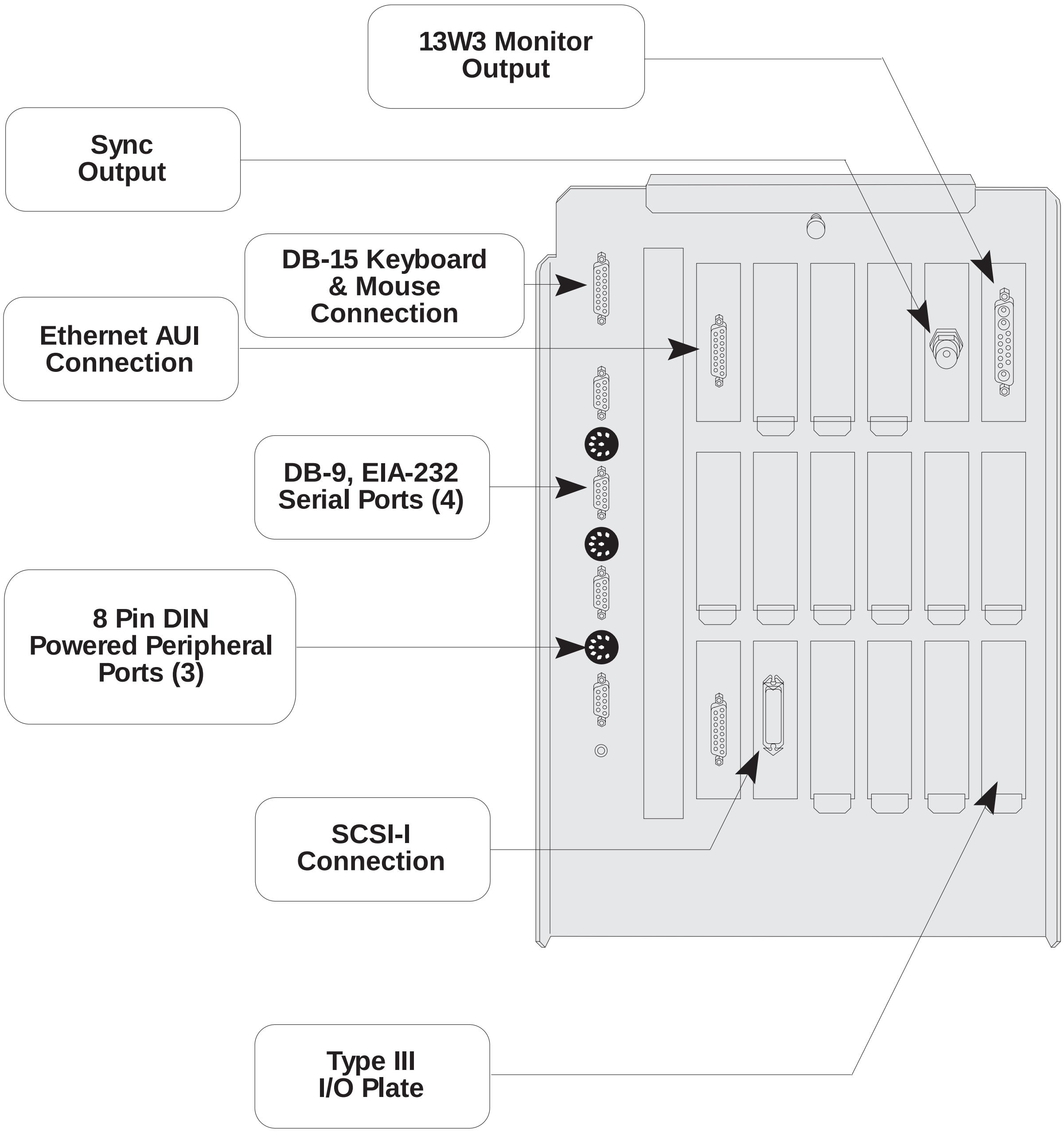


Figure 3-21 Diehard2 I/O Panel - Starter, XS, XS24 & Elan Graphics

3.7.4 I/O Panel - VGX, VGXT

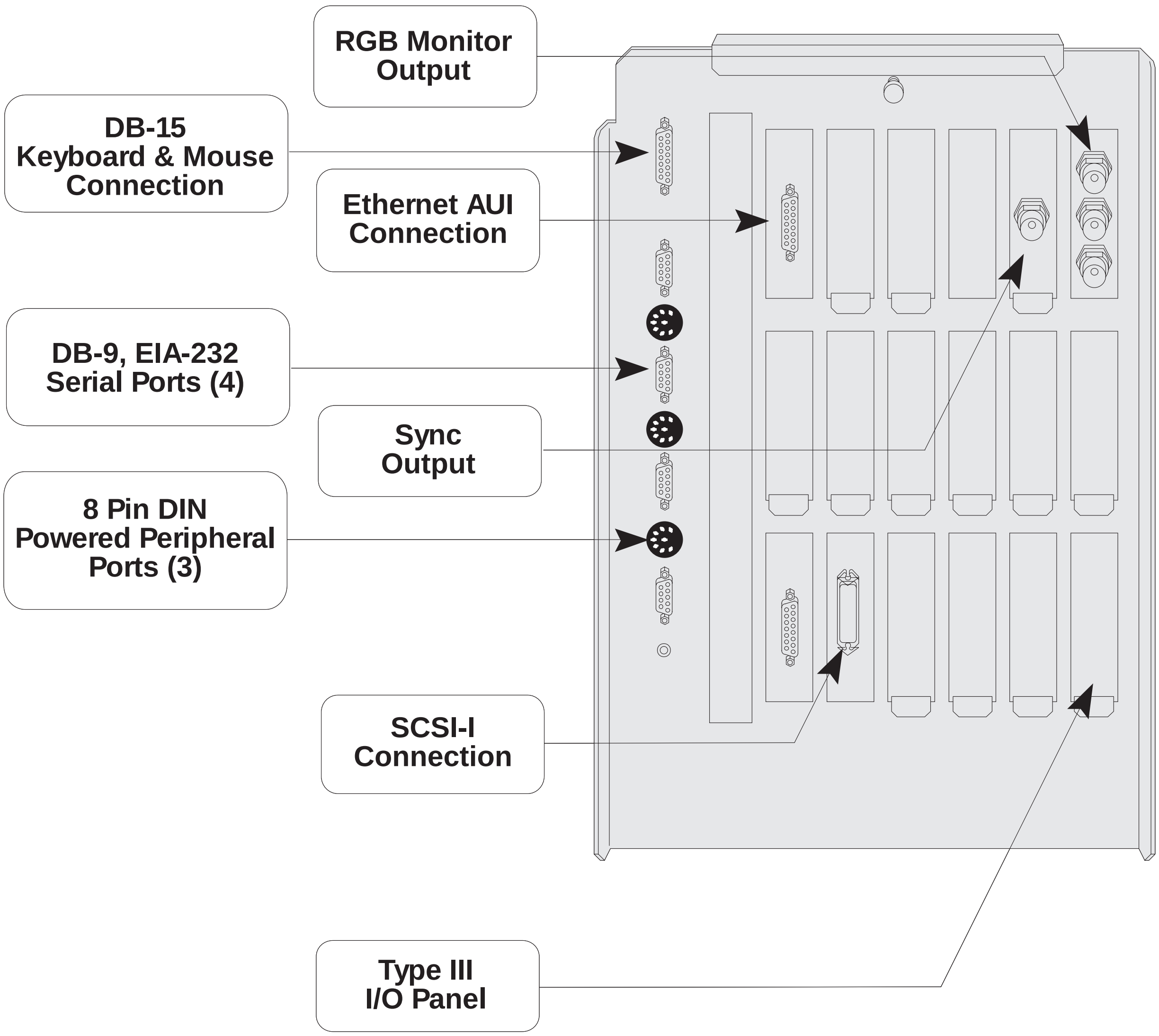


Figure 3-22 Diehard2 I/O Panel - VGX and VGXT Graphics

3.8 Indigo

3.8.1 Front & Rear View

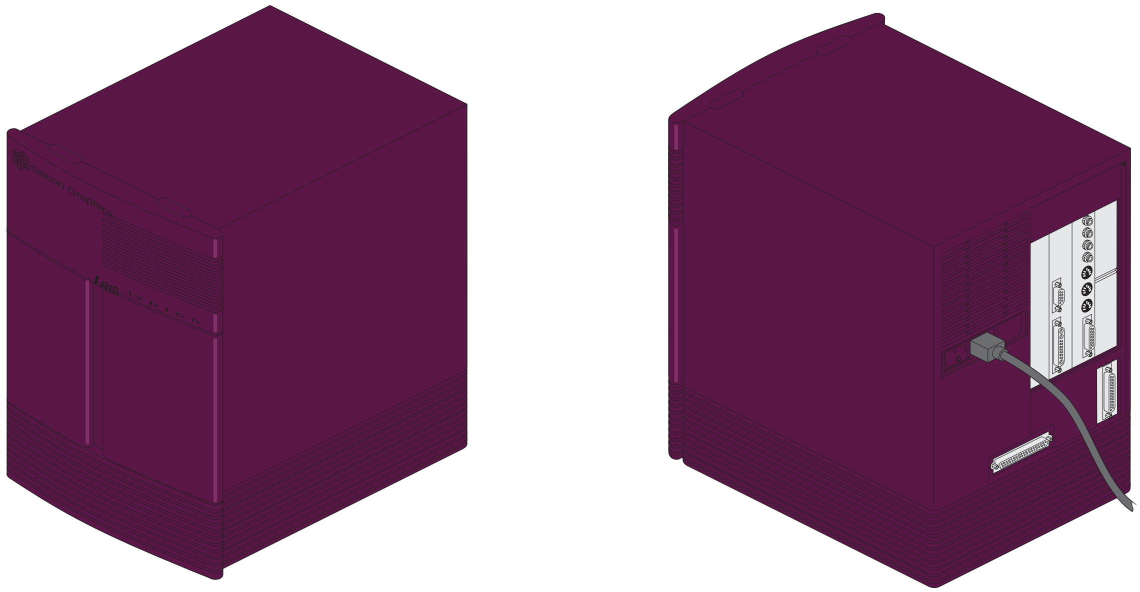


Figure 3-23 Indigo Front & Rear Quarter Views

3.8.2 I/O Panels - R3000 or R4000 CPU, Starter Graphics

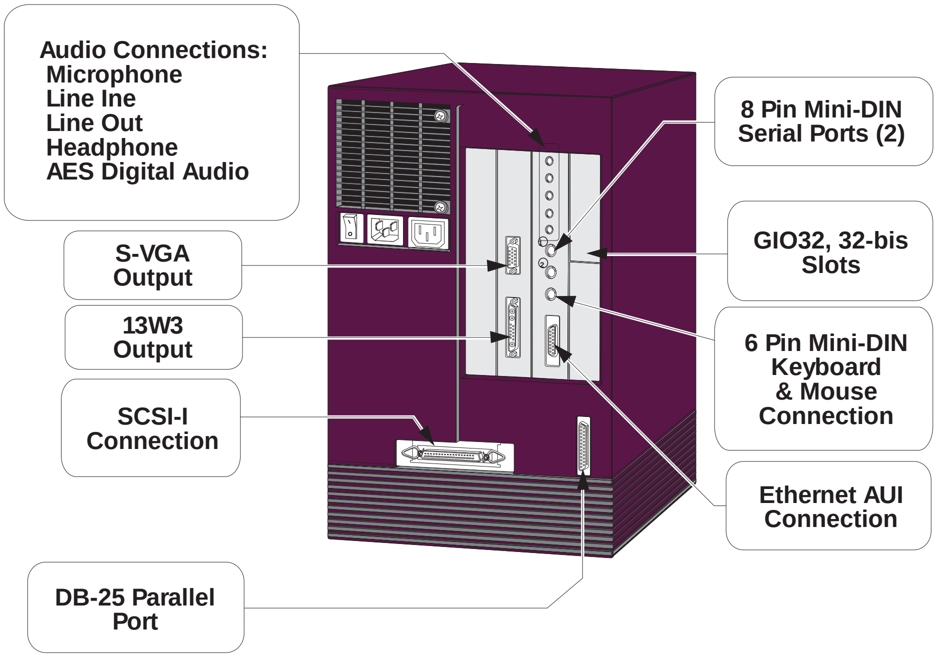


Figure 3-24 Indigo I/O Panel - R3000 or R4000 CPU with Starter Graphics

3.8.3 I/O Panel - Elan (or XS, XS24, XZ) Graphics and Galileo Video

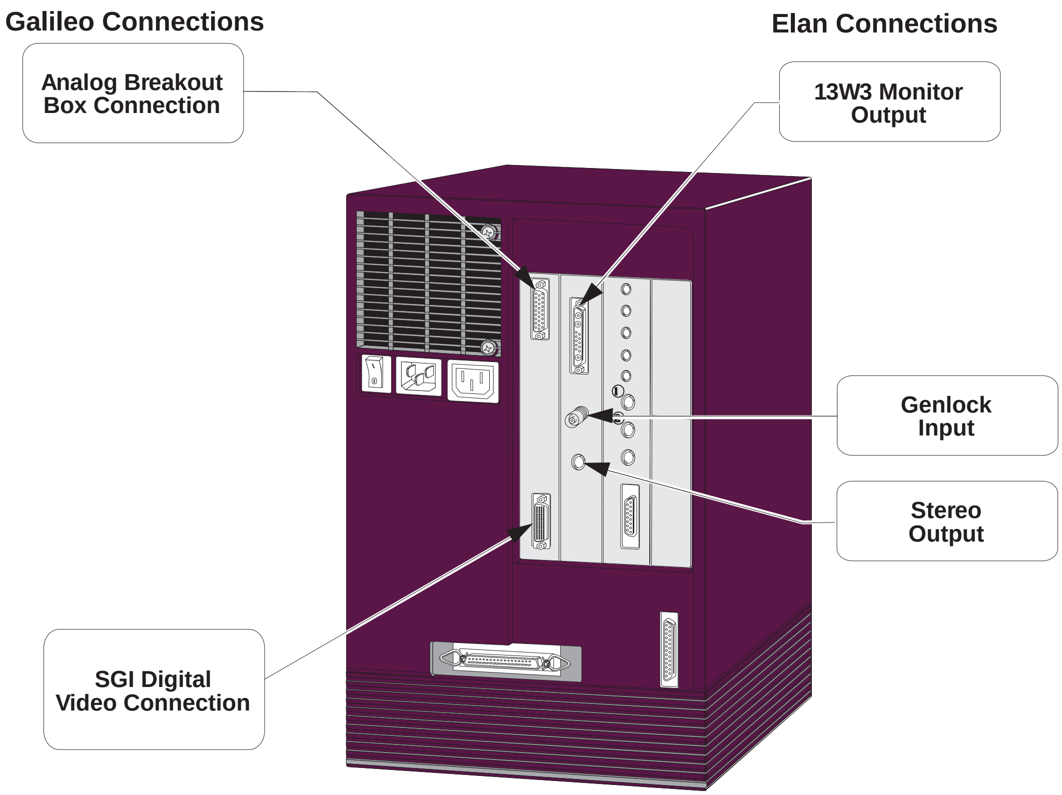


Figure 3-25 Indigo I/O Panel - Elan Graphics and Galileo Video

3.9 Deskside - “Eveready” Chassis

3.9.1 Front & Rear Views

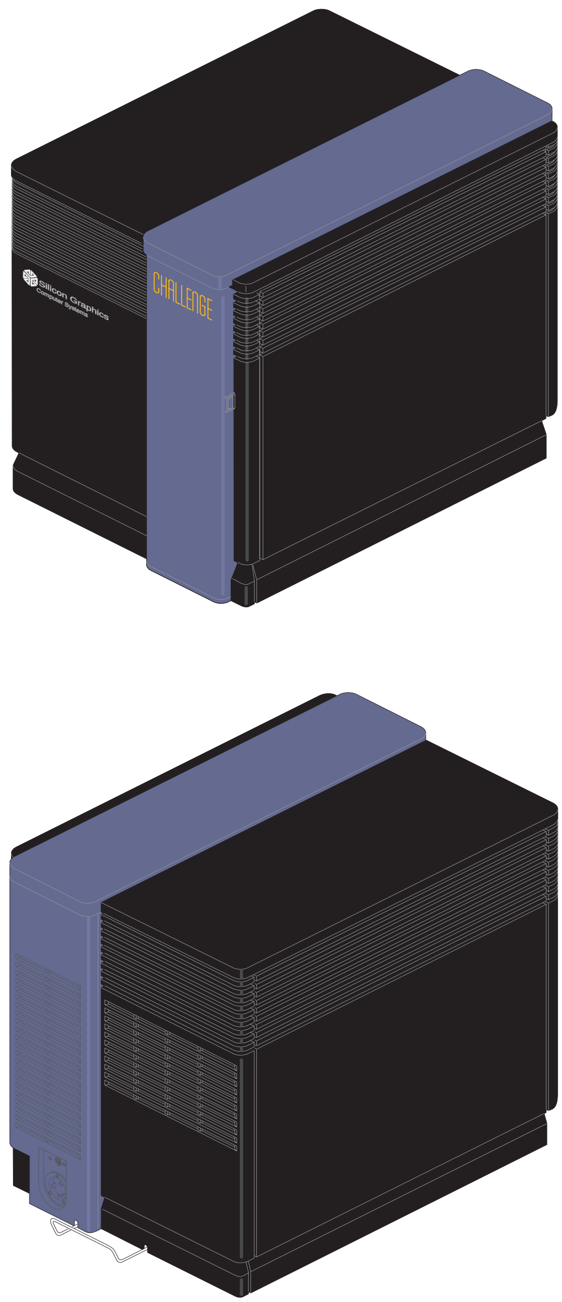


Figure 3-26 Eveready Chassis - Front & Rear Quarter Views

3.9.2 Front Door Open View

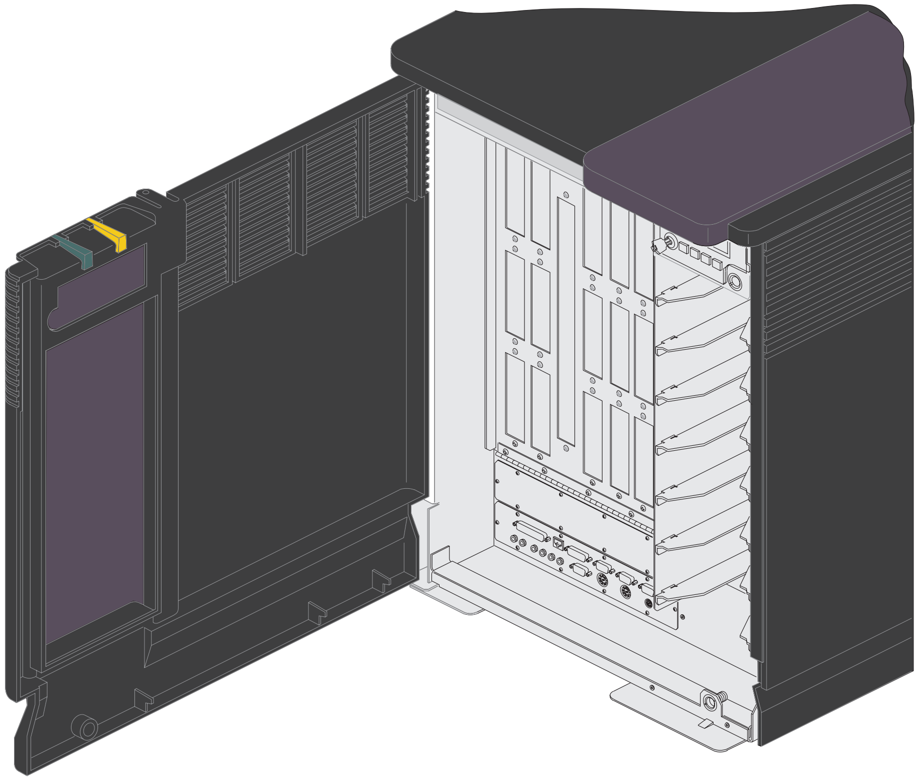


Figure 3-27 Eveready Chassis - Front Door Open

3.9.3 I/O Panel

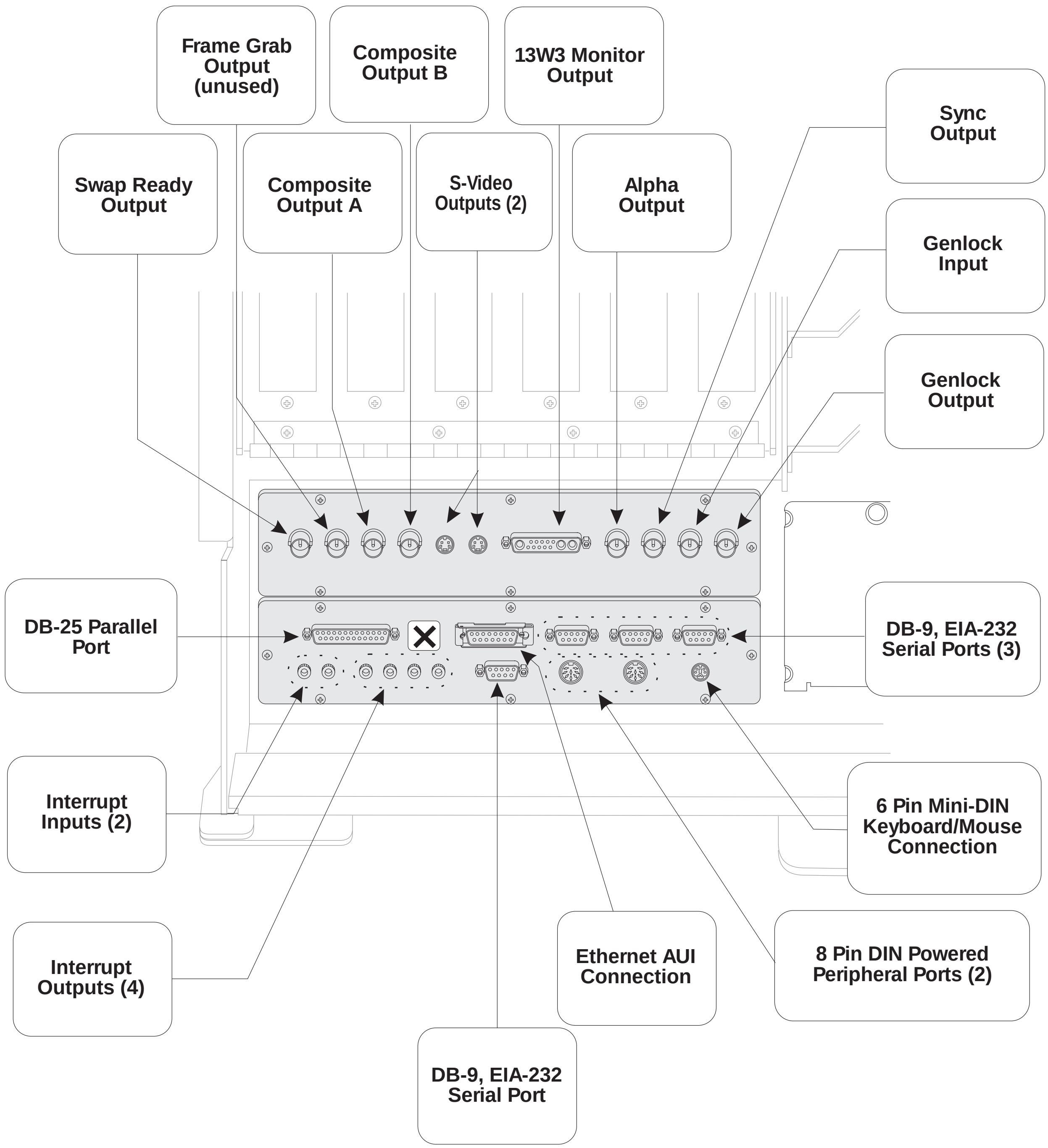


Figure 3-28 Eveready I/O Panel

3.10 "Terminator" Rack

3.10.1 Front & Rear Views - External

Figure 3-29 Terminator Rack - Front & Rear Quarter Views

3.10.2 Front & Rear Views - Without Doors

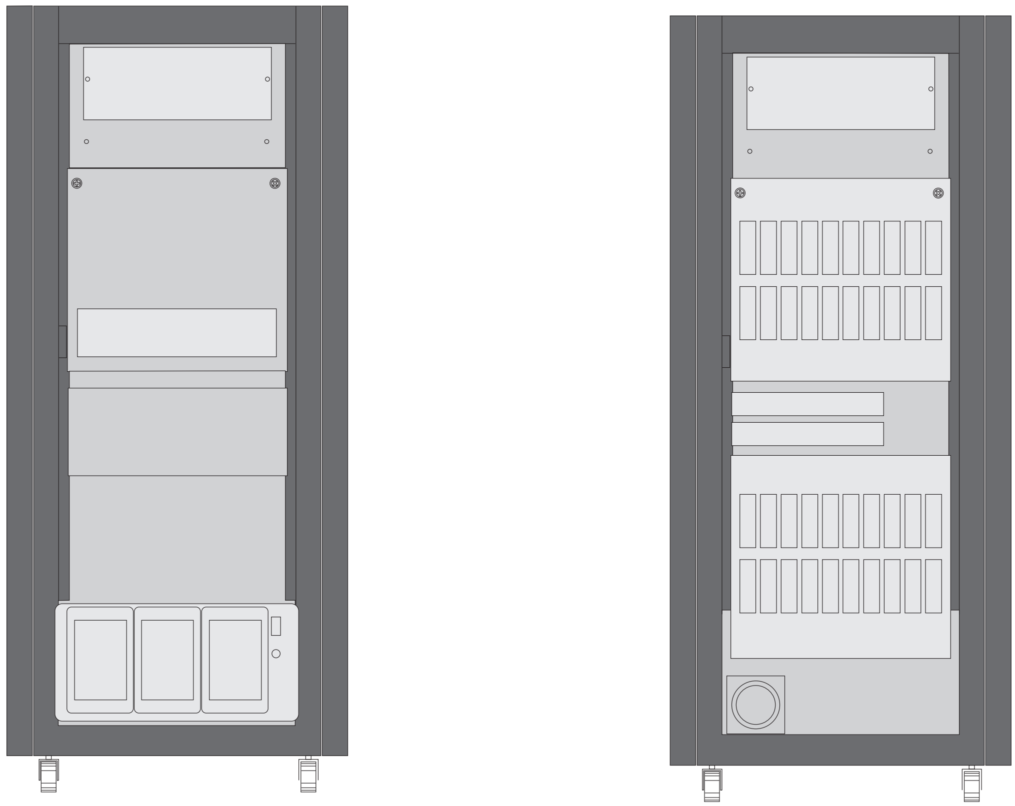


Figure 3-30 Terminator Rack - Front & Rear Views (without doors)

3.10.3 I/O Panel

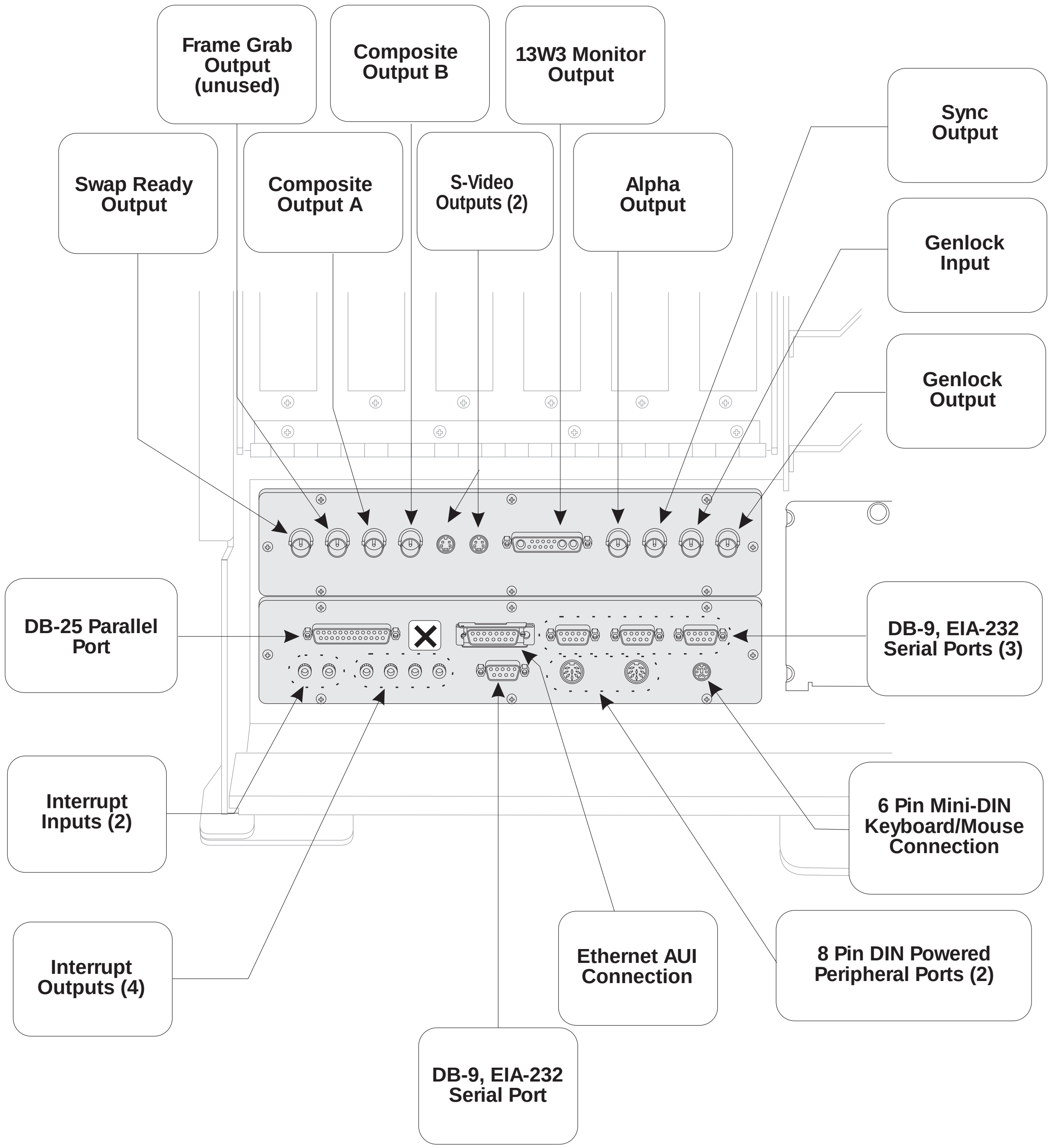


Figure 3-31 Terminator Rack I/O Panel

3.11 Indigo^2 Chassis

3.11.1 Front View

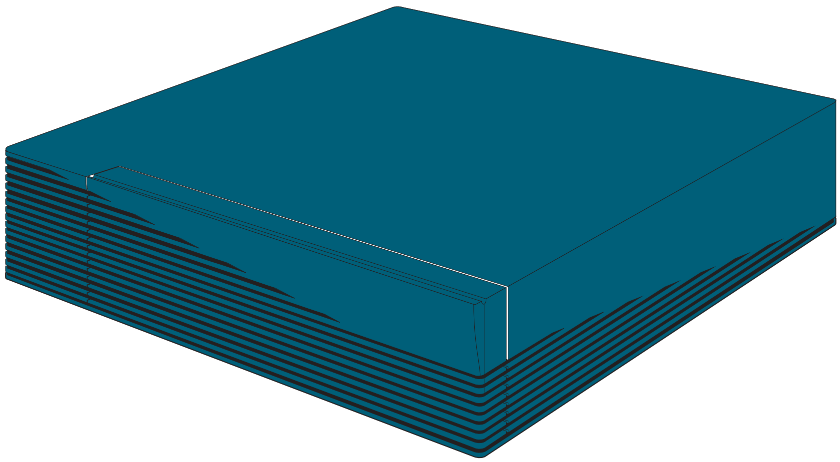


Figure 3-32 Indigo^2 - Front Quarter View

3.11.2 Rear View

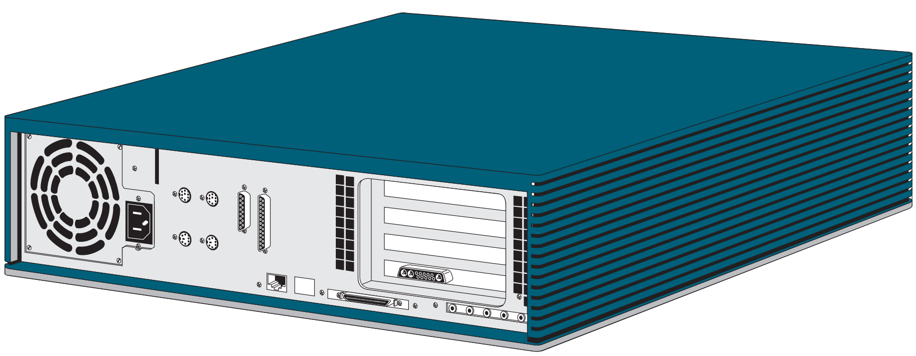


Figure 3-33 Indigo^2 - Rear Quarter View

3.11.3 I/O Panel

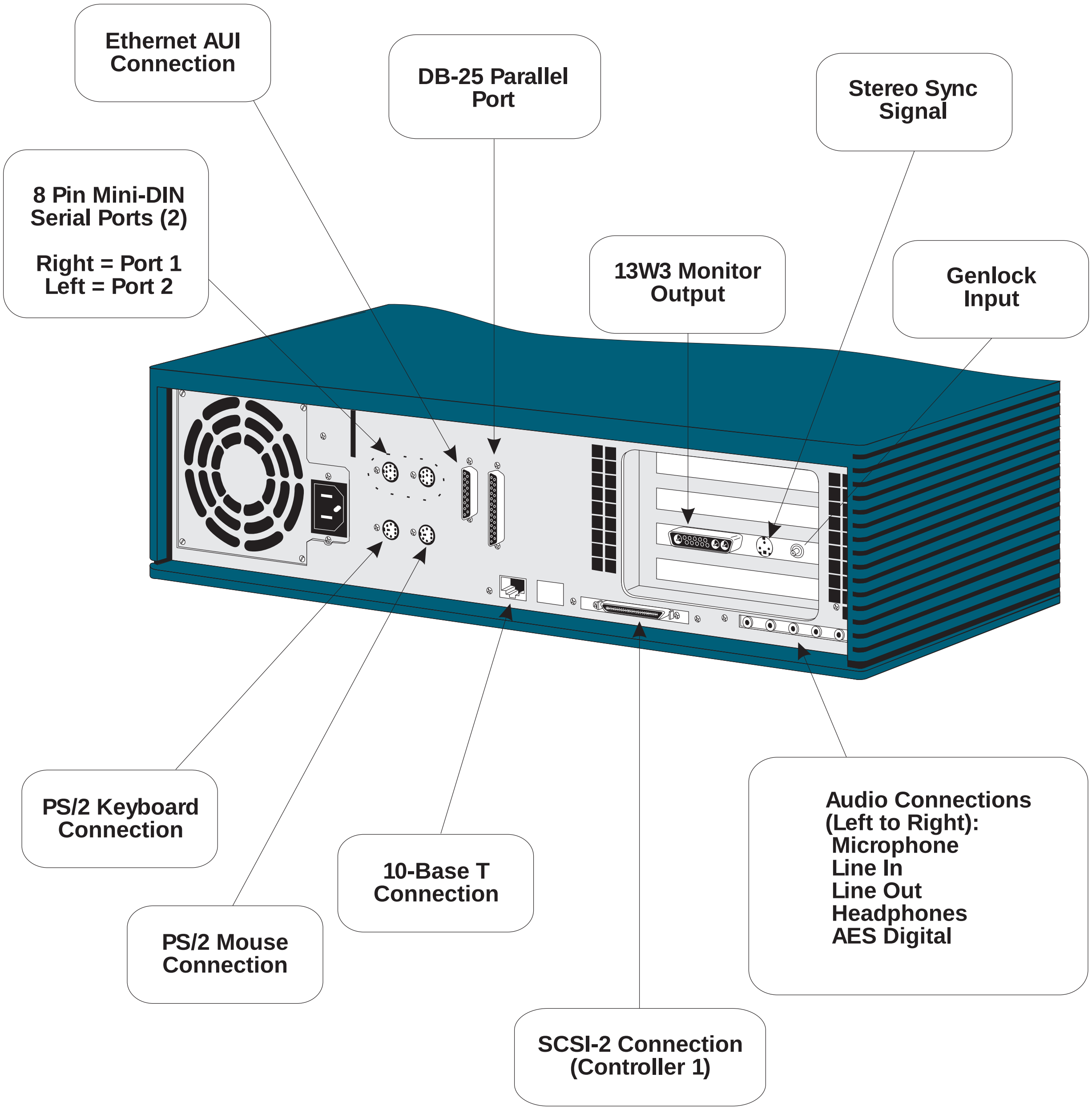


Figure 3-34 Indigo^2 I/O Panel

3.12 Indy Chassis

3.12.1 Front & Rear View

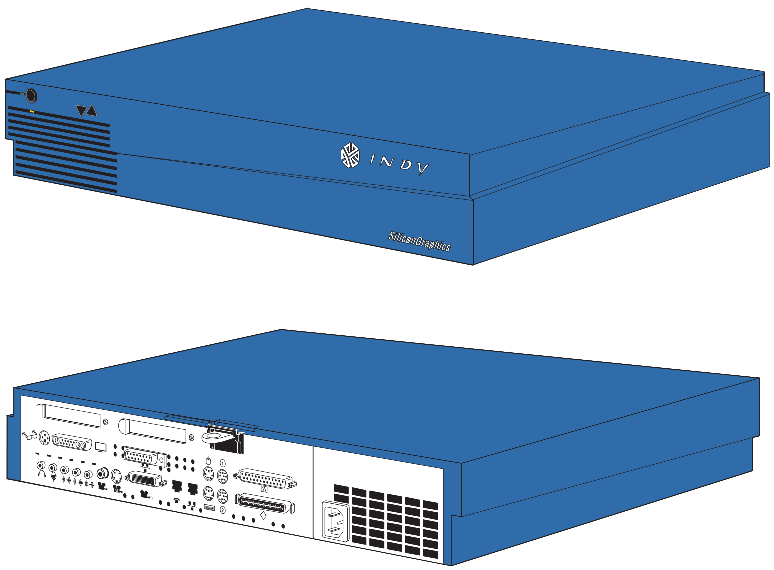


Figure 3-35 Indy Front & Rear Quarter Views

3.12.2 I/O Panel

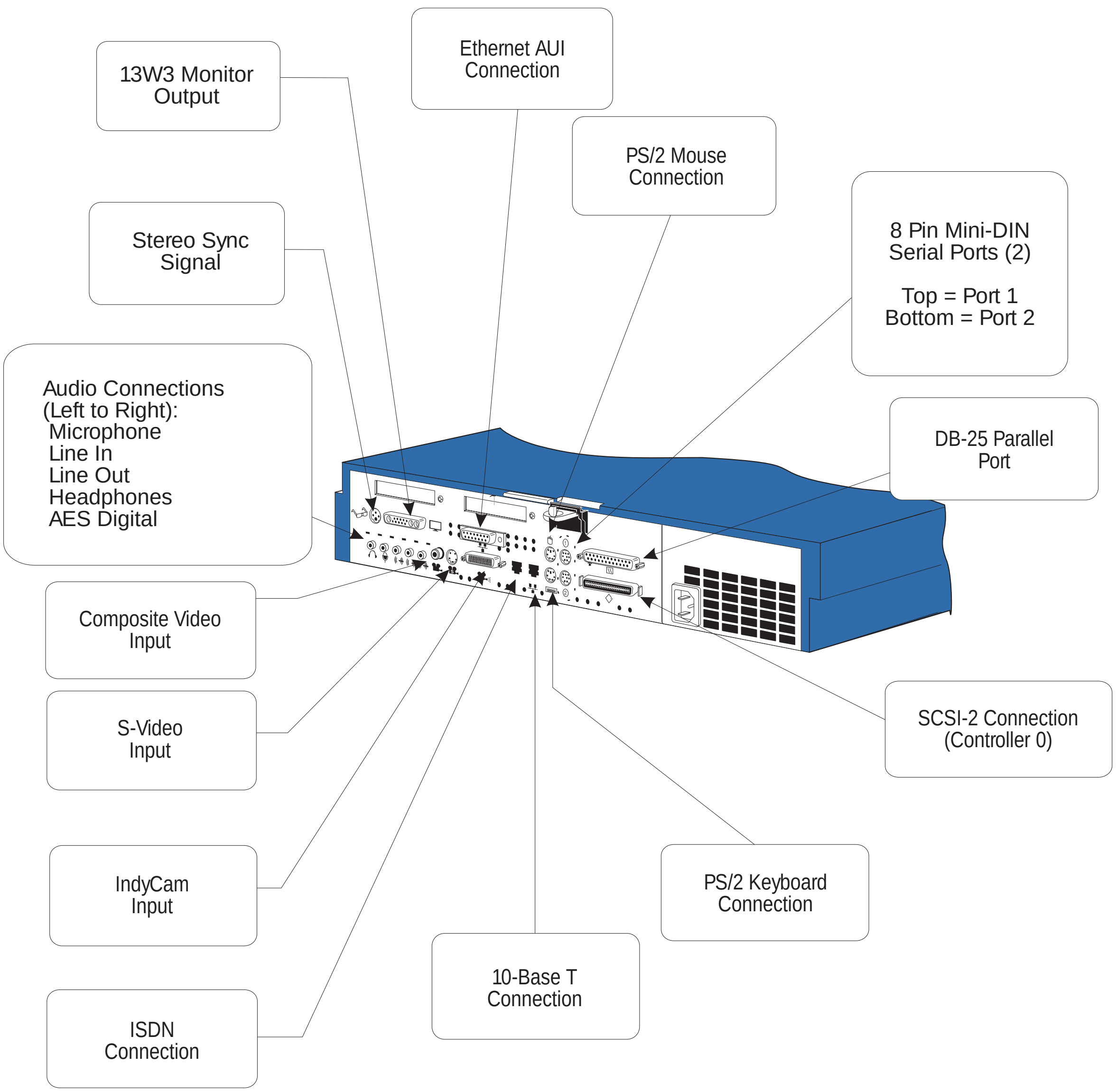


Figure 3-36 Indy I/O Panel

3.12.3 Challenge S

The Challenge S is an Indy with no graphics board and additional SCSI and ethernet connections.

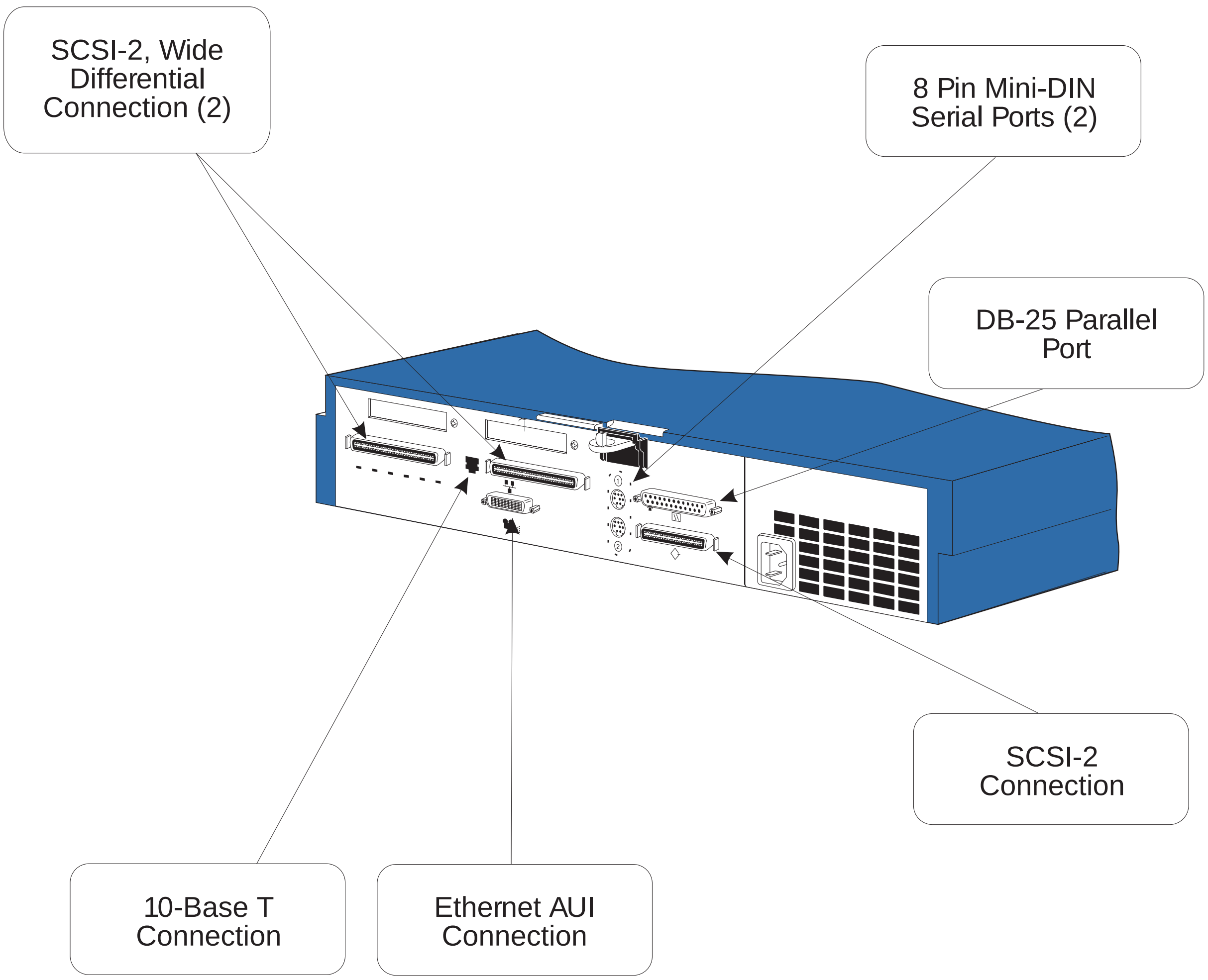


Figure 3-37 Challenge S I/O Panel

3.13 O2

The O2 is available with either an R5000 or R10000 processor system module. The R10000 based system has only one available disk drive slot. The R5000 based system has two drive slots. The Audio/Video module is optional.

3.13.1 Front & Rear Views

Figure 3-38 O2 Front & Rear Quarter Views (O2 R5000)

3.13.2 I/O Panel

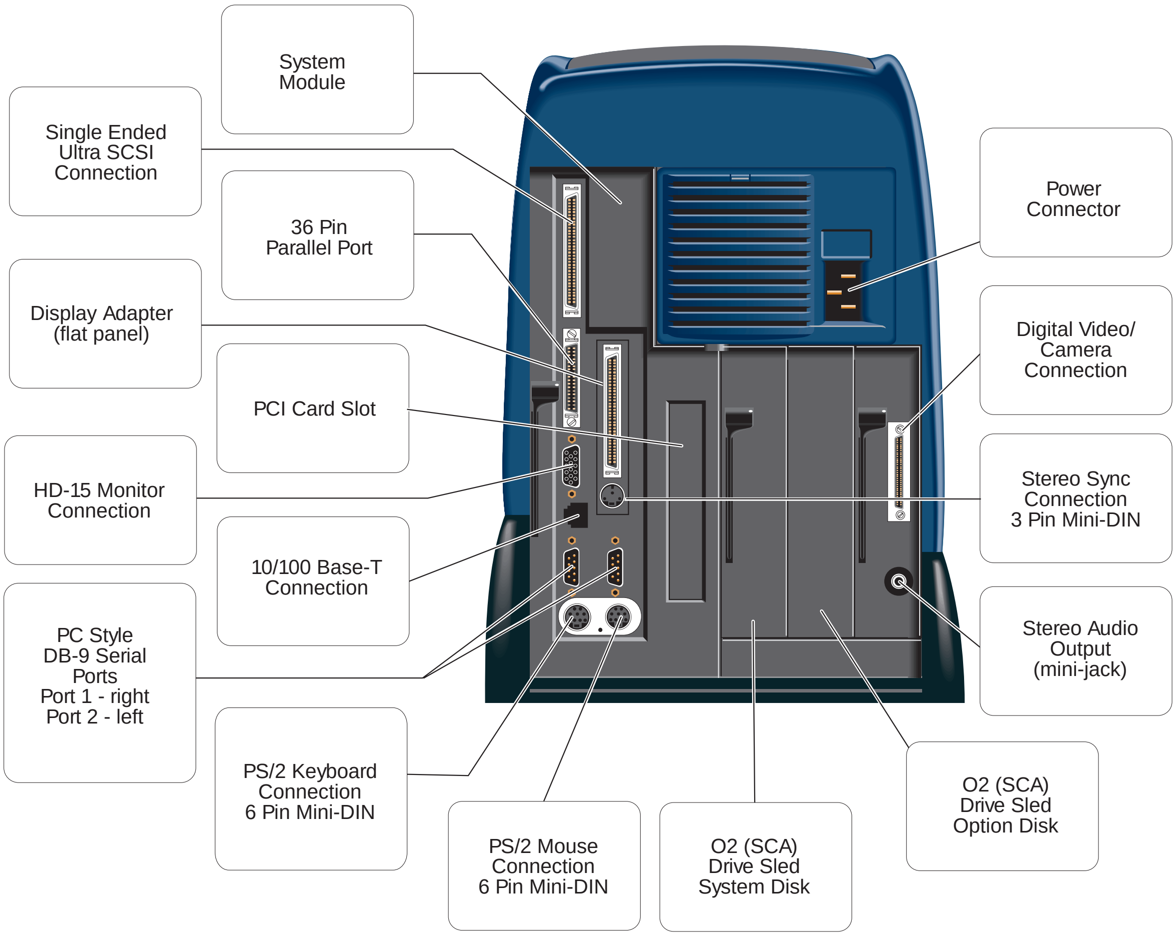


Figure 3-39 O2 R5000 I/O Panel

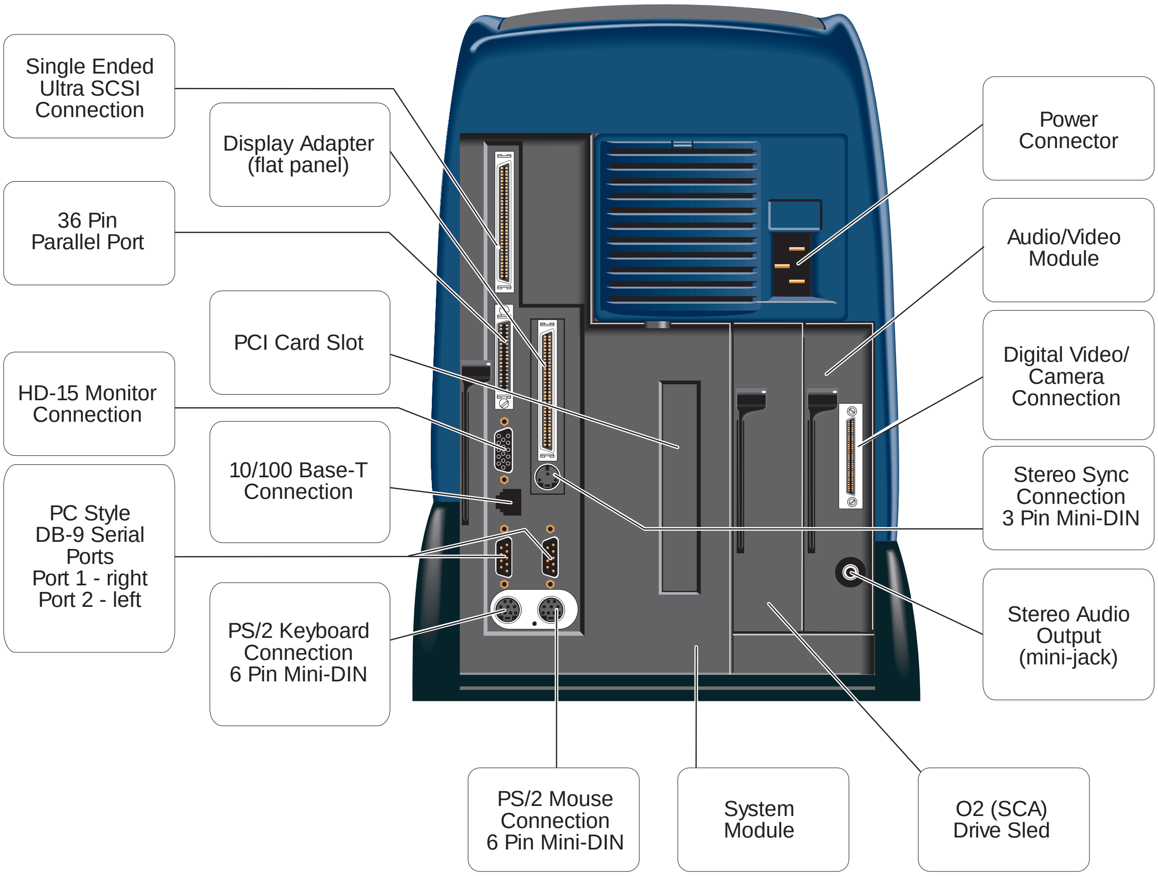


Figure 3-40 O2 R10000 I/O Panel

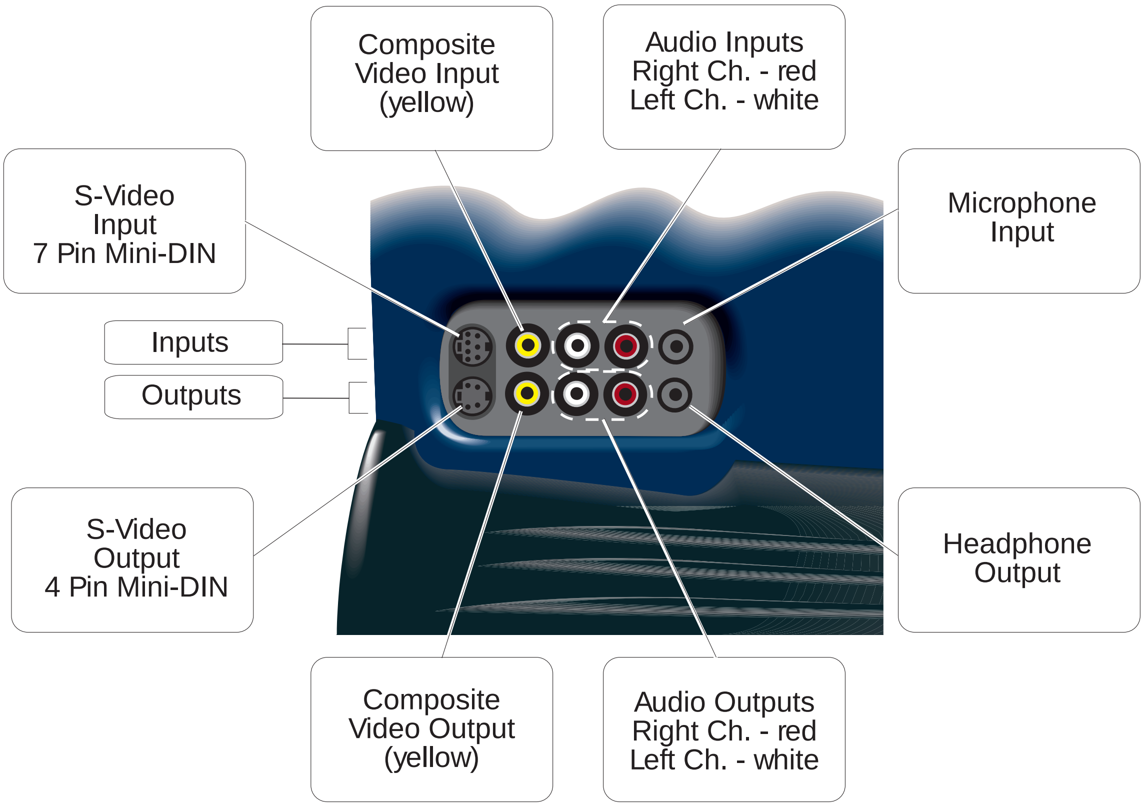


Figure 3-41 O2 AV Module Inputs and Outputs (on side of system)

3.14 OCTANE

3.14.1 Front & Rear Views

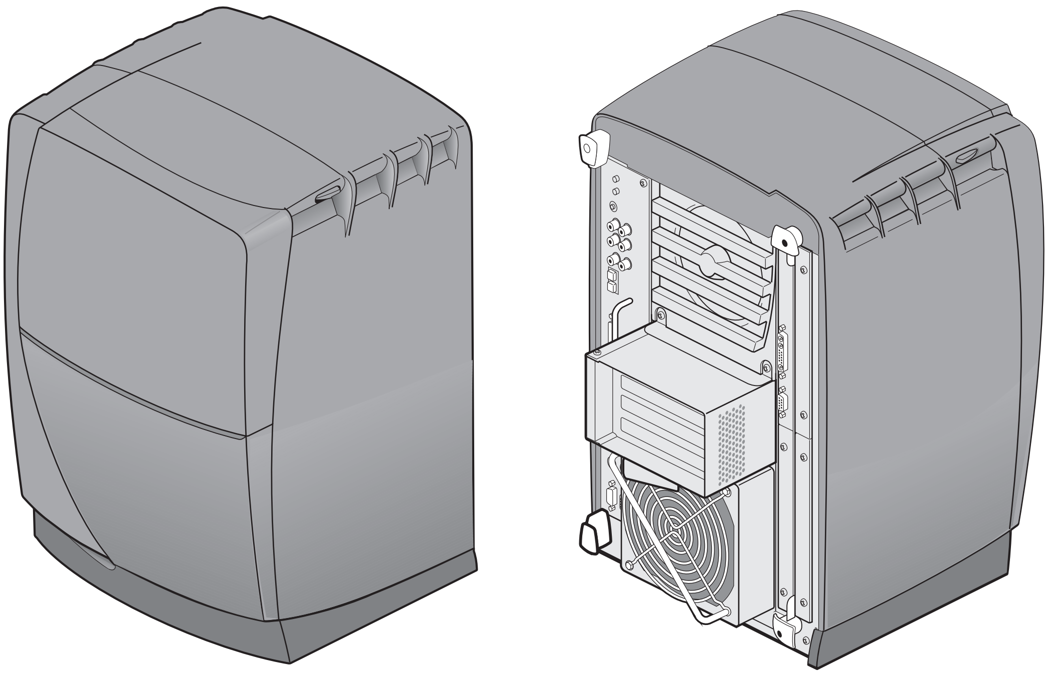


Figure 3-42 OCTANE Front & Rear Quarter Views

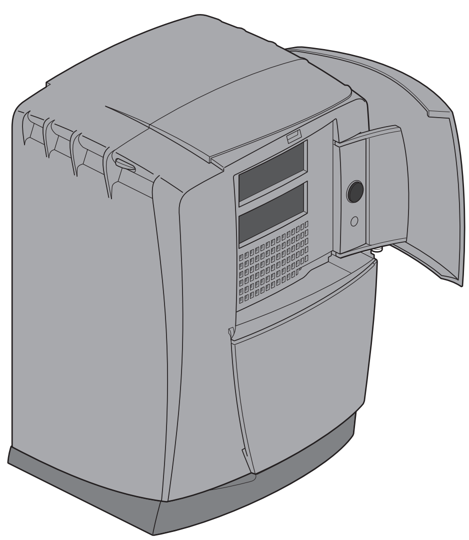


Figure 3-43 OCTANE Front Quarter View With Door Open

3.14.2 I/O Panel

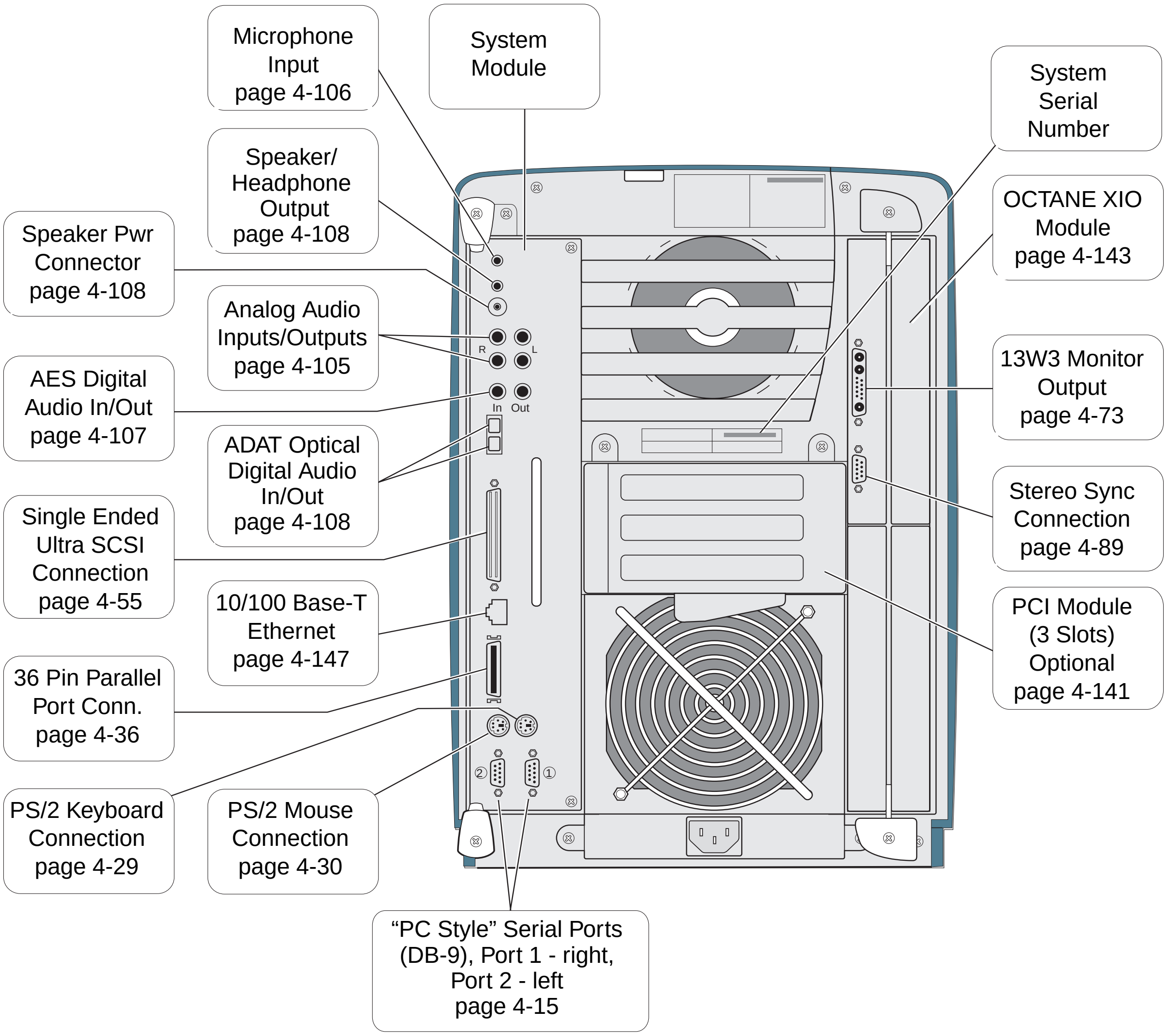


Figure 3-44 OCTANE I/O Panel

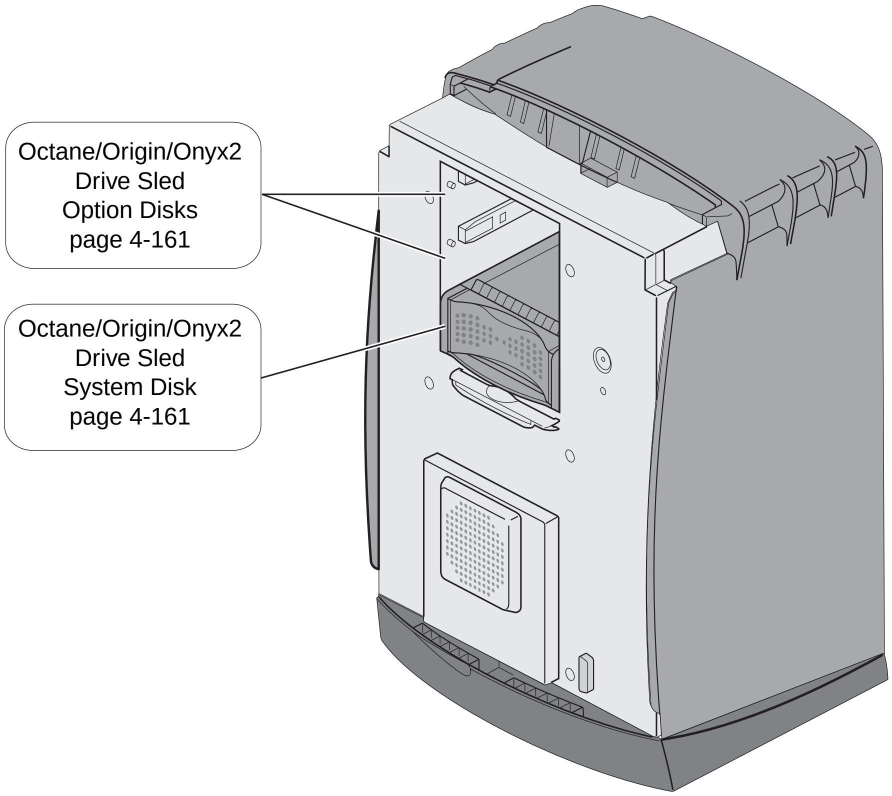


Figure 3-45 OCTANE Front Drive Bays

3.15 Origin200

3.15.1 Front & Rear Views

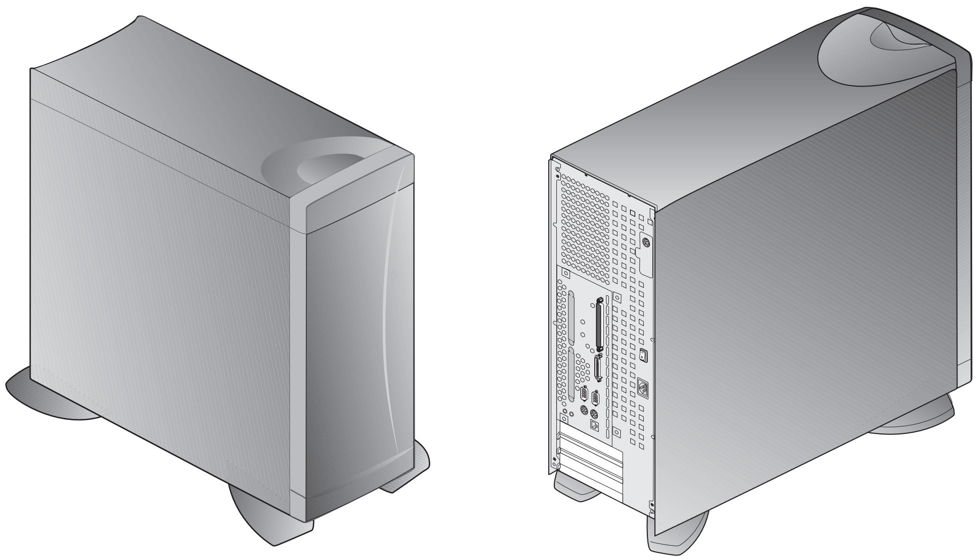


Figure 3-46 Origin200 Front & Rear Quarter Views

3.15.2 Origin200 IO Panel

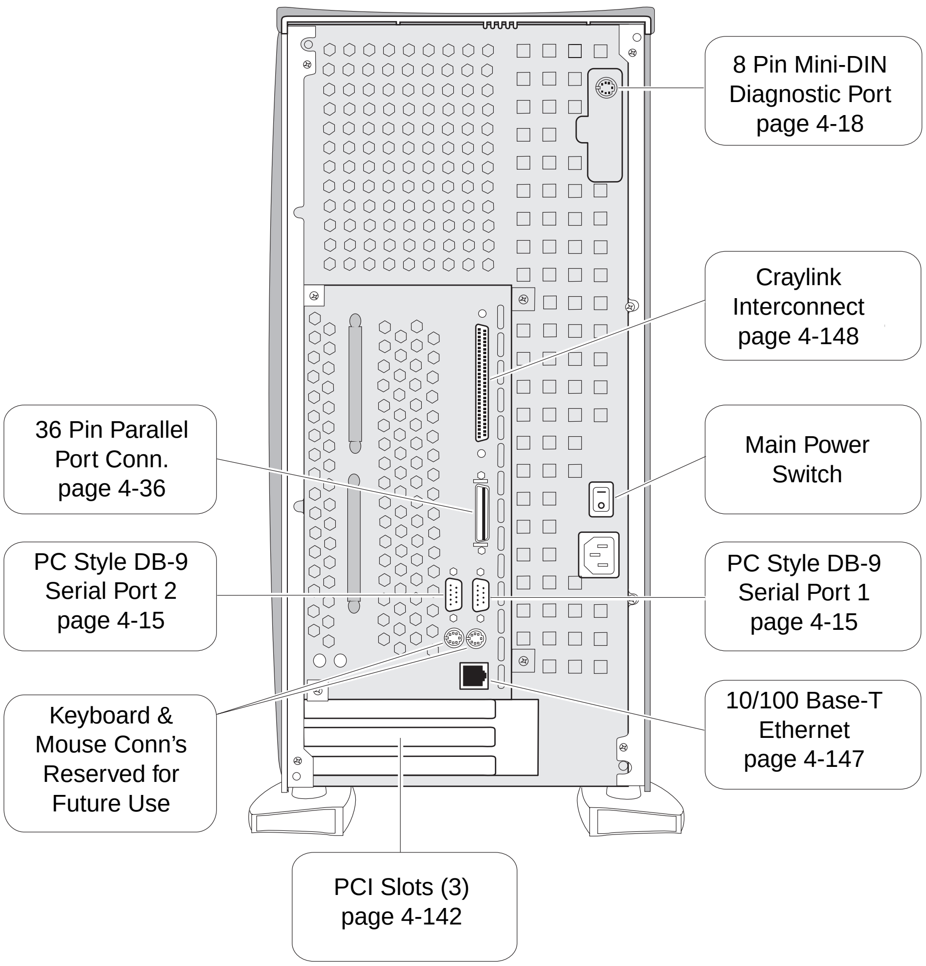


Figure 3-47 Origin200 IO Panel

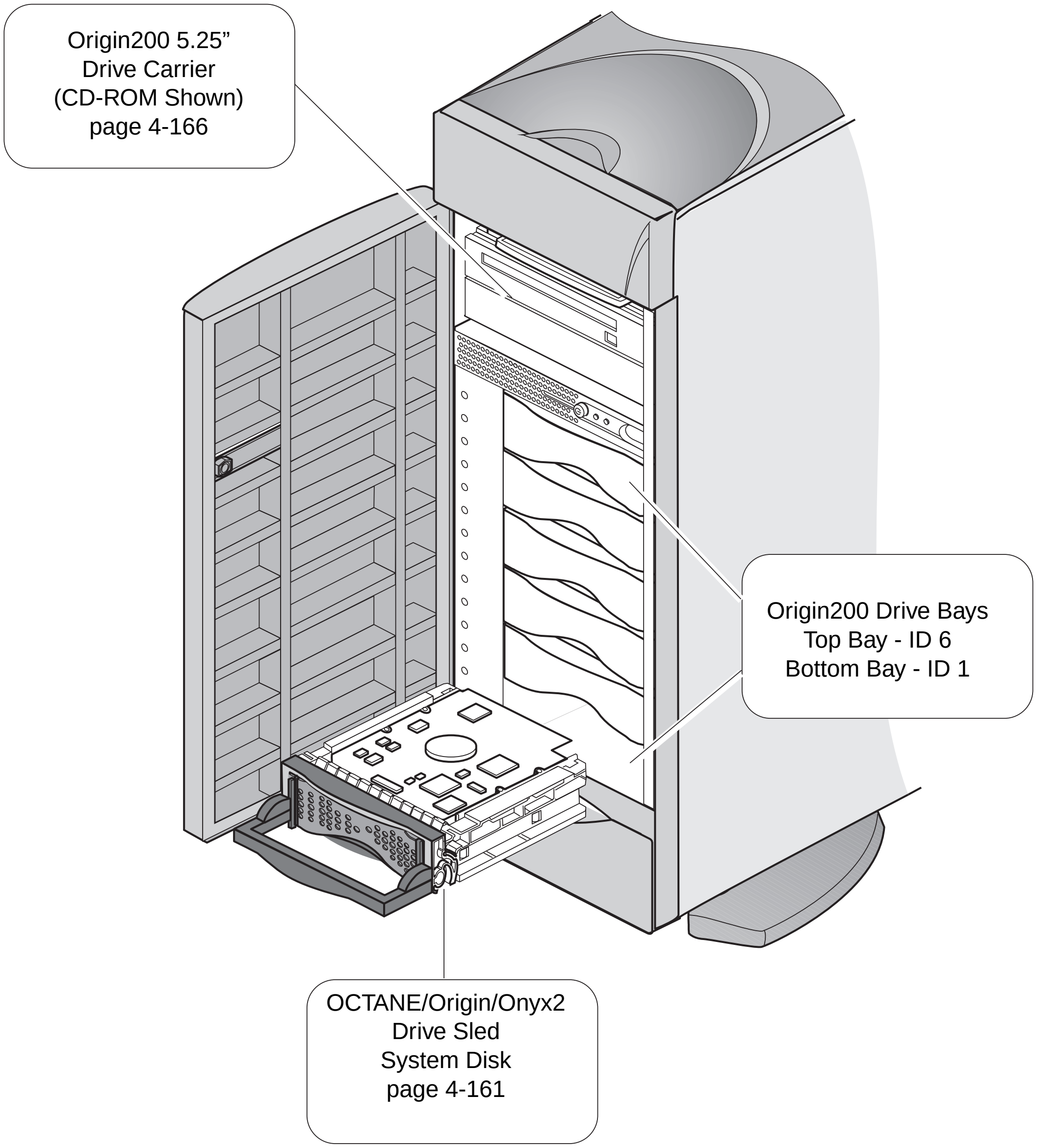


Figure 3-48 Origin200 Front Drive Bays and I/O Panel

3.16 Origin2000

The Origin2000 systems are available in a Deskside version or a Rack configuration. Multiple racks containing up to 128 nodes may be configured using the Craylink as the interconnect mechanism.

3.16.1 Deskside Front & Rear Views

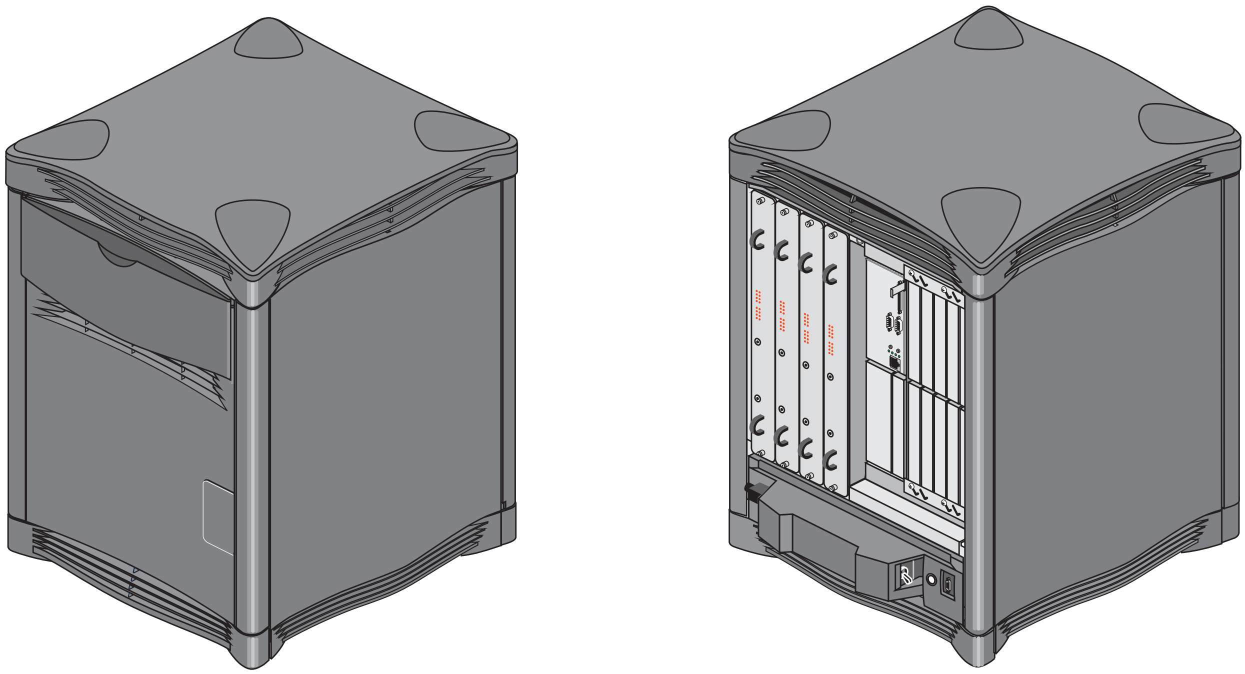


Figure 3-49 Origin2000 Deskside Front and Rear Quarter Views

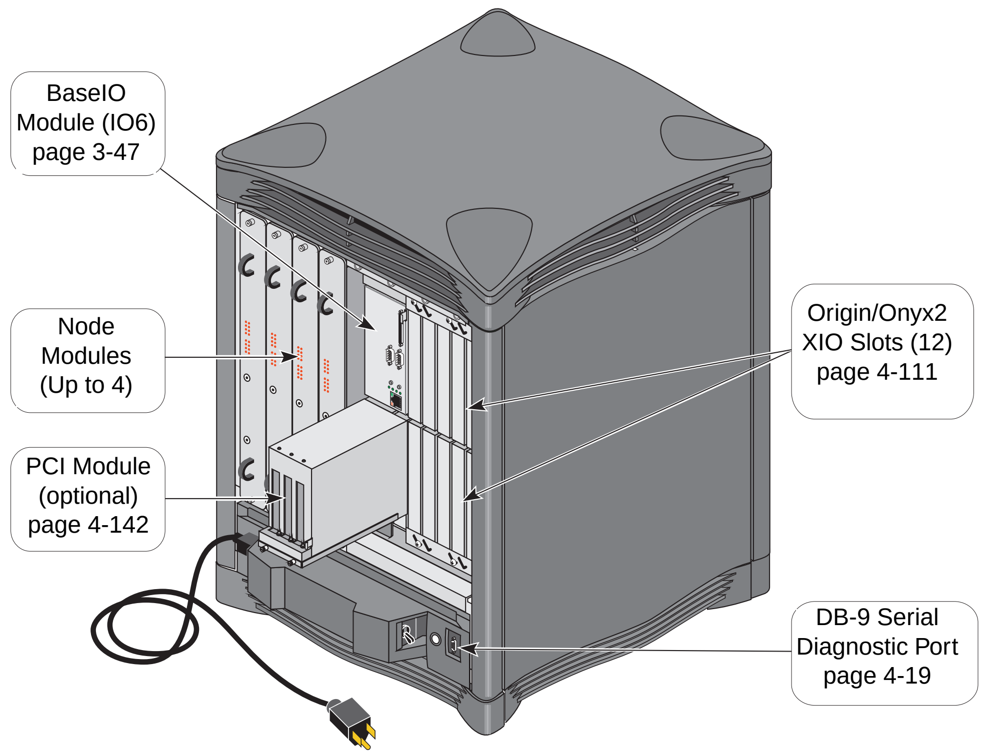


Figure 3-50 Origin2000 Deskside Rear View Showing Major Components

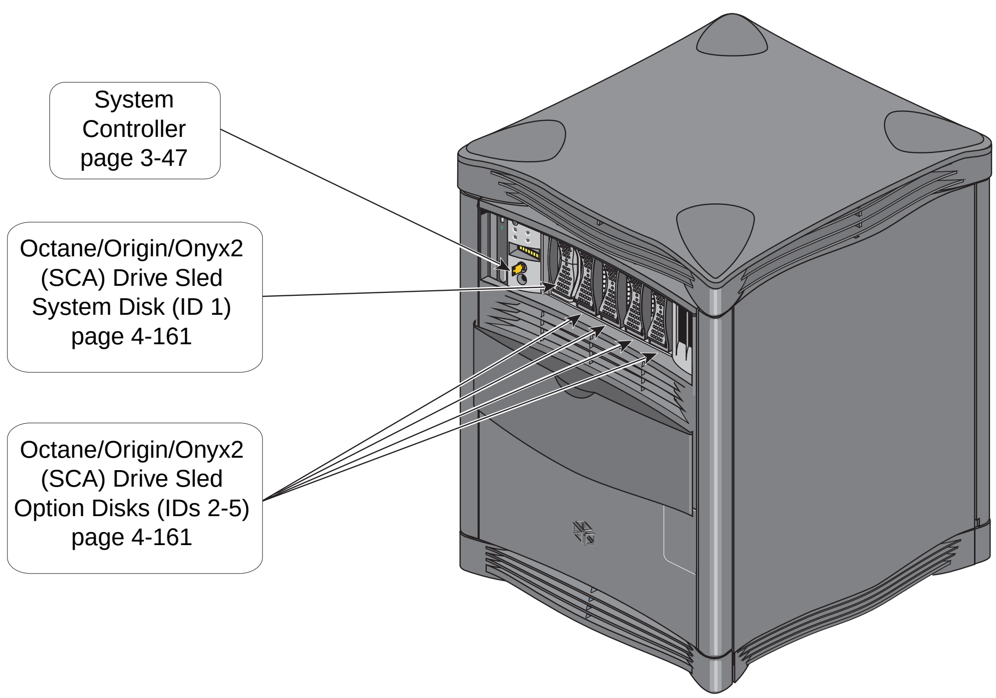


Figure 3-51 Origin2000 Deskside Front View Showing Major Components

3.16.2 Rack Front & Rear Views

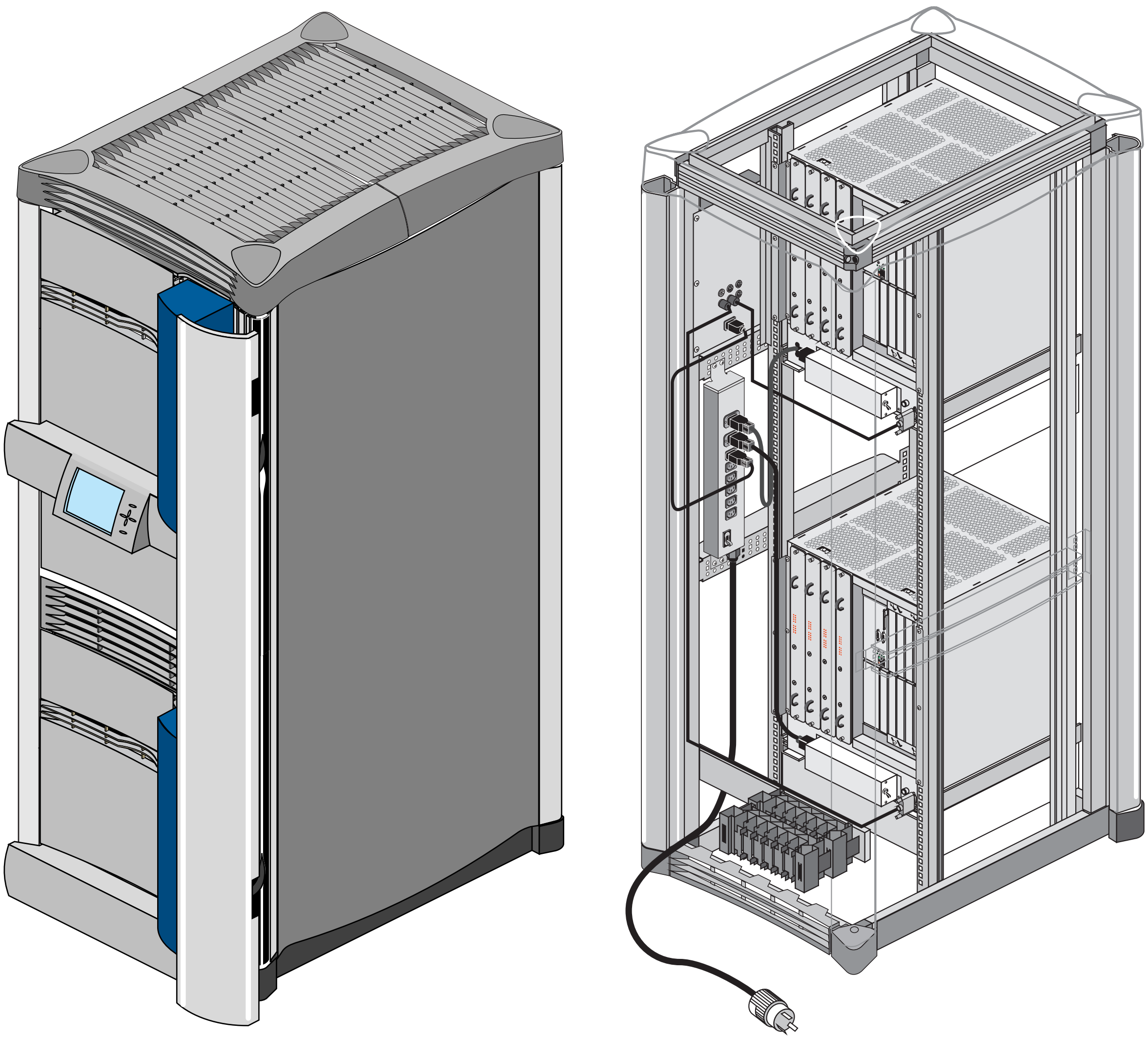


Figure 3-52 Origin2000 Rack Front & Rear (cutaway) Views

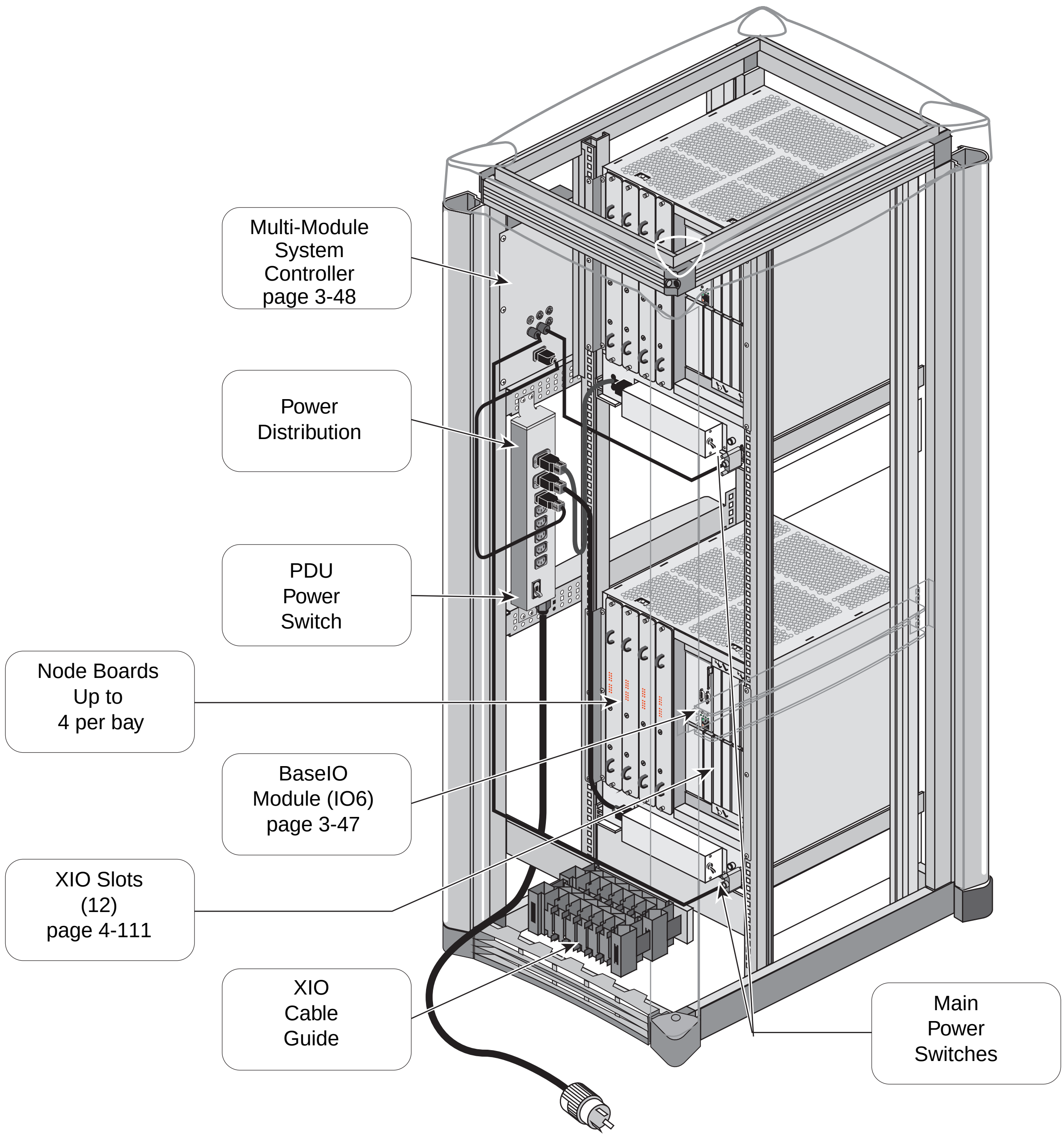


Figure 3-53 Origin Rack Rear View Showing Major Components

3.16.3 I/O Panel (IO6)

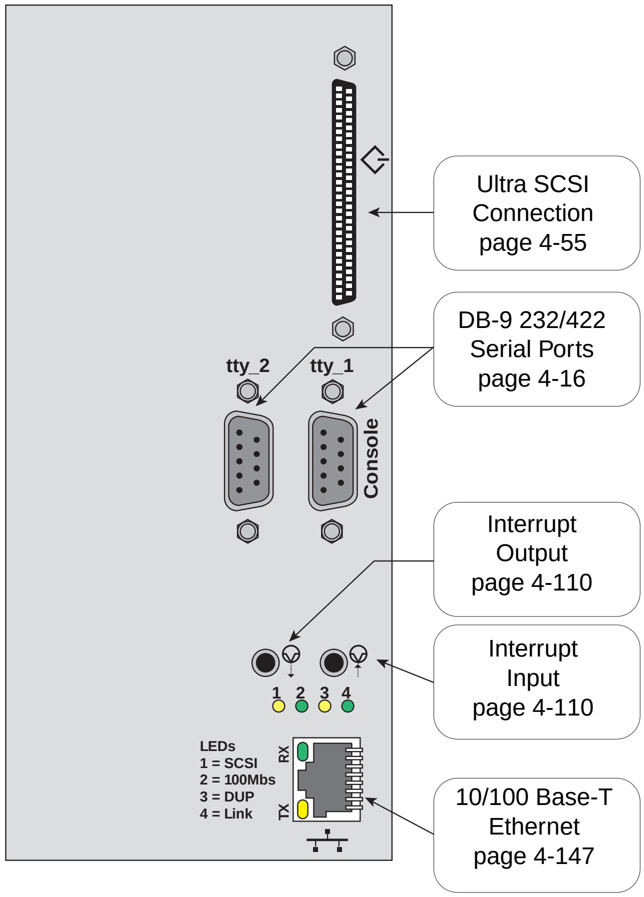


Figure 3-54 Origin2000 (Deskside & Rack) BaseIO Connections

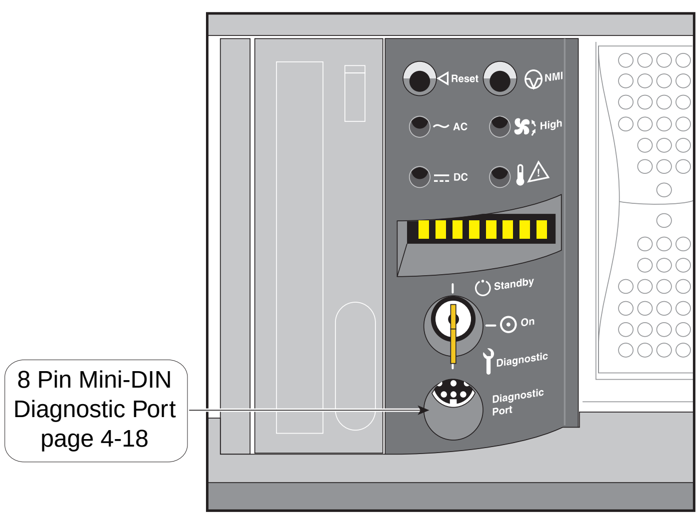


Figure 3-55 Entry Level System Controller Connections

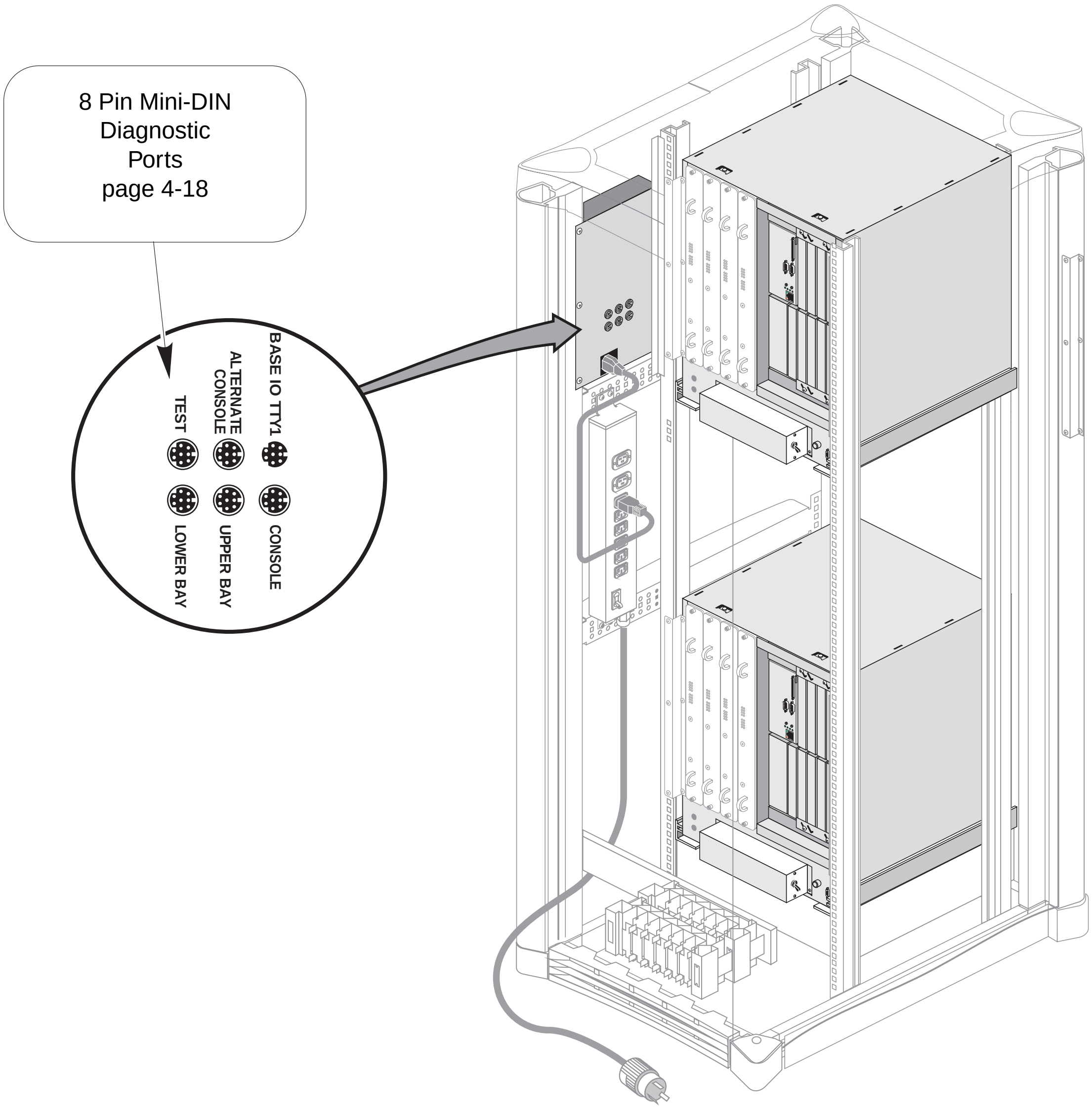


Figure 3-56 Multi-Module System Controller Connections

3.17 Onyx2

The Onyx2 systems are available in a Deskside version or a Rack configuration. Multiple racks containing up to 128 nodes and multiple graphics pipelines may be configured using the Craylink as the interconnect mechanism.

3.17.1 Deskside Front & Rear Views

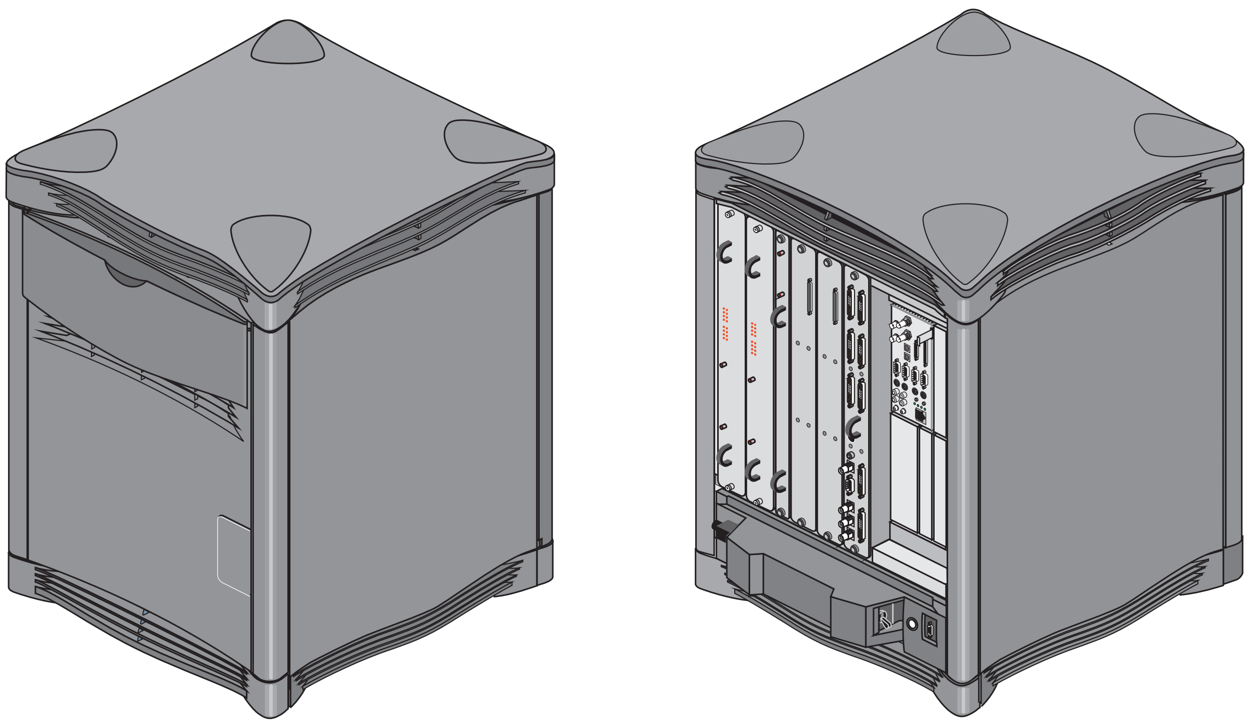


Figure 3-57 Onyx2 Deskside Front & Rear Quarter Views

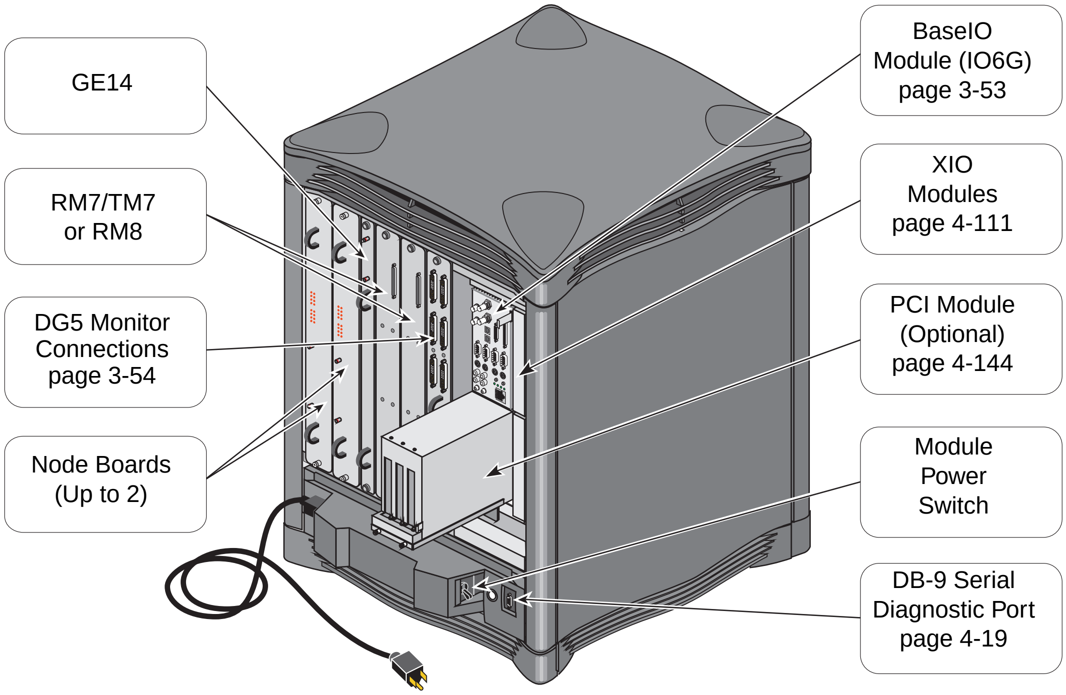


Figure 3-58 Onyx2 Deskside Rear View Showing Major Components

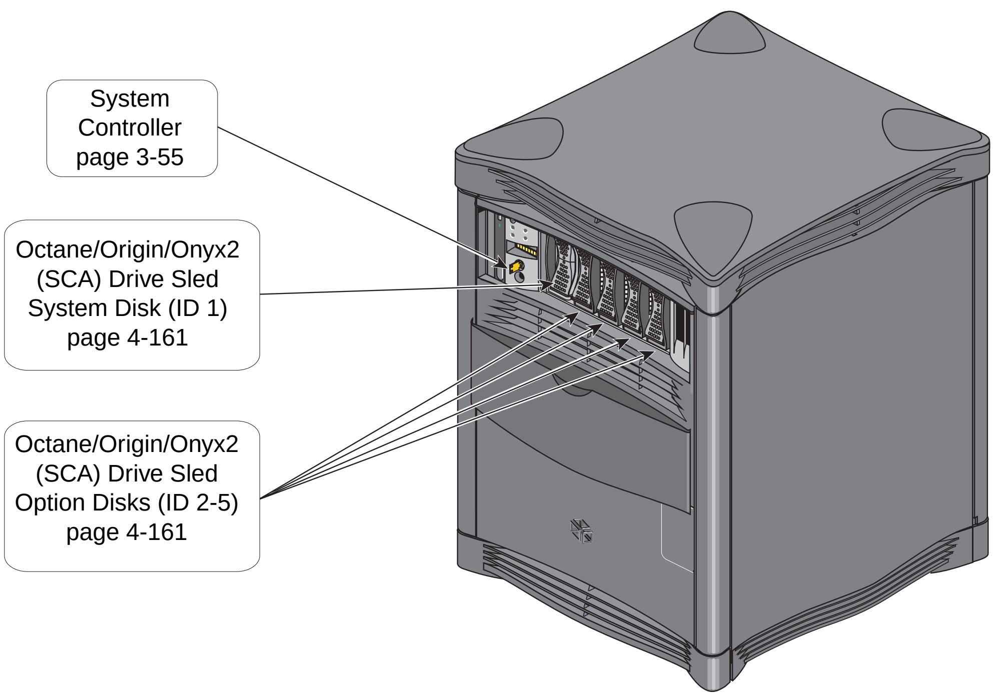


Figure 3-59 Onyx2 Deskside Front Showing Major Components

3.17.2 Onyx2 Rack Front & Rear Views

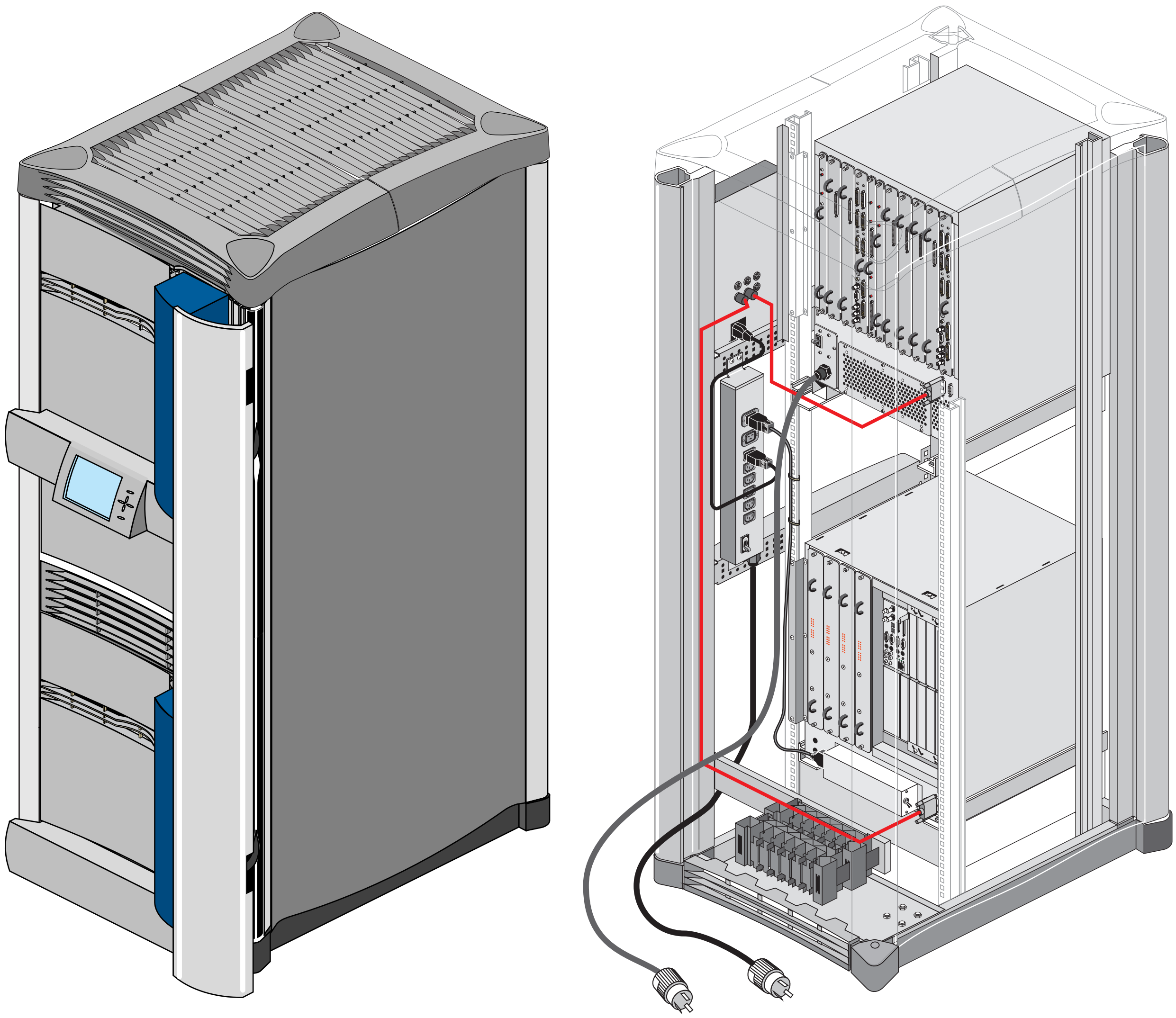


Figure 3-60 Onyx2 Rack Front & Rear (cutaway) Quarter Views

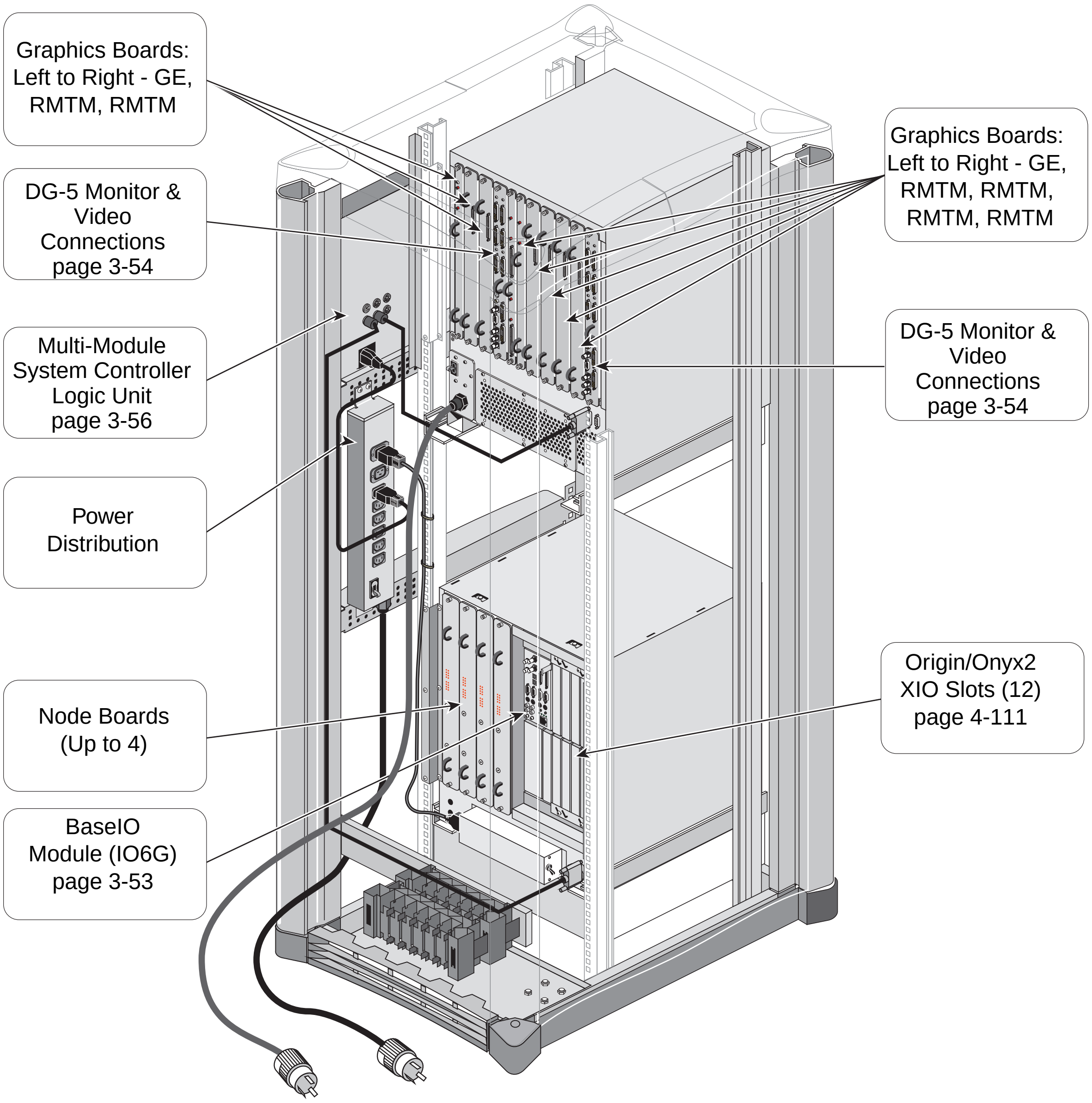


Figure 3-61 Onyx2 Rack Rear View Showing Major Components

3.17.3 I/O Panel (IO6G)

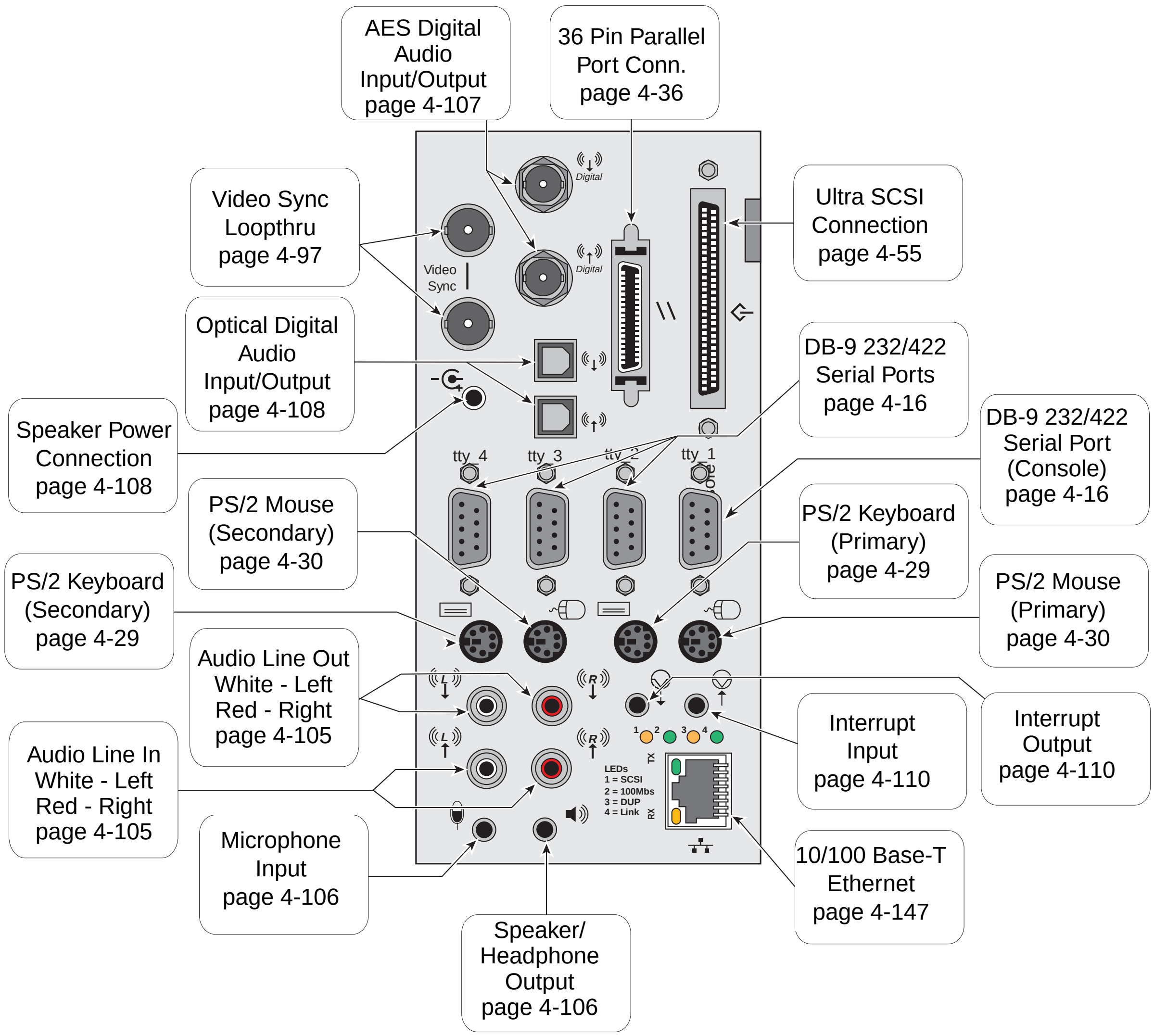


Figure 3-62 Onyx2 BaseIO Module Connections

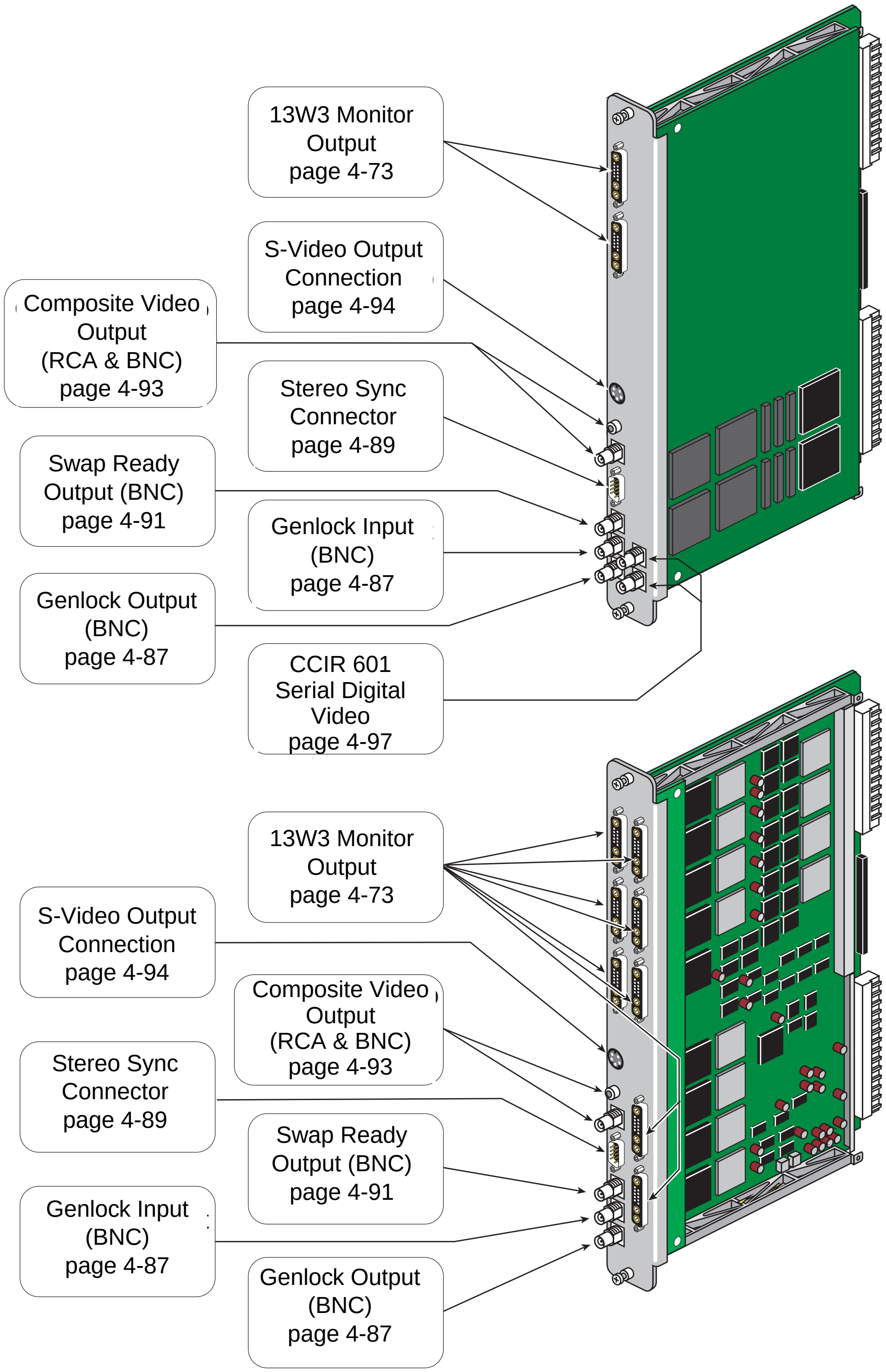


Figure 3-63 Onyx2 DG5 Connections

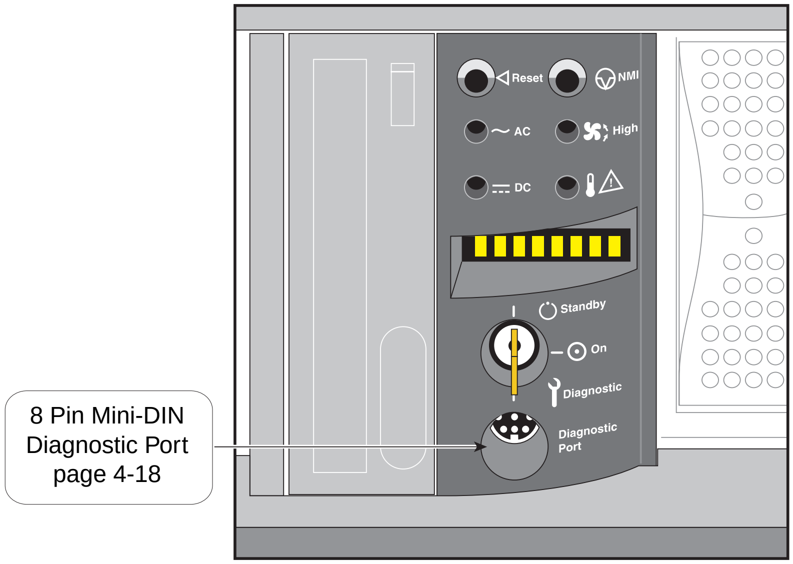


Figure 3-64 Entry Level System Controller

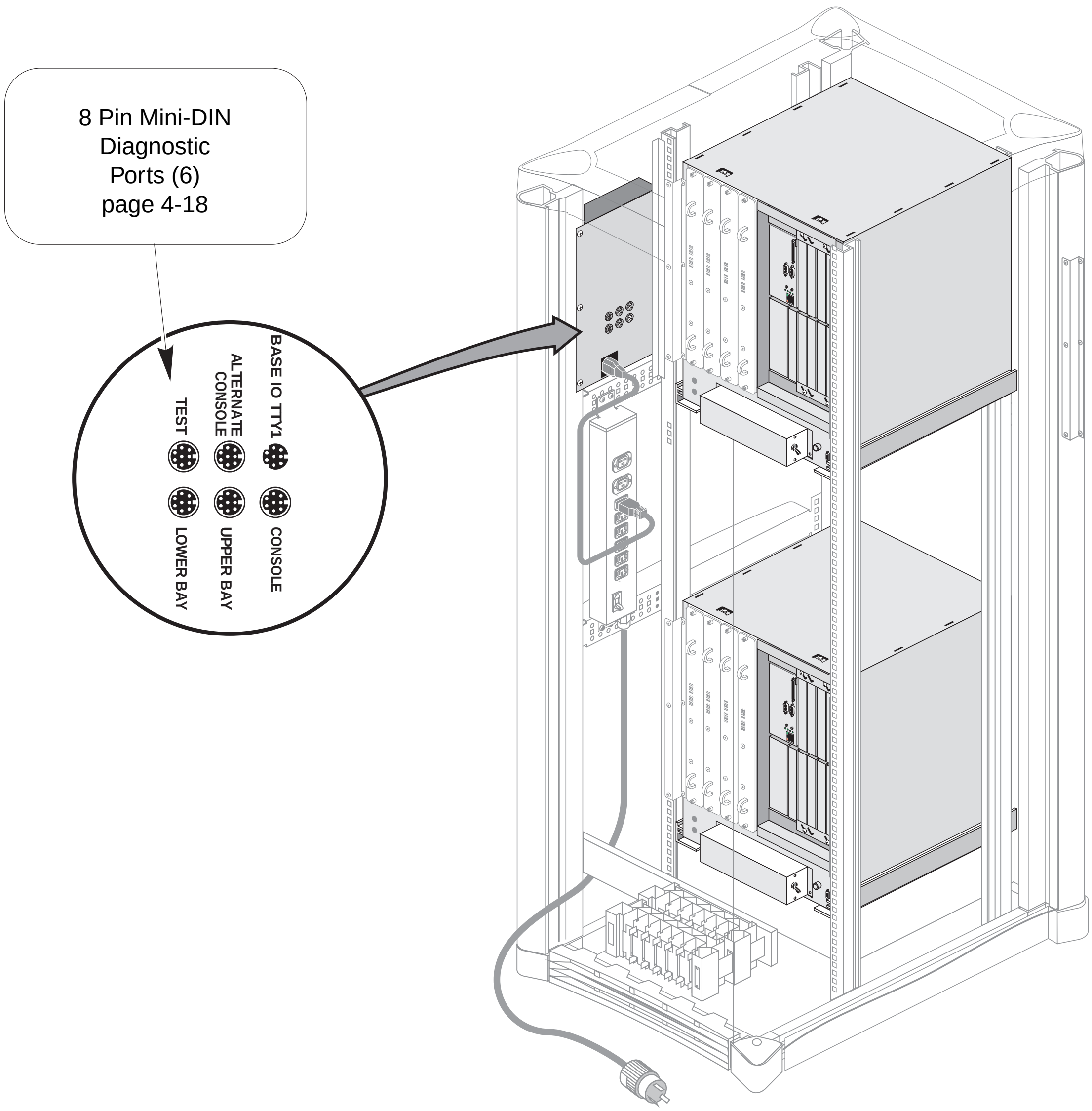


Figure 3-65 Multi-Module System Controller Connections.

Chapter 4

Interfaces

This section provides information on the various interfaces used on Silicon Graphics platforms. For each interface the kind, or kinds, of connectors used are shown and where there is more than one implementation of the interface, a table shows which variety of interface is available on the different SGI platforms.

To find out where a particular interface connection for a specific platform can be found, consult the Platform section of this document. There you will find a drawing of the I/O area for each platform.

The Interfaces are divided into general categories. These categories are listed below:

4.1 Serial Ports

4.1.1 General Information

4.1.1.1 Types of Serial Port Connections

This section documents the three different types of port connections that use serial protocols that are found on Silicon Graphics systems -

- serial ports
- diagnostic ports
- powered peripheral ports.

4.1.1.2 Serial Port Connections

There are two types of connectors used for serial ports on Silicon Graphics systems. They are the 9 pin "D" and the 8 pin Mini-DIN. The pinout and gender of the DB-9 depends on the system or option where they are used. The number and type of serial ports found on various platforms are found in Table 4-1 below.

Table 4-1 also shows the serial ports available via the Audio / Serial Option (ASO) card. This is a mezzanine card available for attachment to an IO4 board.

Silicon Graphics has also offered in the past options to expand the number of available serial ports. These were add-in VME cards with either 6 or 32 ports per added board. These products have been obsolete for some time now and, other than a wiring list for the "CDSIO" 6 port serial board and a modem (Section 4.1.2.3), they are not documented here.

For those systems in the Twin Tower and Single Tower chassis with more than one CPU board, four serial ports are added with each CPU, up to a maximum of 16.

4.1.1.3 Diagnostic and Powered Peripheral Ports

The diagnostic port is new with the Origin200, Origin2000 and Onyx2 products. Unlike the serial ports on the other products, these ports are dedicated to monitoring and controlling the system without also having to function as a regular serial port. In the case of the Origin2000 and Onyx2 rack systems with multiple bays, these diagnostics ports can be connected to a master system controller that can monitor the entire system.

Some systems also include a connection known as a "powered peripheral port". This ports purpose is to provide power to external devices such as Spaceball and the StereoView emitter. This port is required because not all serial ports are capable of powering external devices as is often done with PC compatible systems. The 8 pin DIN connection also provides a sync signal used by the StereoView emitter for switching between eyes. The 4 pin Mini-DIN connection only provides power for external connections, no actual serial port signals are available.

Table 4-2 shows the systems where diagnostic and powered peripheral ports can be found.

Table 4-1 Serial Port Types on SGI Platforms

Chassis Type	Model	9 Pin (DB-9)					8 Pin Mini-DIN
		EIA-232		EIA-232/EIA-422		EIA-422	
		SGI Pinout	PC Pinout	PC Pinout + EIA-422	ASO Pinout	SGI Pinout	
Documented in Section		4.1.2	4.1.5	4.1.6	4.1.4	4.1.3	4.1.7
Twin Tower 12 Slot	4D/60, 70, 80, 120, 210, 220, 310, 320, 420	4					
Twin Tower 15 Slot	4D/120, 210, 220	4					
	4D/240, 340, 440	8					
Predator Rack	4D/240, 280, 340, 380, 440, 480	8 or 16[1]					
Single Tower 13 Slots	4D/85, 210, 220, 240, 310, 320, 340, 420, 440, Crimson	4					
	4D/240, 340, 440	8					
Terminator Rack/ Eveready Deskside	Onyx/8, 16, 24 Challenge XL, Power Challenge L, Power Challenge XL	3				1	
	ASO Serial Option				6		
Personal IRIS	4D/20, 25	2					
	4D/30, 35	2					2
Indigo	All						2
Indigo2	All						2
Indy	All						2
O2	All		2				
OCTANE	All			2			
Origin200	All			2			
Origin2000	Deskside			2			
	Rack			2			
Onyx2	Deskside			4			
	Rack			4			

1. Minimum 8 serial ports available for 4 CPU systems (240, 340, 440), 16 ports available for 8 CPU systems (280, 380, 480).

Table 4-2 Diagnostic Ports and Powered Peripheral Ports

Chassis Type	Model	Diagnostic Ports		Powered Peripheral Ports	
		8 Pin Mini-DIN	9 Pin (DB-9)	8 Pin DIN	4 Pin Mini-DIN
Twin Tower 12 Slot	4D/60, 70, 80, 120, 210, 220, 310, 320, 420			2[1]	
Twin Tower 15 Slot	4D/120, 210, 220			2[1]	
	4D/240, 340, 440				
Predator Rack	4D/240, 280, 340, 380, 440, 480			2	
Single Tower 13 Slots	4D/85, 210, 220, 240, 310, 320, 340, 420, 440, Crimson			2	
	4D/240, 340, 440				
Terminator Rack/ Eveready Deskside	Onyx/8, 16, 24 Challenge XL, Power Challenge L, Power Challenge XL			2	
Personal IRIS	4D/20, 25				2[2]
	4D/30, 35				2[2]
Indigo	All				
Indigo2	All				
Indy	All				
O2	All				
OCTANE	All				
Origin200	All	1			
Origin2000	Deskside	1 (front)	1 (rear)		
	Rack	1 (front)	1 (rear)		
Onyx2	Deskside	1 (front)	1 (rear)		
	Rack	1 (front)	1 (rear)		

1. Available only as an option taking up one I/O Panel space
2. Available as an option only for the TFLU type chassis.

4.1.1.4 Serial Port Access and Naming

Serial ports are access by using the device file /dev/tty*xnn*, where x is the type of connection desired, and nn is the number of the serial port. SGI systems provide three types of serial port connections.

A ttyd*nn* (where *nn* is the port number) device is used for simple serial connections that do not require hardware flow control. An example would be terminals or tablet type devices.

A ttym*nn* device is used for devices that require modem control signals.

A ttyf*nn* device is used for devices that understand hardware flow control signals.

The serial man page contains more detailed information about serial port usage.

4.1.1.5 Serial Port Voltage Levels

The table below defines the input and output voltage levels for the various serial port implementations.

Table 4-3 Serial Port I/O Voltage Levels

Protocol	Platform	I/O Voltages	
		Mark	Space
EIA-232	R2300, IP4, IP5, IP6, O2, OCTANE, Origin200, Origin2000, Onyx2	-12 V	+12 V
EIA-423	Indigo, 4D/30, 4D/35	-5 V	+5 V
	Indigo^2, Indy	-9 V	+9 V
EIA-422	Onyx, Challenge, OCTANE, Origin200, Origin2000, Onyx2	0 V	+5 V

On the Indigo specifically, it is possible that the control signals could drop below the acceptable "legal" limits.

4.1.1.6 Powering External Devices From the Serial Port

The practice of powering external devices from signal pins of the serial port has become common on some systems, especially PC compatibles. Some developers and customers have tried to use serial port devices - like dongles - on the Silicon Graphics systems and have had trouble getting them to work.

The serial ports on Silicon Graphics systems were designed to meet the EIA-232 specification but some systems also include the capability to switch the port to the EIA-422 mode. The parts used for this do not have the same voltage and current characteristics as the components commonly used in PC compatibles. However, they do meet the minimum specifications as required by the EIA-232 specification.

The situation is one of the port meeting the minimum as defined by the specification (1.6 mA), while some external devices require current at, or near, the maximum defined by the specification (10 mA). Any device that requires current that exceeds the minimum specs as defined by EIA-232 (5 Volts across a 3KΩ = 1.6 mA) may not operate properly. It is possible that a specific device will operate properly with a specific system type. This is probably due to the combination of the components used to drive the serial port in both the system and the device.

It is preferable that external devices derive power from some external source. Since the components used for the serial interface have varied from system to system there is no guarantee that because a device works on one system, it will work on a different one.

4.1.1.7 Maximum Data Transfer Rates

The maximum data transfer rates for the serial ports are shown in Table 4-4. The serial port drivers in IRIX only officially support baud rates up to 115,200.

Table 4-4 Serial Port Baud Rate Maximums

<table>
<tr><th colspan="2" rowspan="2">Chassis & Connector</th><th colspan="3">Maximum Baud Rate</th></tr>
<tr><th>EIA-232</th><th>EIA-422</th><th>EIA-423</th></tr>
<tr><td>Twin Tower
12 Slot</td><td rowspan="5">DB-9</td><td rowspan="5">9,600</td><td></td><td></td></tr>
<tr><td>Twin Tower
15 Slot</td><td></td><td></td></tr>
<tr><td>Predator Rack</td><td></td><td></td></tr>
<tr><td>Single Tower
13 Slots</td><td></td><td></td></tr>
<tr><td>Terminator Rack/
Eveready Deskside</td><td>38,400
(built-in) or
115,200
(ASO ports)</td><td></td></tr>
<tr><td rowspan="2">Personal IRIS</td><td>DB-9</td><td>9,600</td><td></td><td></td></tr>
<tr><td rowspan="4">Mini-DIN 8</td><td rowspan="4">38,400</td><td></td><td rowspan="4">38,400</td></tr>
<tr><td>Indigo</td><td></td></tr>
<tr><td>Indigo2</td><td></td></tr>
<tr><td>Indy</td><td></td></tr>
<tr><td>O2</td><td rowspan="5">See
Table 4-1</td><td rowspan="5">460,000</td><td></td><td></td></tr>
<tr><td>OCTANE</td><td rowspan="4">460,000</td><td></td></tr>
<tr><td>Origin200</td><td></td></tr>
<tr><td>Origin2000</td><td></td></tr>
<tr><td>Onyx2</td><td></td></tr>
</table>

4.1.1.8 Comparison of 9 Pin (DB-9) Pinouts

Since there are several DB-9 style serial or diagnostic ports across the product line, Table 4-5 shows a comparison of their pinouts.

Table 4-5 Comparison of DB-9 Style Connector Pinouts

<table>
<tr><th></th><th>4D DB-9</th><th>4D DB-9</th><th colspan="2">ASO</th><th>PC Compatible</th><th>Diagnostic Port</th><th colspan="2">PC Pinout + EIA-422</th></tr>
<tr><th>Protocol</th><th>EIA-232</th><th>EIA-422</th><th>EIA-232</th><th>EIA-422</th><th>EIA-232</th><th>EIA-232</th><th>EIA-232</th><th>EIA-422</th></tr>
<tr><th>Gender</th><th colspan="4">Female</th><th colspan="4">Male</th></tr>
<tr><td>Pin1</td><td>N/C</td><td>DTR</td><td>N/C</td><td>TXDH</td><td colspan="3">DCD</td><td>N/C</td></tr>
<tr><td>Pin 2</td><td>TD</td><td colspan="3">TXDL</td><td colspan="3">RD</td><td>RXDL</td></tr>
<tr><td>Pin 3</td><td>RD</td><td colspan="3">RXDL</td><td colspan="3">TD</td><td>TXDL</td></tr>
<tr><td>Pin 4</td><td>RTS</td><td>DCD</td><td colspan="2">RTS</td><td colspan="3">DTR</td><td>TXDH</td></tr>
<tr><td>Pin 5</td><td colspan="4">CTS</td><td colspan="4">GND</td></tr>
<tr><td>Pin 6</td><td>N/C</td><td>GND</td><td>N/C</td><td>RXDH</td><td>DSR</td><td colspan="2">N/C</td><td>RXDH</td></tr>
<tr><td>Pin 7</td><td>GND</td><td>TXDH</td><td colspan="2">GND</td><td colspan="3">RTS</td><td>HSKoA</td></tr>
<tr><td>Pin 8</td><td>DCD</td><td>RXDH</td><td colspan="2">DCD</td><td colspan="3">CTS</td><td>HSKiA</td></tr>
<tr><td>Pin 9</td><td>DTR</td><td>RTS</td><td colspan="2">DTR</td><td>RI (O2 & OCTANE Only)</td><td colspan="3">N/C</td></tr>
</table>

For reference, here are the definitions of the serial port signals:

Table 4-6 Serial Port Signal Definitions

Name	Description
DTR	Data Terminal Ready
DCD	Data Carrier Detect
RD	Receive Data
TD	Transmit Data
DSR	Data Set Ready
RTS	Ready to Send
CTS	Clear To Send
RI	Ring Indicator

Name	Description
RXDL	Receive Data Low
RXDH	Receive Data High
TXDL	Transmit Data Low
TXDH	Transmit Data High
HSKiA	Handshake Input
HSKoA	Handshake Output

4.1.2 9 Pin (DB-9), EIA-232 Serial Port

This serial port was used on the early "4D" systems. It does use the DB-9 connector but it is not compatible with "PC Style" DB-9 serial ports. The pinout is similar, but not exactly the same. This means that cables and adapters designed for PC serial ports will not work correctly with this port in all cases. For clarification, see Table 4-5, "Comparison of DB-9 Style Connector Pinouts", on page 4-10.

4.1.2.1 Connector Drawing

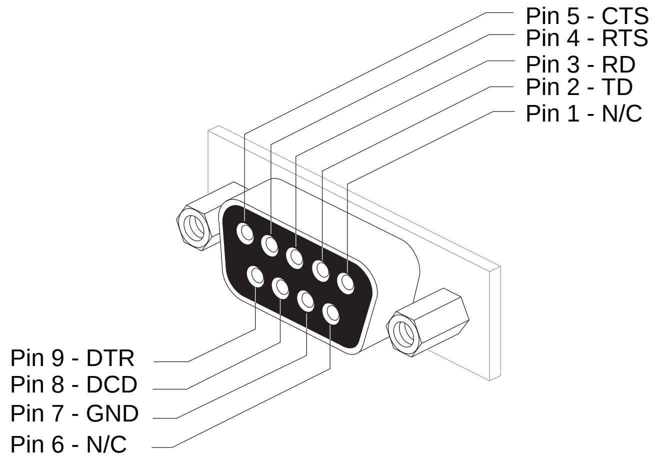


Figure 4-1 DB-9, EIA-232 Serial Port Connector

4.1.2.2 Pinout

Table 4-7 9 Pin EIA-232 Pinout

Pin	Signal Name	Description
1	N/C	No Connection
2	TD	Transmit Data
3	RD	Receive Data
4	RTS	Request To Send
5	CTS	Clear To Send
6	N/C	No Connection
7	GND	Signal Ground
8	DCD	Data Carrier Detect
9	DTR	Data Terminal Ready

4.1.2.3 Modem Cables for "CDSIO" Serial Ports

At one point in time, Silicon Graphics offered a 6 port serial VME card that is commonly referred to as a the "cdsio" board. The board was made by Central Data (thus the 'cd' in 'cdsio'). There were two IO panel assemblies with three DB-9 connectors apiece that were used to bring the ports out to the IO panel. Many people assumed that the pinouts of these connectors were identical to the DB-9's found in the rest of the 4D series, but this was not the case. Typical connections to terminals worked just fine, but modem connections had difficulty due to the unusual pinout.

To construct a cable to connect a modem to one of the cdsio ports use the following wiring:

Table 4-8 CDSIO Port Modem Cable Wiring

DB-9	DB-25	Signal
1	6	DSR
2	2	TX
3	3	RX
4	4	CTS
5	5	RTS
6	22	RI
7	7	SG
8	8	DCD
9	20	DTR

4.1.3 9 Pin (DB-9), EIA-422 Serial Port

This serial port connection was used on the early "4D" systems and should not be confused with the later EIA-422 serial ports that also use the DB-9 connector. See Table 4-5, "Comparison of DB-9 Style Connector Pinouts", on page 4-10 for clarification.

4.1.3.1 Connector Drawing

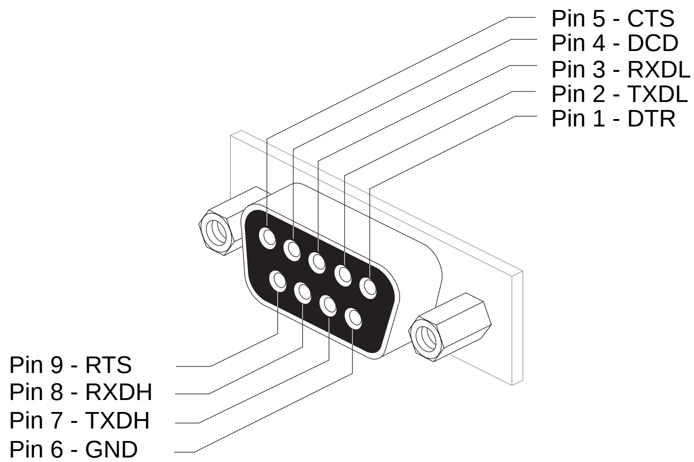


Figure 4-2 DB-9, EIA-422 Serial Port Connector

4.1.3.2 Pinout

Table 4-9 9 Pin EIA-422 Serial Port Pinout

Pin	Signal Name	Description
1	DTR	Data Terminal Ready
2	TXDL	Transmit Data Low
3	RXDL	Receive Data Low
4	DCD	Data Carrier Detect
5	CTS	Clear To Send
6	GND	Signal Ground
7	TXDH	Transmit Data High
8	RXDH	Receive Data High
9	RTS	Request To Send

4.1.4 9 Pin (DB-9), Audio/Serial Option (ASO) EIA-232/422 Serial Port

4.1.4.1 Connector Drawing

EIA-422 Mode signals shown in [brackets].

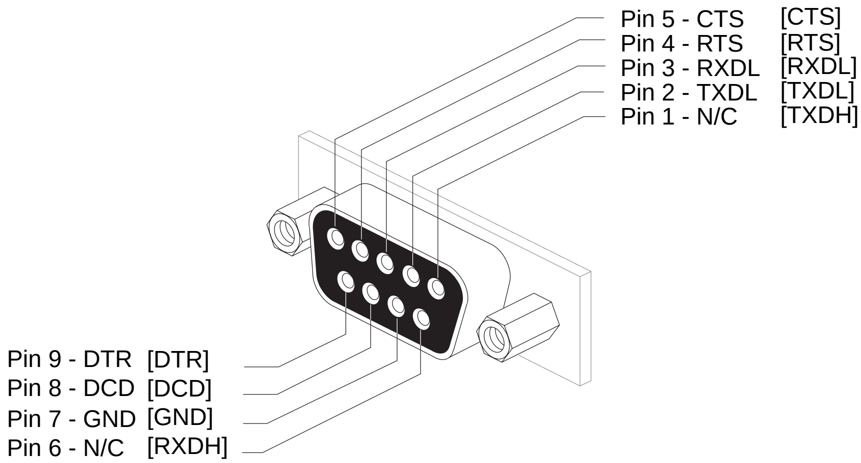


Figure 4-3 Audio/Serial Option (ASO) Serial Port Connector

4.1.4.2 Pinout

Table 4-10 Audio/Serial Option Serial Port Connector Pinout

Pin #	EIA-232 Mode		EIA-422 Mode	
	Signal Name	Description	Signal Name	Description
1	N/C	No Connection	TXDH	Transmit high
2	TXDL	Transmit low	TXDL	Transmit low
3	RXDL	Receive low	RXDL	Receive low
4	RTS	Request to send	RTS	Request to send
5	CTS	Clear to send	CTS	Clear to send
6	N/C	No Connection	RXDH	Receive high
7	GND	Signal ground	GND	Signal ground
8	DCD	Data Carrier Detect	DCD	Data Carrier Detect
9	DTR	Data Terminal Ready	DTR	Data Terminal Ready

4.1.5 9 Pin (DB-9), PC Compatible EIA-232 Serial Port

4.1.5.1 Connector Drawing

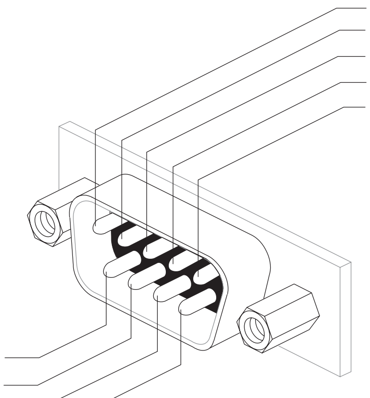


Figure 4-4 PC Compatible EIA-232 Serial Port Connector

4.1.5.2 Pinout

Table 4-11 PC Compatible EIA-232 Serial Port Connector Pinout

Pin	RS-232	
	Assignment	Description
1	DCD	Data Carrier Detect
2	RD	Receive Data
3	TD	Transmit Data
4	DTR	Data Terminal Ready
5	GND	Signal Ground
6	DSR	Data Set Ready
7	RTS	Request To Send
8	CTS	Clear To Send
9	RI (O2 Only)	Ring Indicator

4.1.6 9 Pin (DB-9), EIA-232/EIA-422 Serial Port (OCTANE, Origin & Onyx2)

4.1.6.1 Connector Drawing

EIA-422 Mode signals shown in [brackets].

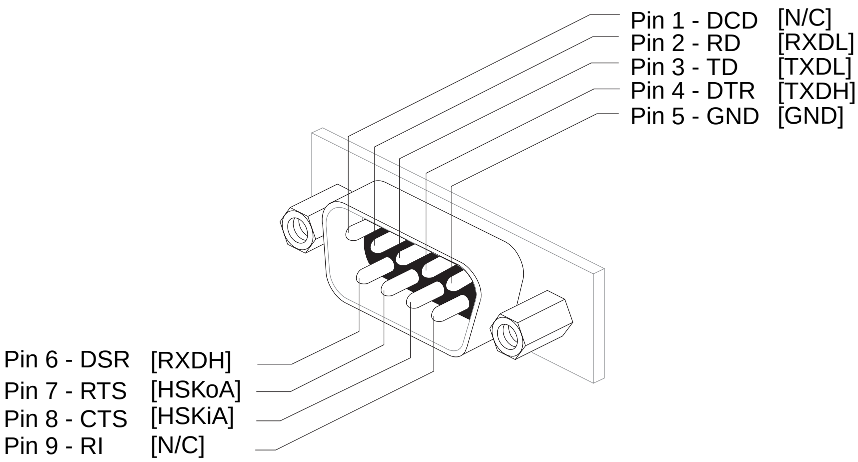


Figure 4-5 DB-9 EIA-232 / 422 Serial Port Connector

4.1.6.2 Pinout

Table 4-12 DB-9 EIA-232 / 422 Serial Port Connector Pinout

Pin	EIA-232		EIA-422	
	Signal Name	Description	Signal Name	Description
1	DCD	Data Carrier Detect	N/C	No Connection
2	RD	Receive Data	RXDL	Receive Data Low
3	TD	Transmit Data	TXDL	Transmit Data Low
4	DTR	Data Terminal Ready	TXDH	Transmit Data High
5	GND	Signal Ground	GND	Signal Ground
6	DSR	Data Set Ready	RXDH	Receive Data High
7	RTS	Request To Send	HSKoA	Handshake Output
8	CTS	Clear To Send	HSKiA	Handshake Input
9	N/C	No Connection	N/C	No Connection

The EIA-232 pinout of this connector is identical to the connection found on the O2 with the exception that pin 9 is a no connect in this case. On the O2 pin 9 is the Ring Indicator signal.

4.1.7 8 Pin Mini-DIN Serial Port

4.1.7.1 Connector Drawing

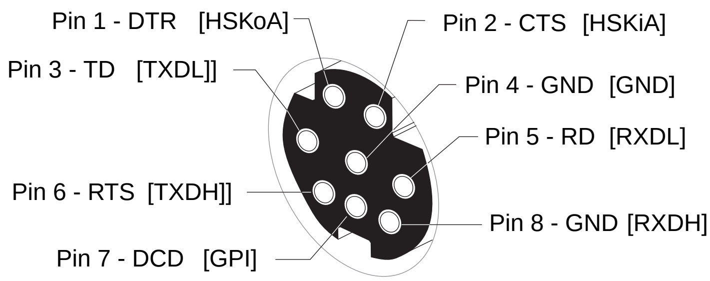


Figure 4-6 8 Pin Mini-DIN Serial Port Connector

4.1.7.2 Pinout

Table 4-13 8 Pin Mini-DIN EIA-232 Serial Port Pinout

Pin	EIA-423 Mode		EIA-422 Mode	
	Signal Name	Description	Signal Name	Description
1	DTR	Data Terminal Ready	HSKoA	Output Handshake
2	CTS	Clear To Send	HSKiA	Input Handshake Or External Clock
3	TD	Transmit Data	TXDL	Transmit Data Low
4	GND	Signal Ground	GND	Signal Ground
5	RD	Receive Data	RXDL	Receive Data Low
6	RTS	Request To Send	TXDH	Transmit Data High
7	DCD	Data Carrier Detect	GPi	General Purpose Input
8	GND	Signal Ground	RXDH	Receive Data High

1. Switching between EIA-423 and EIA-422 modes is accomplished by using a streams ioctl. Consult the serial man page for more information.

4.1.8 8 Pin Mini-DIN Diagnostic Port

4.1.8.1 Connector Drawing

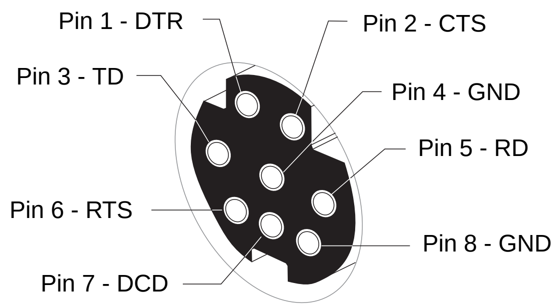


Figure 4-7 8 Pin Mini-DIN Diagnostic Port

4.1.8.2 Pinout

Table 4-14 8 Pin Mini-DIN Diagnostic Port Pinout

Pin	Signal Name	Description
1	DTR	Data Terminal Ready
2	CTS	Clear To Send
3	TD	Transmit Data
4	GND	Signal Ground
5	RD	Receive Data
6	RTS	Request To Send
7	DCD	Data Carrier Detect
8	GND	Signal Ground

4.1.9 9 Pin (DB-9) Diagnostic Port

4.1.9.1 Connector Drawing

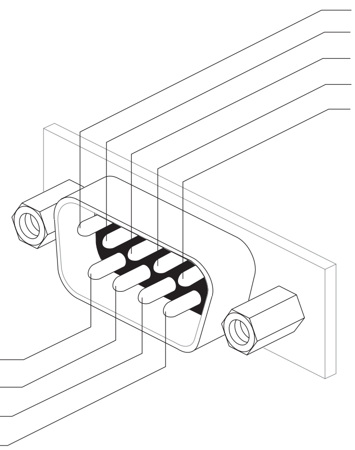


Figure 4-8 DB-9 Diagnostic Port Connector

4.1.9.2 Pinout

Table 4-15 DB-9 Diagnostic Port Pinout

Pin	RS-232	
	Assignment	Description
1	DCD	Data Carrier Detect
2	RD	Receive Data
3	TD	Transmit Data
4	DTR	Data Terminal Ready
5	GND	Signal Ground
6	N/C	No Connection
7	RTS	Request To Send
8	CTS	Clear To Send
9	N/C	No Connection

1. The pinout of the this diagnostic port differs from the regular serial ports found on O2, Origin200/2000 and Onyx2 only in the Pin 6 and Pin 9 signals.

4.1.10 8 Pin DIN Powered Peripheral Port

This port was not originally built into the Twin Tower chassis. Two ports were added on a separate I/O panel as an option. Starting with the Single Tower (Diehard) chassis, the high-end systems were designed to incorporate two of these ports.

4.1.10.1 Connector Drawing

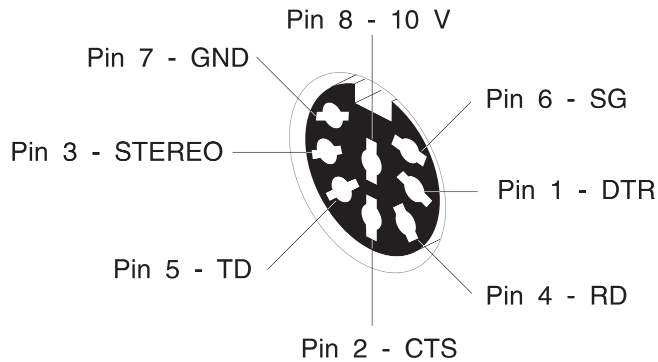


Figure 4-9 8 Pin DIN Powered Peripheral Port Connector

4.1.10.2 Pinout

Table 4-16 8 Pin DIN Powered Peripheral Port Pinout

Pin	Signal Name	Description
1	DTR	Data Terminal Ready
2	CTS	Clear To Send
3	STEREO	Stereo Field Sync
4	RD	Receive Data
5	TD	Transmit Data
6	GND	Signal Ground
7	GND	Ground Point
8	V10P	10 Volt Supply (max 500 mA)

1. This port only operates in EIA-232 mode.
2. The ground point is provided as a chassis ground primarily for EMI considerations.
3. On those systems with this port, the available Powered Peripheral Ports share the signal lines with tty2, tty3, and tty4 (if applicable), the regular 9 Pin ports. This implies that if the 9 pin serial port is in use, the Powered Peripheral Port may not be used.

4.1.11 4 Pin Mini-DIN Power Ports (+5 and +12 Vdc)

While these ports are not strictly serial ports, they are typically used in conjunction with the serial ports on a Personal IRIS. There are two connections. One supplies + 5 Vdc, the other supplies +12 Vdc. Typically a “Y” cable is used to connect this port and a regular serial port to a serial device that requires power. A small I/O panel with two of these ports is available as an option on most of the Personal IRIS chassis. Early chassis did not have the opening in the chassis for this I/O panel. With the TFLU chassis the space for these connectors became standard.

4.1.11.1 Connector Drawing

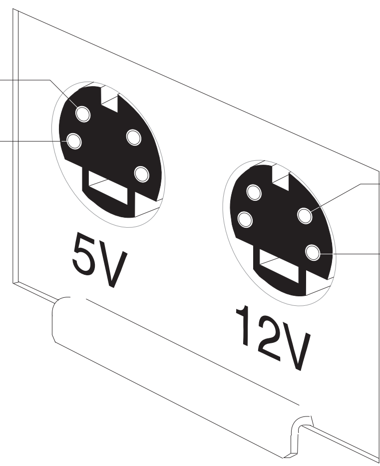


Figure 4-10 4 Pin Mini-DIN Power Port Connectors

4.1.11.2 Pinout

Table 4-17 4 Pin Mini-DIN Power Port Pinout

Type	Pin	Signal Name	Description
+5 Vdc Connection	1	N/C	No Connection
	2	+5	+ 5 Volts dc (1A max)
	3	N/C	No Connection
	4	5VRTN	+ 5 Volt Return
+12 Vdc Connection	1	+12	+12 Volts dc (0.5A max)
	2	N/C	No Connection
	3	12RTN	+ 12 Volt Return
	4	N/C	No Connection

4.2 Keyboard and Mouse Ports

4.2.1 General Information

Some styles of keyboards can be used on systems other than the ones they were originally shipped on. For this reason, this section identifies the keyboard and / or mouse system connection separately from any connections on the keyboard itself.

4.2.1.1 Types of Keyboard and Mouse System Connections

Keyboard and mouse connections to the system are either through a combined keyboard / mouse interface, or through PS / 2 style keyboard and mouse interfaces, which are carried on separate cables. The connectors used are either a 15 pin D (DB-15), a 9 pin D (DB-9), a 6 pin mini-DIN or a PS / 2 style 6 pin mini-DIN. Table 4-18 defines which chassis have which types of interfaces. The Origin200 has connectors for keyboard and mouse, but are reserved for future use.

Table 4-18 Keyboard & Mouse System Connections on SGI Platforms

Chassis Type	Model	Combined Keyboard & Mouse			Separate Keyboard & Mouse
		15 Pin (DB-15)	9 Pin (DB-9)	6 Pin Mini-DIN	PS/2 Style (6 Pin Mini-DIN)
Documented in Section		**4.2.2**	**4.2.3**	**4.2.4**	**4.2.5 & 4.2.6**
Twin Tower 12 Slot	All	X			
Twin Tower 15 Slot	All	X			
Predator Rack	All	X			
Diehard Single Tower	All	X			
Diehard2	All	X			
Personal IRIS	4D/20, 25		X		
	4D/30, 35			X	
Indigo	All			X	
Terminator Rack	All			X	
Eveready Deskside	All			X	
Indigo2	All				X
Indy	All				X
O2	All				X
OCTANE	All				X
Origin200*	All				X
Origin2000 & Onyx2 Deskside	All				X

4.2.1.2 Keyboard and Mouse Voltages and Interfaces

The table below shows the supply voltage(s) and logic levels for the keyboard and mouse as well as the type of interface each device has.

Table 4-19 Keyboard & Mouse Voltages and Interfaces

Interface	Platform	Supply Voltage	Logic Levels Mark/Space	Interface
DB-15 Keyboard/Mouse	All Twin Tower, Single Tower, Predator Rack	+12 V/ -12 V	-12/+12	EIA-232
DB-9 Keyboard/Mouse	4D/20, 25	+12 V/ -12 V	-12/+12	EIA-232
6 Pin Mini-DIN Keyboard/Mouse	4D/30, 35,	+8 V		EIA-232
	Indigo R3K	+5 V		EIA-232
	Indigo R4K	+12 V		EIA-232
	Terminator, Eveready	+ 12 V	-12/+12	EIA-232
6 Pin Mini-DIN PS/2 Keyboard	Indigo^2, Indy, O2, OCTANE, Origin200, Origin2000, Onyx2	+5 V	0/+5	TTL
6 Pin Mini-DIN PS/2 Mouse	Indigo^2, Indy, O2, OCTANE, Origin200, Origin2000, Onyx2	+5 V	0/+5	TTL

4.2.1.3 Keyboard Styles

There are four styles of keyboards for the system.

4D Style - This keyboard has a captive cable with a DB-15 connector for the system. This keyboard has a DB-9 connector on each side of the keyboard for the mouse connection. This is the keyboard used from the inception of the 4D series up until the Diehard2 platform. The mouse intended for this keyboard was an optical mouse.

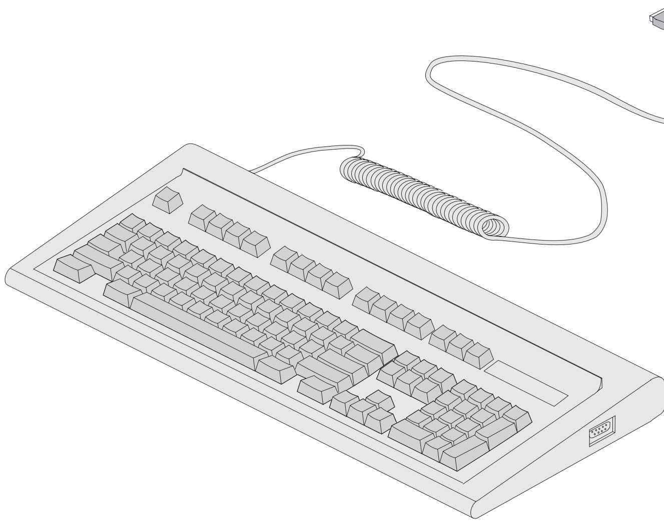


Figure 4-11 4D Style Keyboard

Personal IRIS Style - This keyboard has two DB-9 connectors. One is used for connecting to the system while the other is used to connect the mouse. This keyboard originally shipped first with the Personal IRIS. The mouse shipped with this keyboard was an optical mouse.

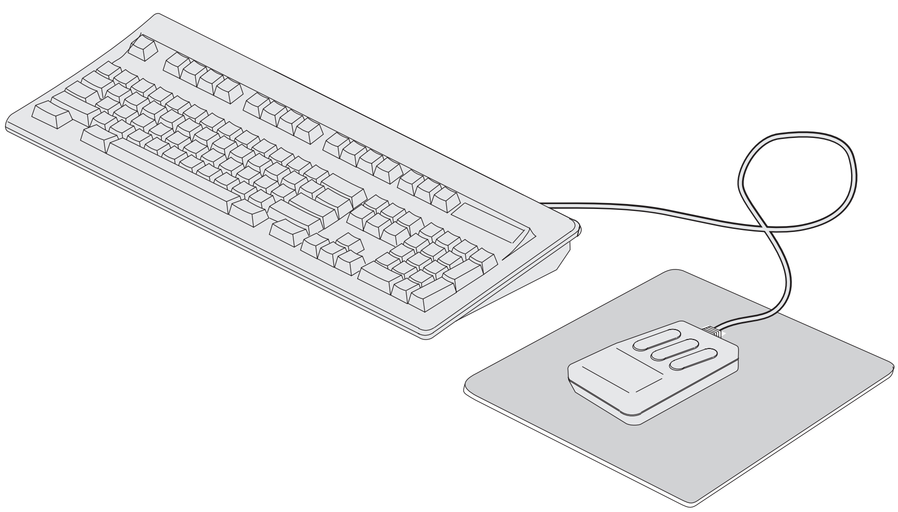


Figure 4-12 Personal IRIS Style Keyboard and Mouse

Indigo Style - This keyboard has two 6 pin mini-DIN connectors. One is used for connecting to the system while the other is used to connect the mouse. The two connectors are wired identically. The mouse originally shipped with the Indigo was a mechanical mouse. With the appropriate cable (DB-9 to 6 pin mini-DIN) this keyboard can be used on an older style Personal IRIS. Starting with the Eveready / Terminator chassis this style of keyboard was shipped with the high-end systems.

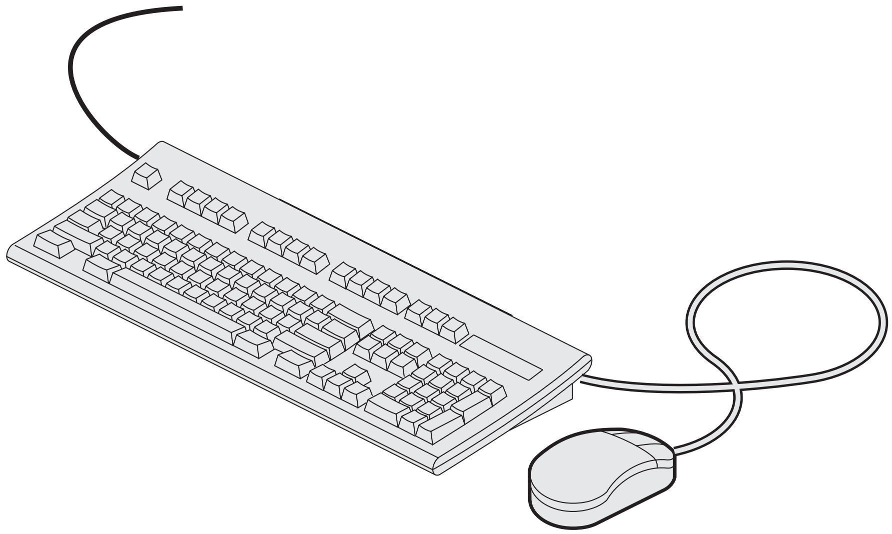


Figure 4-13 Indigo Style Keyboard & Mouse

PS/2 Style - This keyboard style has a captive cable for connecting to the system. There are no connectors available on this keyboard for connecting the mouse. This keyboard was originally shipped with the Indigo^2 and Indy.

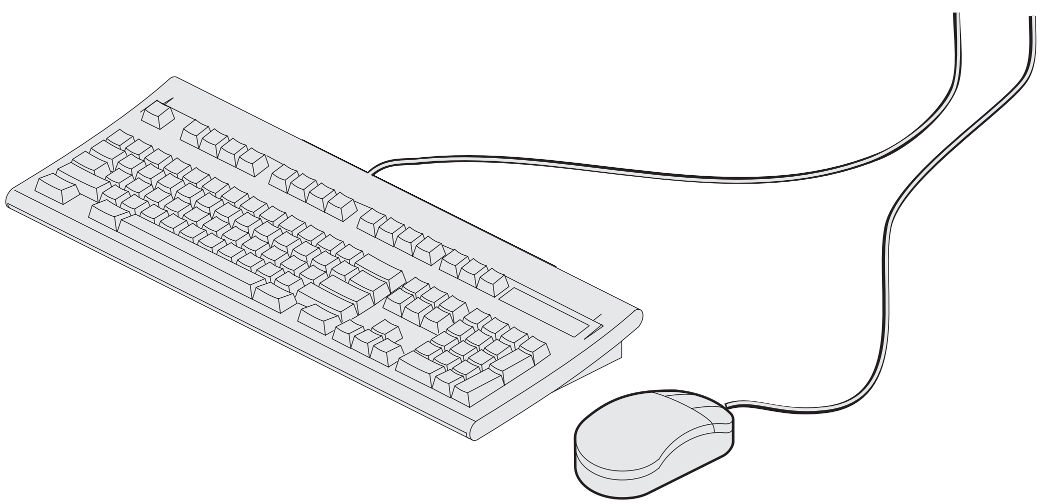


Figure 4-14 PS / 2 Style Keyboard & Mouse

4.2.2 DB-15 Keyboard/Mouse System Connection

4.2.2.1 Connector Drawing

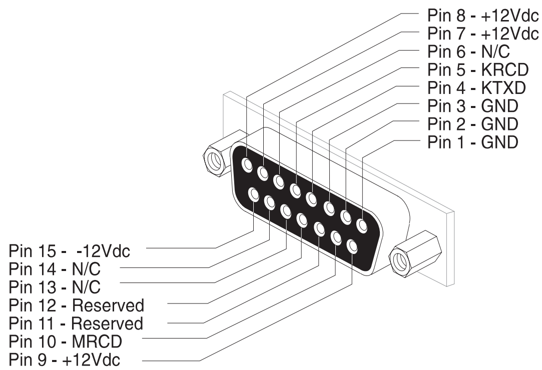


Figure 4-15 DB-15 Keyboard / Mouse Connector

4.2.2.2 Pinout

Table 4-20 DB-15 Keyboard / Mouse System Connector Pinout

Pin	Signal Name	Description	Input/Output
1	GND	Ground	-
2	GND	Ground	-
3	GND	Ground	-
4	KTXD	Keyboard Transmit Data	Output
5	KRCD	Keyboard Receive Data	Input
6	N/C	No Connection	-
7	+12Vdc	Power	Output
8	+12 Vdc	Power	Output
9	+12 Vdc	Power	Output
10	MRCD	Mouse Transmit Data	Input
11	RES	Reserved	-
12	RES	Reserved	-
13	N/C	No Connection	-
14	N/C	No Connection	-
15	-12 Vdc	Power	Output

1. Maximum current draw on the +12 Vdc lines is 1 amp.
2. Maximum current draw on the -12 Vdc line is 1 amp.

4.2.3 DB-9 Keyboard/Mouse System Connection

4.2.3.1 Connector Drawing

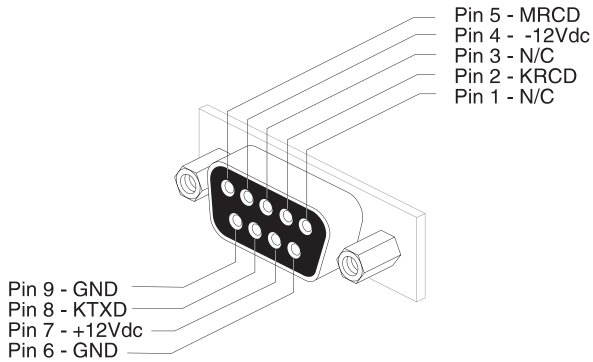


Figure 4-16 DB-9 Keyboard / Mouse Connector

4.2.3.2 Pinout

Table 4-21 DB-9 Keyboard / Mouse System Connector Pinout

Pin	Signal Name	Description	Input/Output
1	N/C	No Connection	-
2	KRCD	Keyboard Receive Data	Input
3	N/C	No Connection	-
4	-12 Vdc	Power	Output
5	MRCD	Mouse Receive Data	Input
6	GND	Ground	-
7	+12 Vdc	Power	Output
8	KTXD	Keyboard Transmit Data	Output
9	GND	Ground	-

4.2.4 6 Pin Mini-DIN Keyboard/Mouse System Connection

4.2.4.1 Connector Drawing

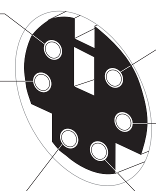


Figure 4-17 6 Pin Mini-DIN Keyboard / Mouse Connector

4.2.4.2 Pinout

Table 4-22 6 Pin Mini-DIN Keyboard / Mouse System Connector Pinout

Pin	Signal Name	Description	Input/Output
1	KRCD	Keyboard Receive	Input
2	MRCD	Mouse Receive	Input
3	GND	Ground	-
4	+5/8/12 Vdc[1]	Power	Output (1 Amp Max)
5	KTXD	Keyboard Transmit	Output
6	N/C	No Connection	-

1. Consult the table on page 4-23 to determine the supplied voltage.

4.2.5 PS/2 Keyboard System Connection (6 Pin Mini-DIN)

4.2.5.1 Connector Drawing

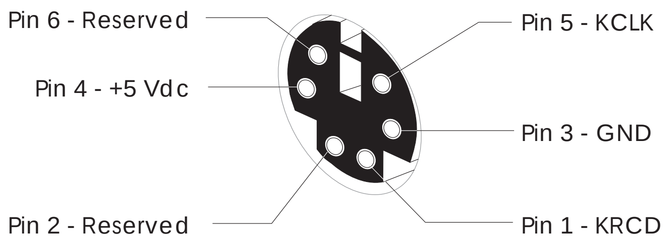


Figure 4-18 PS/2 Keyboard Connector

4.2.5.2 Pinout

Table 4-23 6 Pin Mini-DIN Keyboard System Connector Pinout

Pin	Signal Name	Description	Input/Output
1	KRCD	Keyboard Receive	Input
2		Reserved	-
3	GND	Ground	Output
4	+5 Vdc	Power	Output (1 Amp Max)
5	KCLK	Keyboard Clock	Output
6		Reserved	-

4.2.6 PS/2 Mouse System Connection (6 Pin Mini-DIN)

4.2.6.1 Connector Drawing

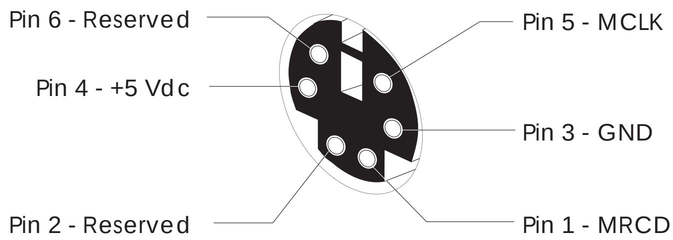


Figure 4-19 PS/2 Mouse Connector

4.2.6.2 Pinout

Table 4-24 6 Pin Mini-DIN Mouse System Connector Pinout

Pin	Signal Name	Description	Input/Output
1	MRCD	Mouse Receive	Input
2	-	Reserved	-
3	GND	Ground	Output
4	+5 Vdc	Power	Output (1 Amp Max)
5	MCLK	Mouse Clock	Output
6	-	Reserved	-

4.2.7 DB-9 Mouse Connection (4D Style Keyboard)

This mouse is not a device that sends its information in the form of a serial stream of data including the codes for button presses. This mouse connection was part of the custom keyboard used for the original 4D series of systems.

4.2.7.1 Connector Drawing

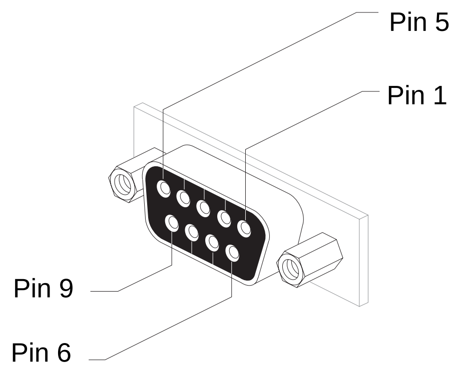


Figure 4-20 DB-9 Mouse Connector

4.2.7.2 Pinout

Table 4-25 DB-9 Mouse System Connector Pinout (4D Keyboard)

Pin	Signal Name	Description	Input/Output
1	VCC	+12 Volts	-
2	XA		Input
3	XB or -5V		Input/-
4	YA		Input
5	YB or MTXD		Input
6	Left Button		Input
7	Middle Button		Input
8	Right Button		Input
9	GND	Ground	-

4.3 Parallel Ports

A single parallel port has been available for SGI systems as a built-in port. It has been built into almost all the systems since the Personal IRIS. Some of the built in parallel ports use the DB-25 connector and some use the 36 pin high density connector. Table 4-27 shows the parallel ports available by platform. Over the years the capabilities of the parallel port have increased. Table 4-27 shows the modes supported by the various parallel ports.

One other parallel port has been available from SGI as an optional port. This was a VME add-in board that supported the Versatec plotter.

Table 4-26 Parallel Port Connector Types

Chassis	**Built In Parallel Port Connector Type**		**Ikon Versatec Parallel Port (option only)**
Connector Type	**DB-25**	**36 Pin HiDensity**	**DB-37**
Documented in Section	**4.3.1**	**4.3.2**	**4.3.3**
Twin Tower, Diehard, Predator			X
Personal IRIS	X		X
Indigo	X		
Indigo2	X		
Onyx, Challenge	X		
Indy	X		
O2		X	
OCTANE		X	
Origin200		X	
Origin2000			
Onyx2		X	

There are four possible modes the parallel ports can support:

- STDPP - Standard Parallel Port

  This is a standard centronics type parallel port. It can be used to support a parallel interface printer. It is unidirectional in its data flow. This is the same style of parallel port as used on the PC compatible type platforms. In fact, parallel printer cables used on PC compatibles (with one end having a DB-25 connector, the other with a “Centronics” style 36 pin connector) work perfectly for connecting printers to the SGI systems.

- SGIPP - SGI Parallel Port

  This port mode supports bidirectional transfers. It was designed to support a particular Ricoh parallel port scanner. This scanner is does not conform to any other parallel port standard.

- BOISEPP - Boise Parallel Port

  This port mode supports bidirectional transfers according to the Boise interface specification. The “Boise Spec” preceded the adoption of the IEEE 1284 specification. However, the hardware was designed before the Boise spec was complete and approved. Since devices that comply with the “Boise” spec were difficult to find, the port has not been fully tested with a “Boise Compatible” device.

- IEEE 1284 - IEEE Specification for Bi-directional Parallel Peripherals

  The IEEE 1284 specification defines five different modes for a compliant parallel port - compatibility mode, nibble mode, byte mode, ECP (Extended Capability Port) mode, and EPP (Enhanced Parallel Port) mode. The chip used in the systems that support IEEE 1284 has been tested for all these modes. Devices that comply with each of these modes are difficult to find, and thus testing of these features has not been extensive.

Table 4-27 shows the modes supported by the parallel ports on each platform:

Table 4-27 Parallel Ports on SGI Systems

Chassis	Built In Parallel Port				Ikon Versatec Parallel Port (option only)
	STDPP (Unidirectional)	SGIPP (Bidirectional)	BOISEPP (Boise Interface)	IEEE 1284	
Twin Tower, Diehard, Predator					X
Personal IRIS	X				X
Indigo	X	X			
Indigo2	X	X	X		
Onyx, Challenge	X				
Indy	X	X	X		
O2				X	
OCTANE				X	
Origin200				X	
Origin2000					
Onyx2				X	

4.3.1 Built-In Parallel Port (DB-25)

A built-in parallel port has been included with every system designed since the Personal IRIS.

4.3.1.1 Connector Drawing

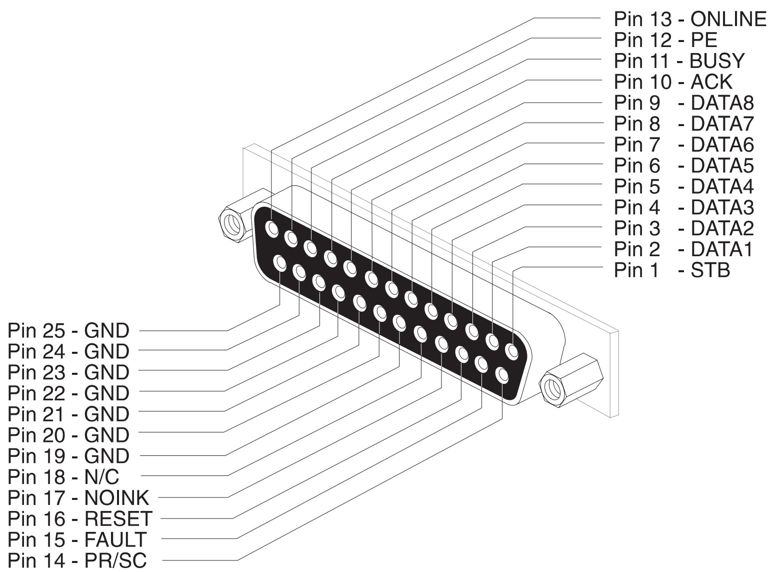


Figure 4-21 DB-25 Parallel Port Connector

4.3.1.2 Parallel Port Modes and Signals

The three possible modes the port can support have different names for certain signals. These signals will be defined here.

- BUSY - In the STDPP and BOISEPP modes this signal indicates that the printer is busy. In the SGIPP mode this signal indicates the device receiving the data is busy. Note that in the SGIPP mode the signal is an input/output pin, while in STDPP the signal is an input only.
- PE - In the STDPP and BOISEPP modes this signal indicates that the printer has some sort of paper error. This could be a paper path problem (a jam, for instance) or that the printer is out of paper. In the SGIPP mode the signal indicates that the device (in this case assumed to be a scanner) has had an error.
- AUTOFEED/PR/SC - In the STDPP and BOISE PP modes the AUTOFEED signal turns on the auto line feed mode of the printer (or some other capability). In the SGIPP mode this signal determines the direction of the data flow. When the signal is high, data flows from the computer to the parallel port device (i.e. printing). When the signal is low, data flows from the device to the computer (i.e. scanning).
- NOINK/SELECTIN - In the STDPP mode this signal, when high, indicates the printer has no ink. In the BOISEPP mode, the signal is used to select the attached device. Note that in STDPP mode the signal is an input, while in the BOISEPP mode it's an output.

Pinout

Table 4-28 Built-In Parallel Port (DB-25) Pinout

Pin	STDPP			SGIPP (Ricoh)			BOISEPP		
	Signal Name	**Description**	**I/O**	**Signal Name**	**Description**	**I/O**	**Signal Name**	**Description**	**I/O**
1	$\overline{STB}$	Strobe	O	Same					
2	DATA1	LSB							
3	DATA2								
4	DATA3								
5	DATA4	Parallel Data	I/O	Same					
6	DATA5								
7	DATA6								
8	DATA7	MSB							
9	DATA8								
10	$\overline{ACK}$	Acknowledge	I	Same					
11	BUSY	Printer Busy	I	BUSY	Data *Receive* Busy	I/O	BUSY	Printer Busy	I
12	PE	Paper Error	I	PE	Scanner Error	I	PE	Paper Error	I
13	SELECT	Printer Online	I	Not Used			SELECT	Printer Online	I
14	$\overline{AUTO}$ $\overline{FEED}$	Auto Line Feed	O	PR/$\overline{SC}$	Establishes Data Direction PR = Out SC = In	O	$\overline{AUTO}$ $\overline{FEED}$	Auto Line Feed	O
15	$\overline{FAULT}$	Printer Fault	I	Not Used			$\overline{FAULT}$	Printer Fault	I
16	$\overline{RESET}$	Reset Signal	O	Same					
17	$\overline{NOINK}$	No Ink in Printer	I	Not Used			SELECT IN	Device Selected	O
18	N/C	No Connection					GND	Signal Ground	-
19 - 25	GND	Ground	-	Same					

4.3.2 Built In Parallel Port (36 Pin High Density)

4.3.2.1 Connector Drawing

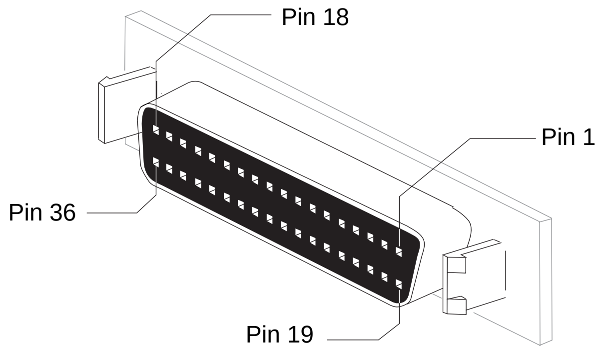


Figure 4-22 36 Pin High Density Parallel Port Connector

4.3.2.2 Pinout

Table 4-29 36 Pin High Density Parallel Port Pinout

Pin	Signal Name	Signal Description	Pin	Signal Name	Signal Description
1	BUSY	PRINTER BUSY	19	GND	SIGNAL GROUND (BUSY)
2	SELECT	PRINTER ONLINE	20	GND	SIGNAL GROUND (SELECT)
3	nACK	ACKNOWLEDGE	21	GND	SIGNAL GROUND (nACK)
4	nFAULT	PRINTER FAULT	22	GND	SIGNAL GROUND (nFAULT)
5	pERROR	PRINTER ERROR	23	GND	SIGNAL GROUND (pERROR)
6	DATA 1	LSB	24	GND	SIGNAL GROUND (DATA 1)
7	DATA 2		25	GND	SIGNAL GROUND (DATA 2)
8	DATA 3		26	GND	SIGNAL GROUND (DATA 3)
9	DATA 4	PARALLEL DATA	27	GND	SIGNAL GROUND (DATA 4)
10	DATA 5		28	GND	SIGNAL GROUND (DATA 5)
11	DATA 6		29	GND	SIGNAL GROUND (DATA 6)
12	DATA 7		30	GND	SIGNAL GROUND (DATA 7)
13	DATA 8	MSB	31	GND	SIGNAL GROUND (DATA 8)
14	nINIT		32	GND	SIGNAL GROUND (nINIT)
15	nSTROBE	DATA STROBE	33	GND	SIGNAL GROUND (nSTROBE)
16	nSELECTIN	DEVICE SELECTED	34	GND	SIGNAL GROUND (nSELECTIN)
17	nAUTOFD		35	GND	SIGNAL GROUND (nAUTOFD)
18		HOST LOGIC HIGH	36		PERIPHERAL LOGIC HIGH

4.3.3 Ikon Parallel Port Interface (DB-37)

This board was made by Ikon Corporation as an OEM product for SGI. It is no longer sold as an SGI product. It is known as the Ikon board. It's interface is a 37 Pin Sub-D (DB-37). This board actually has two outputs. One is for the Versatec, the other is a standard Centronics printer output. However, the Centronics output was never supported by software.

Since this is a 6U VME board, it was put in a 6U to 9U adapter for placement in the Twin Tower, Diehard or Predator series chassis. For these systems an I/O Panel with a DB-37 connector was installed on the I/O Panel. It could also be placed directly into a Personal IRIS. For these systems a version of the board with a sheetmetal extension was available, again with a DB-37 connection.

4.3.3.1 Connector Drawing

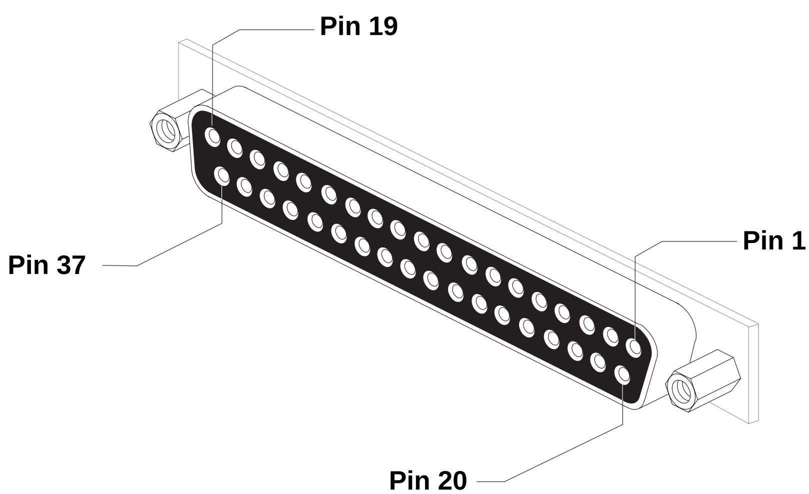


Figure 4-23 DB-37 Ikon Parallel Port Connector

4.3.3.2 Pinout

Table 4-30 Ikon Parallel Port Pinout

Pin	Signal Name	Description	Input/ Output
1	STB	Strobe	Output
2	Data1	Parallel Data	Output
3	Data2		
4	Data3		
5	Data4		
6	Data5		
7	Data6		
8	Data7		
9	Data8		
10	ACK	Acknowledge	Input
11	BUSY	Busy	Input
12	PE	Printer Enabled	Input
13	ONLINE	Printer Online	Input
14	PR/SC	Printer/Scanner	
15	NOPAPER	No Paper in Printer	Input
16	N/C		
17	NOINK	No Ink in Printer	Input
18	N/C		
19 - 30	GND	Ground	
31	RESET	Reset	
32 - 37	N/C		

4.4 Disk Drive Interfaces

Silicon Graphics systems have continued to keep pace with the advances in disk technology. This results in support of a number of different disk drive interfaces over the history of the IRIS product line. While the SCSI bus has evolved into a bus used for more than just disk drives, an important use in SGI platforms is support of the hard disk(s). Therefore, it is covered in this section rather than in a section dedicated to general SCSI peripherals.

Table 4-32, on page 4-40 shows the disk drive interfaces supported on the various platforms as shipped. A table entry that is lightly shaded denotes where a disk interface could be added to the platform as an upgrade. Darker shading denotes the interface is not available for that chassis.

Numbers in table entries indicate maximum number of controllers and maximum number of disk drives per controller separated by a “/”. For example, where two controllers each controlling 4 drives is possible, the entry would be “2/4”. The total number of drives possible may exceed the number of drive bays or modules available in a chassis or the drives may not physically fit in a chassis. In cases such as these (for example, SMD drives on a Twin Tower chassis) external drive bays or racks are assumed.

4.4.1 Bus Lengths

Each type of disk interface operates over a bus with a limited maximum length. Beyond that length disk accesses are error prone and could cause significant system problems. Table 4-31 shows the maximum length allowed for the disk interfaces documented here.

Table 4-31 Maximum Bus Length for Disk Interfaces

Interface	Single Ended/ Differential	Maximum Bus Length
ESDI		3 m
SMD		15 m
IPI		15 m
SCSI-1	Single Ended	6 m
	Differential	25 m
SCSI-2	Single Ended	3 m
	Differential	10 m
Ultra SCSI	Single Ended	1.5 m
	Differential	10 m

Table 4-32 Disk Drive Interfaces on SGI Systems

Chassis	ESDI	SMD	IPI	SCSI-1	SCSI-2				Ultra-SCSI
				Single-ended	Narrow, Single-ended	Wide, Single-ended	Narrow, Differential	Wide, Differential	Wide, Single-ended
Twin Tower 12 Slot	4/2 or 4/4[1]	4/4	4/8						
Twin Tower 15 Slot	4/2 or 4/4[1]	4/4	4/8	1/7					
Diehard	4/2 or 4/4[1]	4/4	4/8	1/7			4/7[4]		
Predator	4/2 or 4/4[1]	4/4	4/8	1/7, 2/7 or 4/7[3]			4/7[4]		
Diehard2		4/4	4/8	2/7			4/7[4]		
Terminator Rack/ Eveready Deskside		4/4	4/8			8/15[2]		8/15[2]	
Personal IRIS				1/7					
Indigo (R3K)				1/7					
Indigo (R4K)					1/7				
Indigo[2]					2/7				
Indy					1/7				
Challenge S					1/7			2/15	
O2									2/{3,15}[5]
OCTANE									2/{3,15}[5]
Origin200					1/2				1/6
Origin2000									2/{6,15}[6]
Onyx2									2/{6,15}[6]

1. The 3201 controller could control 2 ESDI disks, the later 4201 controller was faster and could control up to 4 ESDI disks.
2. Drives can be configured as either single ended or differential depending on the adapter at the rear of the drive sled.
3. The Power Center Server in the Predator Rack could contain 2 IO3's resulting in 4 available SCSI buses.
4. Differential SCSI-2 drives controlled by the "Jaguar" or "Cougar" controller board.
5. The internal bus supports 3 devices while the external bus supports the full complement of 15 devices.
6. The internal bus supports 6 devices while the external bus supports the full complement of 15 devices.

Each chassis uses a certain amount of the maximum bus length for connecting disk (or other devices) inside the chassis. This amount of cabling must be taken into account when attaching disks external to the system chassis. The total length of internal and external cabling must not exceed the maximum bus length as shown in the table above. Table 4-33, “Internal Chassis Bus Lengths”, on page 4-41 shows the lengths of cable used internally on the various chassis.

Table 4-33 Internal Chassis Bus Lengths

Chassis	ESDI	SMD	IPI	SCSI-1	SCSI-2	Ultra SCSI
Twin Tower 12 Slot	6 ft. (1.82 m) + 2 ft. (0.6 m) for each drive module	1.5 ft. (0.45 m)	1.5 ft. (0.45 m)	3.28 ft. (1 m) + 1.64 ft. (0.5 m) for each drive module		
Twin Tower 15 Slot	6 ft. (1.82 m) + 2 ft. (0.6 m) for each drive module	1.5 ft. (0.45 m)	1.5 ft. (0.45 m)	3.28 ft. (1 m) + 1.64 ft. (0.5 m) for each drive module		
Diehard		1.5 ft. (0.45 m)	1.5 ft. (0.45 m)	7 ft. (2.13 m)		
Predator		1.5 ft. (0.45 m)	1.5 ft. (0.45 m)			
Diehard2		1.5 ft. (0.45 m)	1.5 ft. (0.45 m)	Ch 0: 8 ft. (2.43 m) Ch 1: 6 ft. (1.82 m)		
Eveready Deskside					3 ft. (0.91 m)	
Terminator Rack					3 ft. (0.91 m)	
Personal IRIS				3.9 ft. (1.2 m)		
Indigo (R3K)				1.3 ft. (0.4 m)		
Indigo (R4K)					1.3 ft. (0.4 m)	
Indigo^2					1.3 ft. (0.4 m)	
Indy					1.3 ft. (0.4 m)	
O2						0.83 ft. (0.25 m)
OCTANE						4 ft. (1.2 m)
Origin200						
Origin2000						1 ft. (0.3 m)
Onyx2						1 ft. (0.3 m)

4.4.2 Terminations

For proper operation, the disk interfaces must have the appropriate termination at the end of the bus. For ESDI, SMD and IPI these terminations are made at the last drive of the chain, usually by plugging in a termination pack into a connector on the disk drive itself.

For SCSI, termination is typically done via a separate terminator assembly. Systems shipped with SCSI-1 capability were equipped with a passive terminator for attaching to the end of the SCSI bus (the SCSI bus connector as shipped from the factory). Starting with the systems that shipped with SCSI-2 buses, the systems were equipped with active terminators. Given the higher speed of the SCSI-2 bus, the active termination is required. Using passive termination on SCSI-2 systems may cause disk problems.

It cannot be overemphasized how important termination is for proper system operation. Many customer problems result from missing or improper termination.

4.4.3 ESDI Disk Interface

4.4.3.1 General Information

ESDI drives were used primarily on the early Twin Tower chassis. The drive modules that stacked on top of the power supply tower had connectors on the back of the module that connected the drive to the controller. The controller connected to the drives via I/O panel assemblies and external cables.

A drive module would have three connectors on the back. One would be the DB-25 for data to that specific drive, the other two would be DB-37's which connected to the drive and allowed for connection of a "daisy chain" cable to the next drive module. The drawing below shows such a panel.

Although it is possible to support ESDI drives and controllers on platforms in later products, it was replaced rapidly by SCSI as the default disk interface.

The ESDI interface consists of two separate connectors. One is a 37 pin Sub-D (DB-37) that carries control signals to all the drives connected to one controller. The other is a 25 pin Sub-D (DB-25) that carries data to one specific drive. The actual ESDI interface is via a 34 and 20 pin flat cable, but for ease of external connection, the DB-37 and DB-25 connectors were used.

4.4.3.2 Connector Drawings

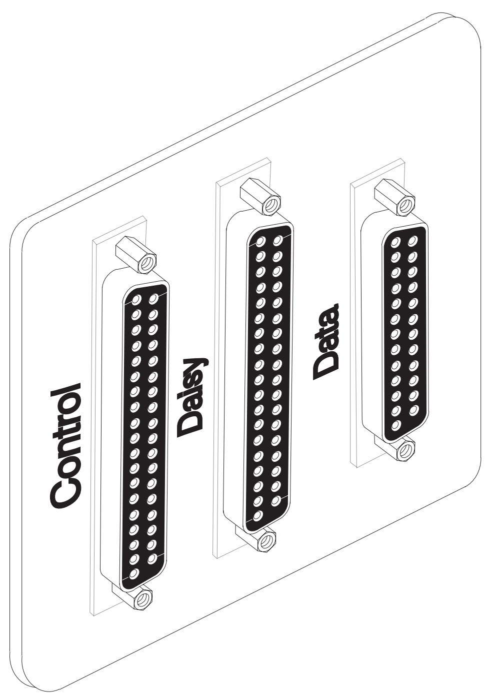


Figure 4-24 ESDI Drive Module Plate

4.4.3.3 Pinout

Table 4-34 ESDI Control Cable Pinout (J1 / P1)

Pin Number	Signal Name
1	-Host Reset
2	Ground
3	+Host Data 7
4	+Host Data 8
5	+Host Data 6
6	+Host Data 9
7	+Host Data 5
8	+Host Data 10
9	+Host Data 4
10	+Host Data 11
11	+Host Data 3
12	+Host Data 12
13	+Host Data 2
14	+Host Data 13
15	+Host Data 1
16	+Host Data 14
17	+Host Data 0
18	+Host Data 15
19	Ground
20	Key

Pin Number	Signal Name
21	Reserved
22	Ground
23	-Host IOW
24	Ground
25	-Host IOR
26	Ground
27	Reserved
28	+Host ALE
29	Reserved
30	Ground
31	+Host IRQ 14
32	+Host IO16
33	+Host ADDR1
34	-Host PDIAG
35	+Host ADDR0
36	+Host ADDR2
37	-Host CS0
38	-Host CS1
39	-Host SLV/ACT
40	Ground

Table 4-35 ESDI Data Cable Pinout (J2 / P2)

Pin Number	Signal Name
1	-Drive Selected
2	-Sector Address Mark Found
3	-Seek Complete
4	-Address Mark Enabled
5	-REserved for Step Mode
6	Ground
7	+Write Clock
8	-Write Clock
9	-Cartridge Changed
10	+Read Reference Clock

Pin Number	Signal Name
11	-Read Reference Clock
12	Ground
13	+NRZ Write Data
14	-NRZ Write Data
15	Ground
16	Ground
17	+NRZ Read Data
18	-NRZ Read Data
19	Ground
20	-Index

4.4.4 SMD Disk Interface

Like ESDI, SMD disks require two cables - one control cable that connects to all the drives and one data cable for each drive. Both the control and data connectors are 62 pin “D” connectors (DB62). The I/O plate with the control connector is marked “Control” while the data connector I/O panel will be marked “Disk 0”, “Disk 1”, “Disk 2” or “Disk 3”.

4.4.4.1 Connector Drawings

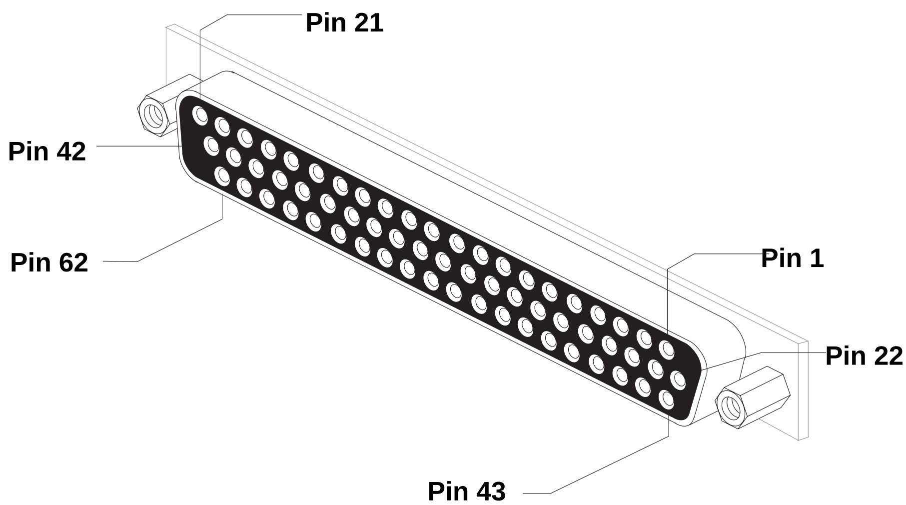


Figure 4-25 SMD Connector

4.4.4.2 Pinout

Table 4-36 SMD Data Connector Pinout

Signal Name	Description	Signal Pin (Low)	Signal Pin (High)
svock		22	46
rddata	read data	43	27
rdck	read clock	2	6
wtck	write clock	3	28
wtdata	write data	44	48
unsel	unit select	29	45
skend		25	8
gnd	ground	1, 4, 7, 23, 24, 30, 47, 49	
N/C	No connection	5, 9, 26, 50	

Table 4-37 SMD Control Connector Pinout

Signal Name	Description	Signal Pin (Low)	Signal Pin (High)
tag1		1	32
tag2		22	52
tag3		43	53
bit0	data bit 0	23	33
bit1	data bit 1	2	12
bit2	data bit 2	3	13
bit3	data bit 3	24	34
bit4	data bit 4	44	54
bit5	data bit 5	45	55
bit6	data bit 6	25	35
bit7	data bit 7	4	14
bit8	data bit 8	5	15
bit9	data bit 9	26	36
bit10	data bit 10	11	21
ocdl		46	56
fltl		47	57
skerr		27	37
oncyl	on cylinder	6	16
index		7	17
ready		28	38
addm		58	48
dpbusy		49	59
unseltag		29	39
unsel1		8	18
unsel2		9	19
sp		30	40
unsel4		50	60
unsel8		51	61
wtpot		31	41
gnd	ground	10, 20	

4.4.5 IPI Disk Interface

The IPI controller has two ports. Each port can control four drives. The single, 50 conductor cable carries the signals to all the drives. A daisy chain cable connects the drive signals from one drive to the next. This is typically done internal to the drive chassis or drive tray. Pinout for this connection is in Table 4-38.

4.4.5.1 Connector Drawings

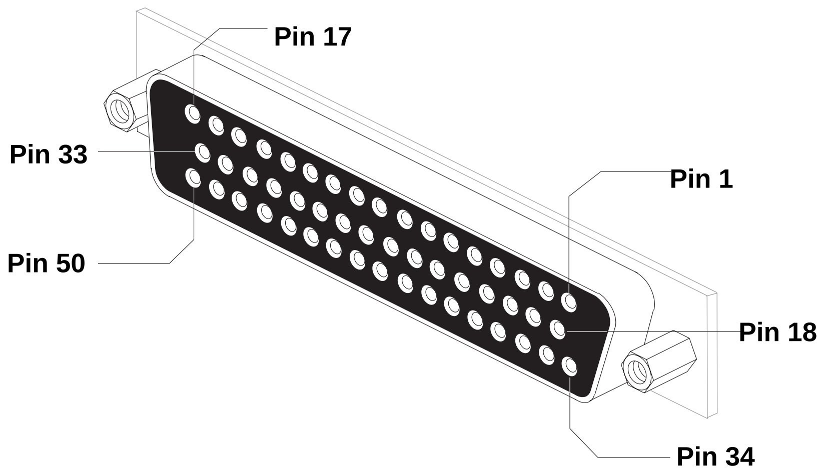


Figure 4-26 IPI Connector

4.4.5.2 Pinout

Table 4-38 IPI Disk Interface Pinout (3 Row DB-50)

Signal Name	Signal Pin (Low)	Signal Pin (High)
ATTN	4	20
SYO	25	41
SLI	23	39
SYI	48	15
MO	29	45
SEL0	27	43
BB0	16	32
BB1	33	49
BB2	36	3
BB3	40	7
BB4	8	24
BB5	42	9
BB6	2	18
BB7	19	36
BBP	50	17
BA0	46	13
BA1	14	30
BA2	6	22
BA3	10	26
BA4	44	11
BA5	12	28
BA6	21	37
BA7	38	5
BAP	31	47
GND	1,34	

4.4.6 SCSI-1 Interface (Centronics)

4.4.6.1 Connector Drawing

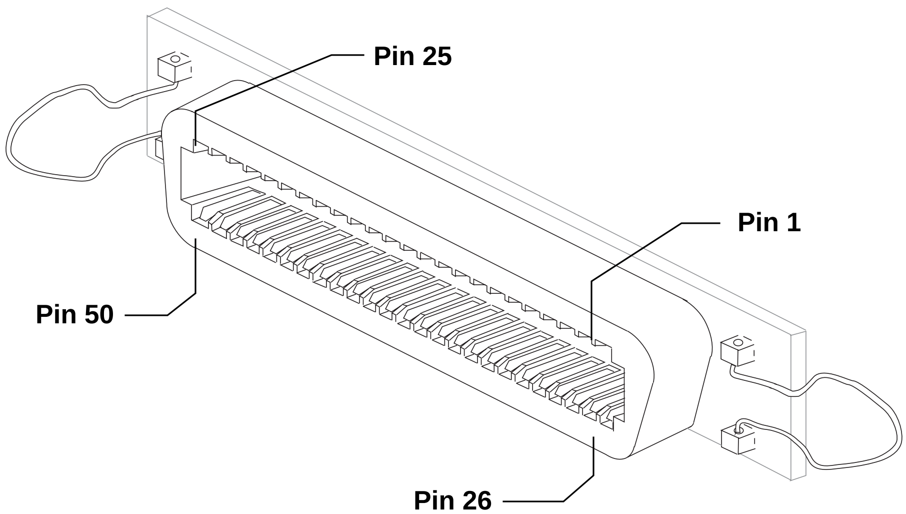


Figure 4-27 SCSI-I (Centronics) Connector

4.4.6.2 Termination

Termination is typically done via a separate terminator assembly. This assembly usually is placed on the external SCSI connector.

Systems shipped with SCSI-1 capability were equipped with a passive terminator for attaching to the end of the SCSI bus (the SCSI bus connector as shipped from the factory).

Starting with the systems that shipped with SCSI-2 buses, the systems were equipped with active terminators. Given the higher speed of the SCSI-2 bus, the active termination is required. Using passive termination on SCSI-2 systems may cause disk problems.

It cannot be overemphasized how important termination is for proper system operation. Many customer problems result from missing or improper termination.

4.4.6.3 Pinout

Table 4-39 SCSI-1 (Centronics) Connector Pinout

Signal Name	Description	Signal Pin	Ground Pin
DB0	Data Bit 0	2	1
DB1	Data Bit 1	4	3
DB2	Data Bit 2	6	5
DB3	Data Bit 3	8	7
DB4	Data Bit 4	10	9
DB5	Data Bit 5	12	11
DB6	Data Bit 6	14	13
DB7	Data Bit 7	16	15
DBP	Data Parity Bit	18	17
GND	Ground	20	19
GND	Ground	22	21
GND	Ground	24	23
TRMPWR	Terminator Power (4V SCSI-1, 4.25V SCSI-2)	26	
GND	Ground	28	27
GND	Ground	30	29
ATN	Attention	32	31
GND	Ground	34	33
BSY	Busy	36	35
ACK	Acknowledge	38	37
RST	Reset	40	39
MSG	Message	42	41
SEL	Select	44	43
C/D	Control/Data	46	45
REQ	Request	48	47
I/O	Input/Output	50	49

4.4.7 SCSI-2 (Narrow) High Density Interface

4.4.7.1 Connector Drawing

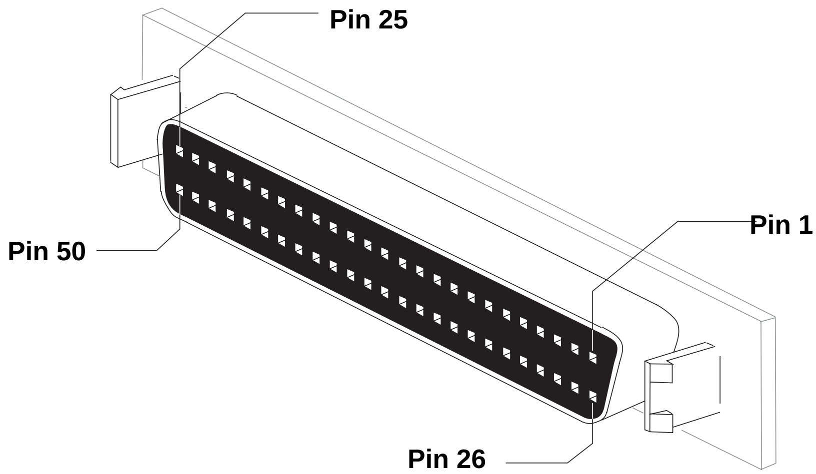


Figure 4-28 SCSI-2 (Narrow) High Density Connector

4.4.7.2 Pinout

The pinout for the SCSI-2 High Density connection is the same as for the SCSI-1 (Centronics) connection. Consult Table 4-39, on page -50, for that pinout.

4.4.7.3 Termination

Termination is typically done via a separate terminator assembly. This assembly usually is placed on the external SCSI connector.

Systems shipped with SCSI-1 capability were equipped with a passive terminator for attaching to the end of the SCSI bus (the SCSI bus connector as shipped from the factory).

Starting with the systems that shipped with SCSI-2 buses, the systems were equipped with active terminators. Given the higher speed of the SCSI-2 bus, the active termination is required. Using passive termination on SCSI-2 systems may cause disk problems.

It cannot be overemphasized how important termination is for proper system operation. Many customer problems result from missing or improper termination.

4.4.8 SCSI-2 Wide Interface

Both the single ended and differential types of SCSI-2 connections use the same 68 pin connector. The pinouts are slightly different. The tables that follow show the pinouts for each type of connection.

4.4.8.1 Connector Drawing

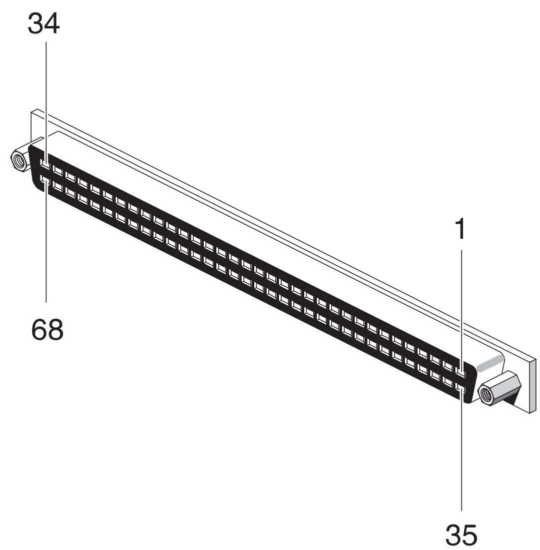


Figure 4-29 SCSI-2 (Wide) Hi Density Connector

4.4.8.2 Single Ended Pinout

Table 4-40 SCSI-2 Wide, Single Ended Connector Pinout

Pin	Signal Name	Description	Pin	Signal Name	Description
1	GND	Ground	35	-DB(12)	Data Bit 12
2	GND	Ground	36	-DB(13)	Data Bit 13
3	GND	Ground	37	-DB(14)	Data Bit 14
4	GND	Ground	36	-DB(15)	Data Bit 15
5	GND	Ground	39	-DB(P1)	Data Parity Bit 1
6	GND	Ground	40	-DB(0)	Data Bit 0
7	GND	Ground	41	-DB(1)	Data Bit 1
8	GND	Ground	42	-DB(2)	Data Bit 2
9	GND	Ground	43	-DB(3)	Data Bit 3
10	GND	Ground	44	-DB(4)	Data Bit 4
11	GND	Ground	45	-DB(5)	Data Bit 5
12	GND	Ground	46	-DB(6)	Data Bit 6
13	GND	Ground	47	-DB(7)	Data Bit 7
14	GND	Ground	48	-DB(P)	Data Parity Bit 0
15	GND	Ground	49	GND	Ground
16	GND	Ground	50	GND	Ground
17	TERMPWR	Terminator Power	51	TERMPWR	Terminator Power
18	TERMPWR	Terminator Power	52	TERMPWR	Terminator Power
19	RESERVED	Reserved	53	RESERVED	Reserved
20	GND	Ground	54	GND	Ground
21	GND	Ground	55	-ATN	Attention
22	GND	Ground	56	GND	Ground
23	GND	Ground	57	-BSY	Busy
24	GND	Ground	58	-ACK	Acknowledge
25	GND	Ground	59	-RST	Reset
26	GND	Ground	60	-MSG	Message
27	GND	Ground	61	-SEL	Select
28	GND	Ground	62	-C/D	Control/Data
29	GND	Ground	63	-REQ	Request
30	GND	Ground	64	-I/O	Input/Output
31	GND	Ground	65	-DB(8)	Data Bit 8
32	GND	Ground	66	-DB(9)	Data Bit 9
33	GND	Ground	67	-DB(10)	Data Bit 10
34	GND	Ground	68	-DB(11)	Data Bit 11

4.4.8.3 DIfferential Pinout

Table 4-41 SCSI-2 Wide, Differential Connector Pinout

Pin	Signal Name	Description	Pin	Signal Name	Description
1	+DB(12)	Data Bit 12	35	-DB(12)	Data Bit 12
2	+DB(13)	Data Bit 13	36	-DB(13)	Data Bit 13
3	+DB(14)	Data Bit 14	37	-DB(14)	Data Bit 14
4	+DB(15)	Data Bit 15	38	-DB(15)	Data Bit 15
5	+DB(P1)	Data Parity Bit 1	39	-DB(P1)	Data Parity Bit 1
6	GND	Ground	40	GND	Ground
7	+DB(0)	Data Bit 0	41	-DB(0)	Data Bit 0
8	+DB(1)	Data Bit 1	42	-DB(1)	Data Bit 1
9	+DB(2)	Data Bit 2	43	-DB(2)	Data Bit 2
10	+DB(3)	Data Bit 3	44	-DB(3)	Data Bit 3
11	+DB(4)	Data Bit 4	45	-DB(4)	Data Bit 4
12	+DB(5)	Data Bit 5	46	-DB(5)	Data Bit 5
13	+DB(6)	Data Bit 6	47	-DB(6)	Data Bit 6
14	+DB(7)	Data Bit 7	48	-DB(7)	Data Bit 7
15	+DB(P)	Data Parity Bit 0	49	-DB(P)	Data Parity Bit 0
16	DIFFSENS	DIfferential Sense	50	GND	Ground
17	TERMPWR	Terminator Power	51	TERMPWR	Terminator Power
18	TERMPWR	Terminator Power	52	TERMPWR	Terminator Power
19	RESERVED	Reserved	53	RESERVED	Reserved
20	+ATN	Attention	54	-ATN	Attention
21	GND	Ground	55	GND	Ground
22	+BSY	Busy	56	-BSY	Busy
23	+ACK	Acknowledge	57	-ACK	Acknowledge
24	+RST	Reset	58	-RST	Reset
25	+MSG	Message	59	-MSG	Message
26	+SEL	Select	60	-SEL	Select
27	+C/D	Control/Data	61	-C/D	Control/Data
28	+REQ	Request	62	-REQ	Request
29	+I/O	Input/Output	63	-I/O	Input/Output
30	GND	Ground	64	GND	Ground
31	+DB(8)	Data Bit 8	65	-DB(8)	Data Bit 8
32	+DB(9)	Data Bit 9	66	-DB(9)	Data Bit 9
33	+DB(10)	Data Bit 10	67	-DB(10)	Data Bit 10
34	+DB(11)	Data Bit 11	68	-DB(11)	Data Bit 11

4.4.9 Single Ended Ultra SCSI

The Ultra SCSI interface is a 16 bit, single-ended interface. It is basically a faster version of the SCSI-2 Wide as documented in section 4.4.8. While the pin count on the interface connector is the same - 68 pins, the type of connector is different, especially in the area of the way the external connector is secured to the system.

Care must be taken when adding 8-bit SCSI devices to an Ultra SCSI bus. For proper operation, the upper data and control lines must be terminated using a specially constructed cable or adapter. In addition, any 8-bit devices should be placed at the end of the bus.

If there are any ultra SCSI compatible devices on the bus, the maximum bus length is 1.5 meters.

The pinout for this connection is almost identical to that shown in Table 4-40, “SCSI-2 Wide, Single Ended Connector Pinout”, on page 4-53. The difference is with pins 17, 18 and 19. For the Ultra SCSI interface these pins are all ground connections.

4.4.9.1 Connector Drawing

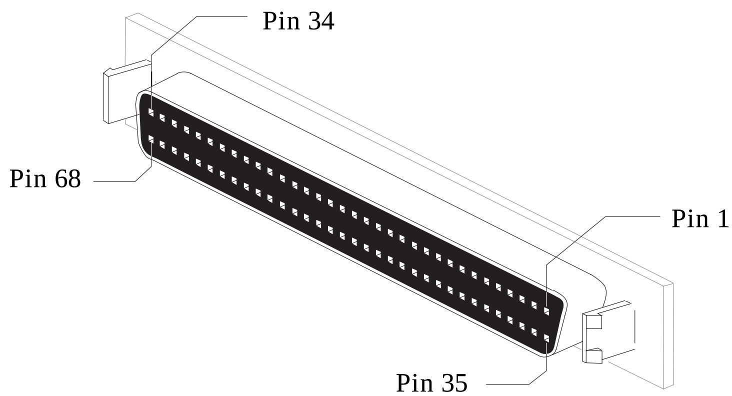


Figure 4-30 Ultra SCSI Connector

4.4.9.2 Pinout

Table 4-42 Single Ended Ultra SCSI Connector Pinout

Pin	Signal Description
1	Ground
2	Ground
3	Ground
4	Ground
5	Ground
6	Ground
7	Ground
8	Ground
9	Ground
10	Ground
11	Ground
12	Ground
13	Ground
14	Ground
15	Ground
16	Ground
17	Ground
18	Ground
19	Ground
20	Ground
21	Ground
22	Ground
23	Ground
24	Ground
25	Ground
26	Ground
27	Ground
28	Ground
29	Ground
30	Ground
31	Ground
32	Ground
33	Ground
34	Ground

Pin	Signal Description
35	-DB(12)
36	-DB(13)
37	-DB(14)
38	-DB(15)
39	-DB(P1)
40	-DB(0)
41	-DB(1)
42	-DB(2)
43	-DB(3)
44	-DB(4)
45	-DB(5)
46	-DB(6)
47	-DB(7)
48	-DB(P)
49	Ground
50	Ground
51	TERMPWR
52	TERMPWR
53	OPEN
54	GROUND
55	-ATN
56	GROUND
57	-BSY
58	-ACK
59	-RST
60	-MSG
61	-SEL
62	-C/D
63	-REQ
64	-I/O
65	-DB(8)
66	-DB(9)
67	-DB(10)
68	-DB(11)

4.4 Monitors

There have been a number of monitor types used with SGI systems. The early systems used fixed frequency monitors. This carried through the Personal IRIS line of machines. With the Indigo, however, two different resolutions were supported, thus the need for a monitor that could handle either of these scan rates. This was known as a “dual scan” monitor.

As the graphics options grew, multi-scan monitors became cheaper, and ergonomic standards required higher scan rates, the monitors shipped with systems have phased over to multi-scan (or autoscan) monitors.

4.4.1 Monitor Connections

The type of connection has changed over time as well. Early monitors included BNC’s for Red, Green, Blue and Sync. Eventually, monitors that would accept ‘Sync on Green’ were used obviating the need for the separate Sync connection.

With the Indigo, a new interconnection was used - the 13W3 connector. This allowed Red, Green and Blue along with some other signals to be made quickly with just one connection. The 13W3 connection is documented on page 4-73.

The other key feature of the 13W3 connection is that it allowed the system to determine (at boot time) the type of monitor connected to the system. This is accomplished with the Monitor Identification Pins (also documented in the section covering the 13W3 interface). This made it possible for the system to use the highest scan rate compatible with the monitor without having to go through some kind of configuration. This default setting could be overridden by using the ‘setmon’ command.

With more recent monitors the Monitor ID pin approach of determining the scan and resolution capabilities was replaced with an I^2C interface. This is a two wire connection that allows the system and monitor to communicate with each other about the scan and resolution capabilities without the limitation imposed by having only 3 or 4 Monitor ID pins.

Another feature of some of the monitors is the support of ‘stereo’. This doubles the scan rate (for example from 60 Hz to 120 Hz), halving the number of vertical lines shown per frame, and syncing a pair of external glasses so that each eye sees only every other frame. By drawing the appropriate images into the ‘left’ and ‘right’ frames of the graphics buffers, a ‘stereo’ image would appear. The signal used to synchronize the glasses is documented on page 4-89.

4.4.2 Monitor Drawings

Figures 4-24 through 4-31 on the following pages show drawings of the various types of monitors used on SGI systems. Note that not all of the monitors listed in Table 4-31 have corresponding drawings. Some of these monitors were used with MIPS based systems and so are listed but no drawings are included here. The monitors in the drawings represent the most frequently encountered models.

Other monitors differ only in a couple of letters of the Model Number. For example, CM2086A3SG, CM2086A3CD and CM2086A3PR. These are the Silicon Graphics (SG), Control Data (CD) and Prime Computers (PR) versions of the same monitor. The actual difference between these monitors is the color of, and the logo on, the monitor.

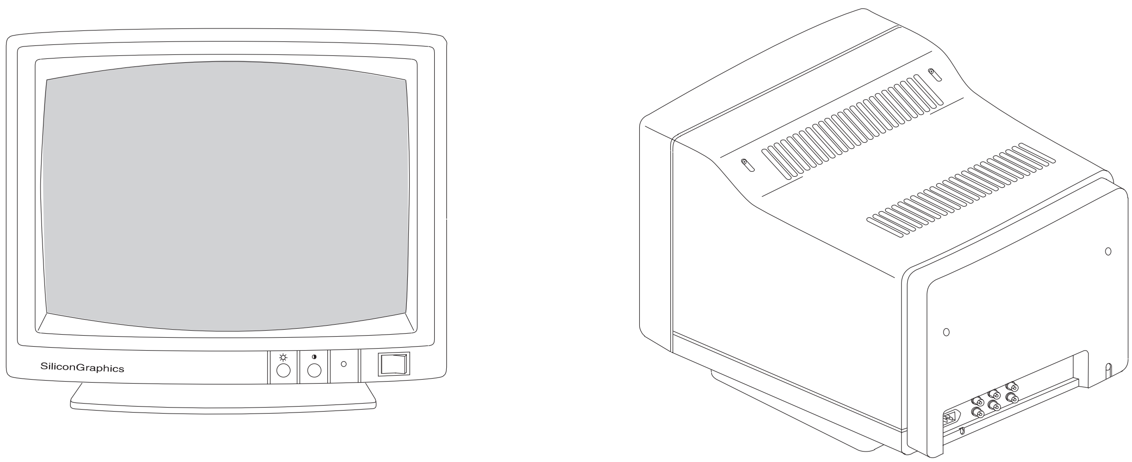


Figure 4-24 Hitachi CM2073 Monitor

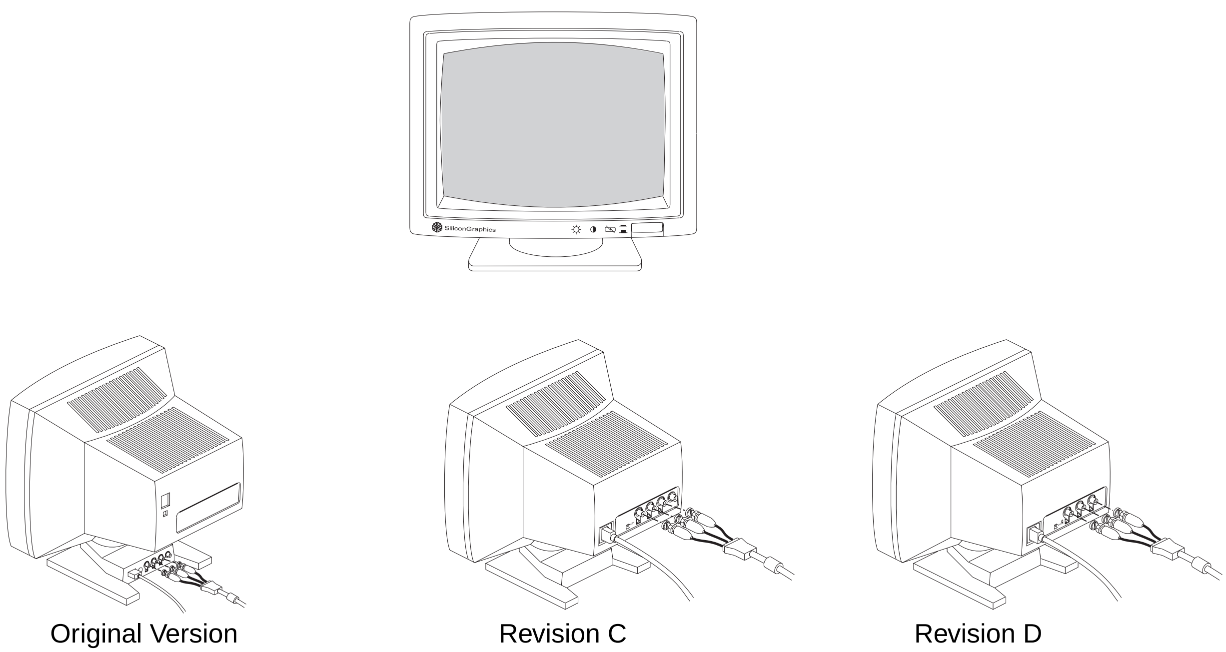


Figure 4-25 Hitachi CM2086 Monitor

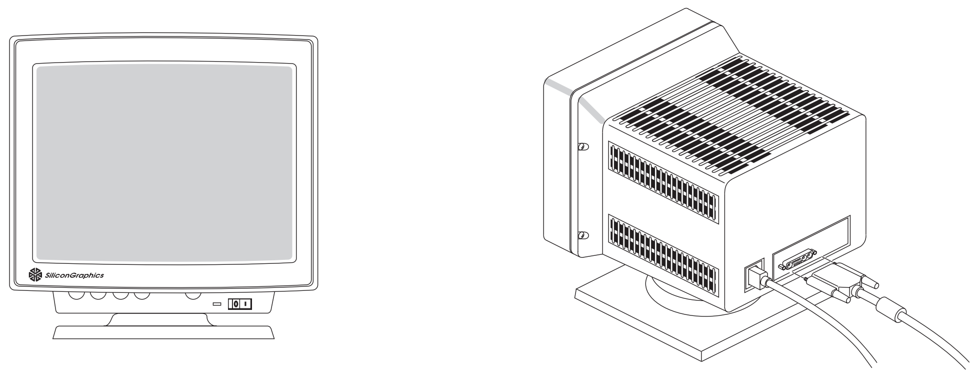


Figure 4-26 Sony GDM1630 Monitor

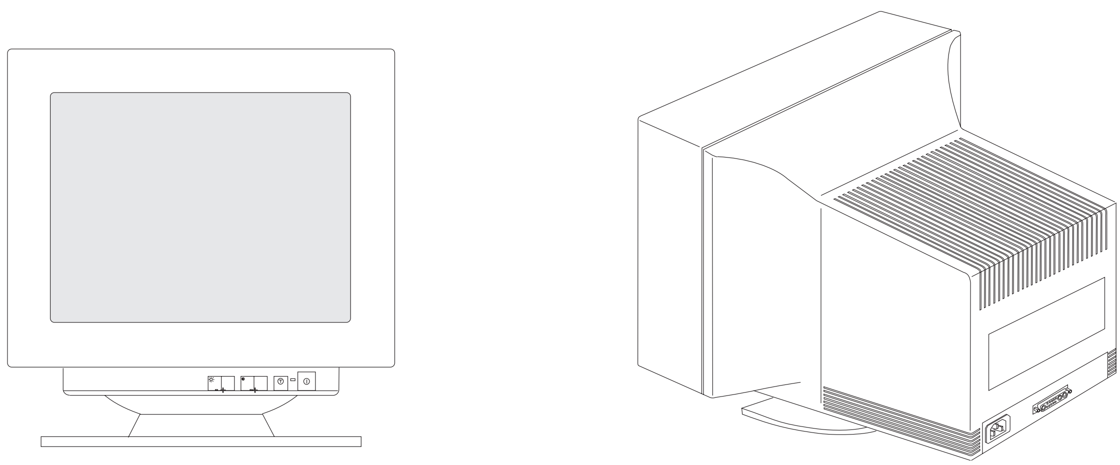


Figure 4-27 Mitsubishi HL6705 Monitor

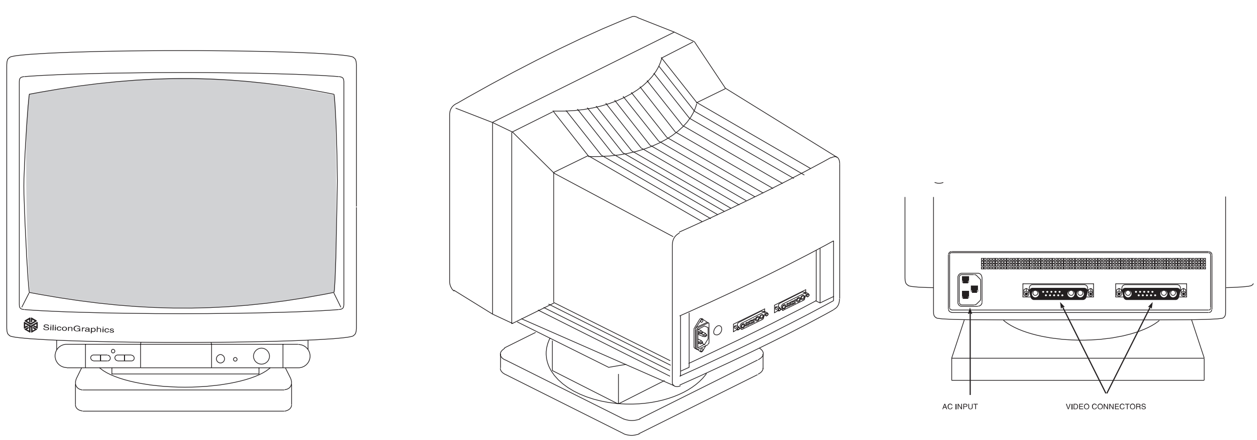


Figure 4-28 Mitsubishi HL7965 Monitor

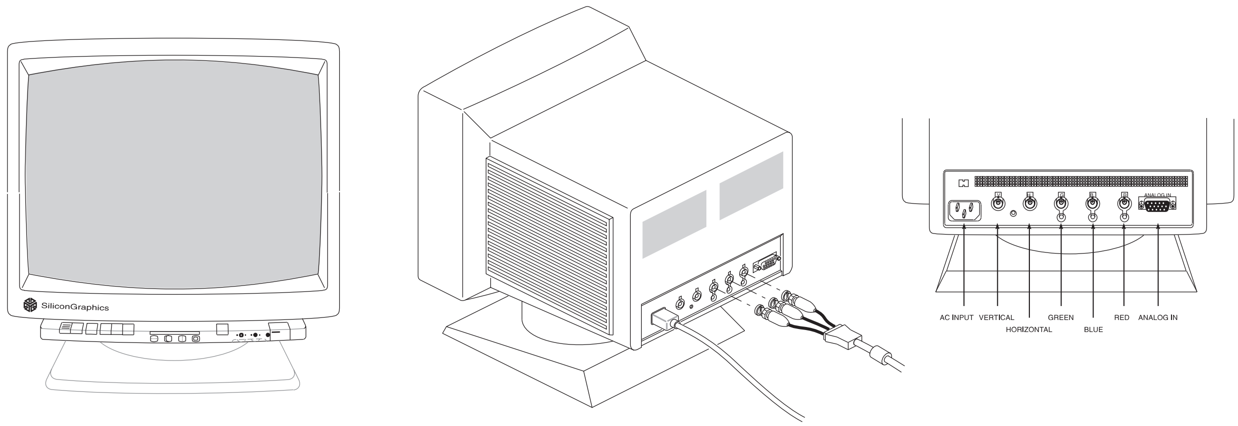


Figure 4-29 Hitachi CM2187 Monitor

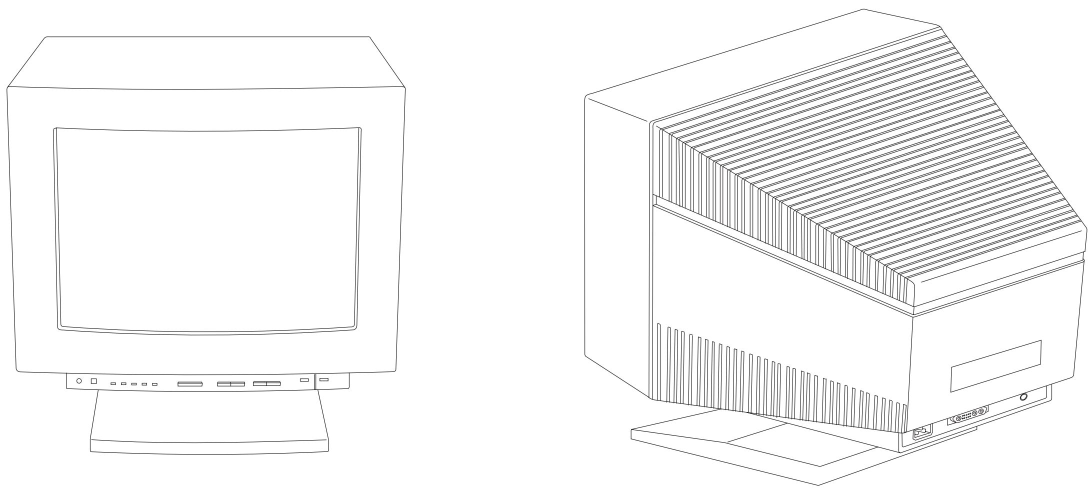


Figure 4-30 Sony GDM17E11 Monitor

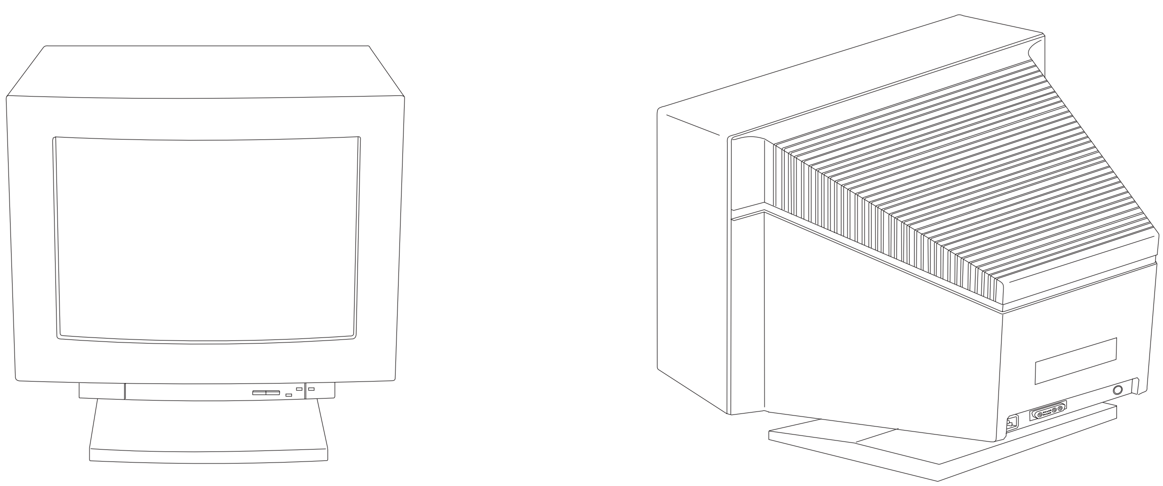


Figure 4-31 Sony GDM20D11 Monitor

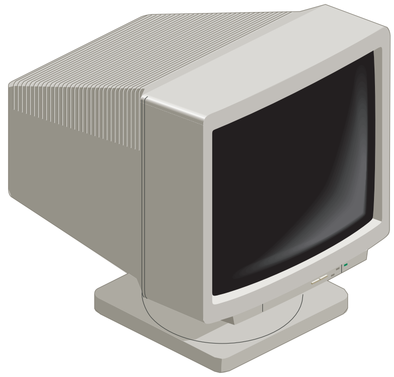


Figure 4-32 Sony GDM17E21 and GDM20E21 Monitors

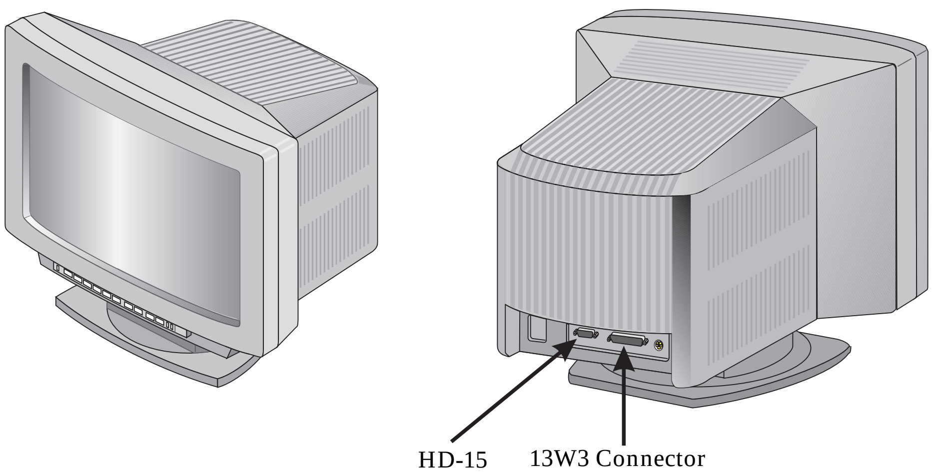


Figure 4-33 Sony GDM90W11 Monitor

4.4.3 Monitor Specifications

Table 4-31, on page 4-63 shows a listing of the different monitors that have been shipped with SGI systems. The table also documents other information about these monitors:

- manufacturer - who manufactured the monitor
- size - the diagonal size of the screen in inches
- model number - the manufacturer's model number (usually found on the back of the monitor)
- SGI part number - this SGI part number may or may not be on the back of the monitor. "SGI" indicates a monitor with the SGI logo on the front bezel.
- resolution - horizontal by vertical resolution of the monitor in pixels

- vertical and horizontal scan rate(s) - the vertical and horizontal frequencies that the monitor is capable of displaying
- stereo capable - whether the monitor supports stereo viewing in both 1280x512 and 1280x492 modes
- what kind of termination is done for video signals - the type of 75Ω termination used for the Red, Green and Blue signals.
- what kind of termination is done for video signals - the type of 75 Ohm termination used for the Red, Green and Blue signals.
  - "Input" indicates a permanently terminated input.
  - "Switch" indicates the termination may be switched on or off.
  - "Auto" indicates the output loop through has an automatic termination. If no connection is made to the output, the input is terminated. If a connection is made to the output, the termination is disconnected.
- loop through capable - whether the monitor supports an active or passive loop-through connection
- input - what type of input interface it has. All of the monitors in this table can utilize sync on the Green channel.
  - "RGBHV" indicates separate individual BNC connectors for Red, Green, Blue, Horizontal (if present), Vertical (if present). The horizontal connector (if present) will usually take a composite H / V sync instead of separate sync signals.
  - "RGB" indicates separate individual BNC connectors for Red, Green and Blue. No horizontal or vertical sync connections are present.
  - "13W3" indicates the large connector in a DB-25 shell with three coaxial connectors and ten individual pins.
  - "HD-15" indicates the Video Graphics Adapter (VGA) connector. This is a 15 pin connector where there are three rows of 5 contacts. Not to be confused with a DB-15 that has two rows - one row with 8 contacts, the other with 7 contacts.
- monitor config - how the monitor tells the system what its resolution capabilities are.
  - "Monitor ID Pins" indicates that the system looks at the Monitor ID pins to determine what scan rate and resolution the monitor supports.
  - "I^2C" indicates that the system communicates with the monitor using the I^2C bus.

This table is organized in roughly a chronological order showing the earliest monitors first.

Table 4-31 Silicon Graphics Display Monitors

Mfgr	Size	Model	SGI Part #	Resolution	Vertical Scan	Horizontal Scan	Stereo ?	Term	Loop	Input	Monitor Config	Comments
Hitachi	19”	CM2073A	9330013	1280x1024	60 Hz	63.9 kHz	No	Switch	No	RGB		Original 4D Monitor
Hitachi	19”	CM2086A3SG rev C	9330017 SGI	1280x1024	60 Hz	63.9 kHz	No	Switch	No	RGB or H/V		
Hitachi	19”	CM2086A1SG rev C	9330018 SGI	1024x768	60 Hz	49.7 kHz	No	Switch	No	RGB		
Hitachi	19”	CM2086A3CD rev C	9330019	1280x1024	60 Hz	63.9 kHz	No	Switch	No	RGB		
Sony	19”	GDM-1950	9330020 SGI	1280x1024	60 Hz	63.9 kHz	No	Input	No	RGB		
Sony	19”	GDM-1950	9330038 SGI	1280x1024	60 Hz	63.9 kHz	No	Input	No	RGB		
Hitachi	19”	CM2086A3PR rev C	9330021	1280x1024	60 Hz	63.9 kHz	No	Switch	No	RGB		
Hitachi	19”	CM2086A3SG rev D	9330042 SGI	1280x1024	60 Hz	63.9 kHz	Yes	Switch	No	RGB		
Hitachi	19”	CM2086A3CD rev D	9330043	1280x1024	60 Hz	63.9 kHz	Yes	Switch	No	RGB		
Sony	16”	GDM-1630SG	9330040 SGI	1280x1024 1024x768	60 Hz 60 Hz	63.9 kHz 48.78 kHz	No	Switch Auto	Yes	RGBHV or H/V		
Sony	16”	GDM-1630SG	9330809 SGI	1280x1024 1024x768	60 Hz 59.64 Hz	63.9 kHz 48.48 kHz	No	Switch Auto	Yes	13W3	Monitor ID Pins	First shipped with Indigo
Sony	19”	GDM-1930SG	9330041 SGI	1280x1024 1024x768	60 Hz 59.64 Hz	63.9 kHz 48.48 kHz	No	Switch Auto	Yes	13W3	Monitor ID Pins	
Sony	19”	GDM-1930SG	9330810 SGI	1280x1024 1024x768	60 Hz 59.64 Hz	63.9 kHz 48.48 kHz	No	Switch Auto	Yes	13W3	Monitor ID Pins	FIrst shipped with Indigo
Mitsubishi	19”	HL6905TK	9330028 SGI	1280x1024 1024x768	50-90 Hz autosync	30-64 kHz autosync	No	Switch	No	RGBHV or H/V		

Table 4-31 (continued) Silicon Graphics Display Monitors

Mfgr	Size	Model	SGI Part #	Resolution	Vertical Scan	Horizontal Scan	Stereo ?	Term	Loop	Input	Monitor Config	Comments
Mitsubishi	19”	HL69SG	9330035 SGI	1280x1024 1024x768	50-125 Hz autosync	30-64 kHz autosync	Yes	Input	No	RGBHV or H/V		
Hitachi	21”	CM2187SG	9330044 SGI	1600x1200 to 640x480	50-120 Hz autosync	30-78 kHz	Yes	Switch	No	RGBHV or H/V HD-15		
Mitsubishi	19”	HL7965KW-CD	9330811	1280x1024 1024x768	50-130 Hz autosync	30-78 kHz autosync	Yes	Input	Yes	13W3	Monitor ID Pins	
Mitsubishi	19”	HL7965KW-SG	9330812 SGI	1280x1024 1024x768	50-130 Hz autosync	30-78 kHz autosync	Yes	Input	Yes	13W3	Monitor ID Pins	
Mitsubishi	16”	HL6705KW-CD	9330813	1280x1024 1024x768	50-130 Hz autosync	30-64 kHz autosync	Yes	Input	No	13W3	Monitor ID Pins	
Mitsubishi	16”	HL6705KW-SG	9330814 SGI	1280x1024 1024x768	50-130 Hz autosync	30-64 kHz autosync	Yes	Input	No	13W3	Monitor ID Pins	
Sony	16”	GDM-17E11			50-150 Hz	30-82 kHz	Yes	Input	No	13W3	Monitor ID Pins	
Sony	19”	GDM-20D11			50-150 Hz	48-82 kHz	Yes	Input	No	13W3	Monitor ID Pins	
Sony	19”	GDM-20E21	061-0005-001	1280x1024	48-160 Hz	30-96kHz	Yes	Input	No	13W3 or HD-15	I^2C	
Sony	17”	GDM-17E21	061-0010-001	1280x1024	48-160 Hz	30-85kHz	Yes	Input	No	HD-15 or RGBHV	I^2C	
Sony	24”	GDM-90W11	061-0021-001	1900x1200	48-160 Hz	30-96k	Yes	Input	No	13W3 or HD-15	I^2C	

4.5 Memory

Memory for the Silicon Graphics systems has been in the form of memory modules - either SIMMs or DIMMs. However, as memory and processor technology has advanced new memory modules have been introduced. This section documents the types of memory modules that have been used in the systems. Table 4-32 shows the overview of memory module types.

Table 4-32 Memory Modules on IRIS Systems

Chassis	CPU or Memory Bd	CPU Memory Module Type			
		Type	Size(s)	Bank = *n* modules	Available Slots
Twin Tower	IP4	30 Pin SIMM	2MB, 4MB, 8MB	4	16
	MC2				
Diehard					
Predator Rack					
Personal IRIS	R2000		1MB, 2MB	4	16
	R3000	64 Pin SIMM (SGI Custom)	2MB, 4MB, 8MB	4	16
Diehard2	R4000/ R4400	30 Pin SIMM	2MB, 4MB, 8MB	4	32
Terminator Eveready	R4400/ R8000	200 Pin SIMM (ECC)	16 MB, 64MB, 256MB	4	32
Indigo	R3000	64 Pin SIMM (SGI Custom)	2MB, 4MB, 8MB	4	12
	R4000	72 Pin SIMM	4MB, 16MB, 32MB, 64MB	4	12
Indigo^2	R4000, R4400, R4600, R8000, R10000	72 Pin SIMM	4MB, 16MB, 32MB, 64MB	4	12
Indy	All	72 Pin SIMM	4MB, 8MB, 32MB	4	8
O2	All	278 Pin DIMM	32MB, 64MB	2	8
OCTANE	All	200 Pin DIMM (SDRAM)	32MB, 64MB, 128MB	2	8
Origin200, Origin2000, Onyx2	All	244 Pin DIMM (SDRAM)	64MB, 128MB	2	8

4.5.1 4D and Personal IRIS (R2000) Memory Modules

These modules are 30 Pin SIMM modules similar to those used in the PC industry. They came in capacities of 1 MB per module, or a "tall" module that could hold 2 MB. In the Personal IRIS these modules had to be installed in groups of 4.

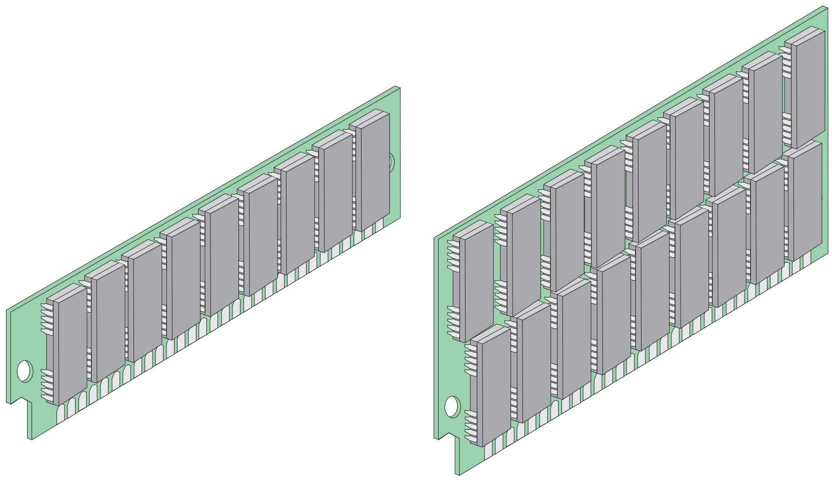


Figure 4-34 4D and Personal IRIS Memory Modules

4.5.2 Indigo R3K/Personal IRIS Memory Module

These memory modules were custom designed by Silicon Graphics and were second sourced by some third party memory manufacturers. These modules were easy to recognize since there was a custom chip on the back side of the module. They were used in both the R3000 based Personal IRISs and the R3000 based Indigos. They were available in capacities of 2, 4 and 8 MBytes. They would typically have a sticker on the backside denoting the size of the module.

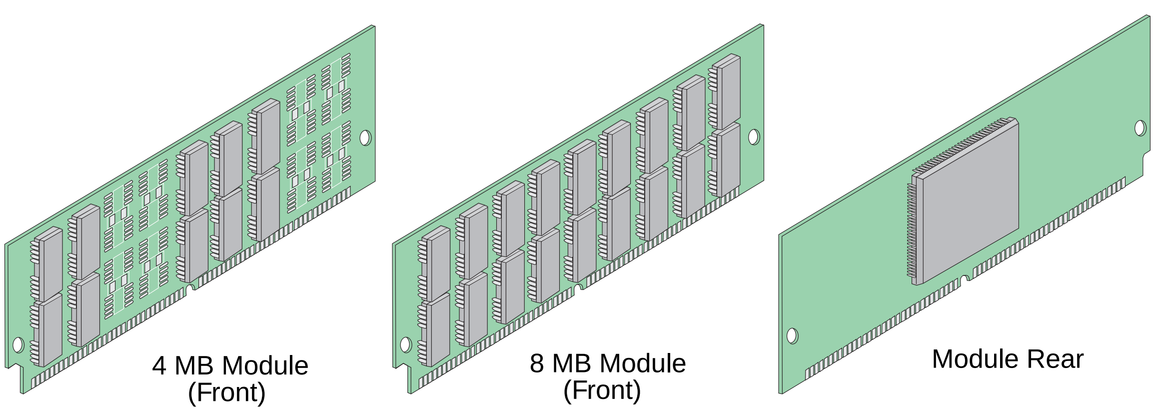


Figure 4-35 Indigo R3K / Personal IRIS Memory Module

4.5.3 Indigo/Indigo2/Indy Memory Module

These memory modules were used in the R4000 based Indigo, Indigo2 and Indy systems. These modules are industry standard 72 pin SIMMs in capacities of 4, 16, 32 and 64 MB.

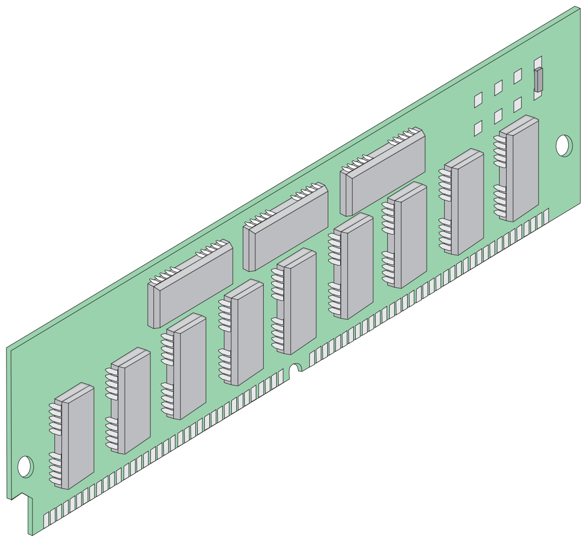


Figure 4-36 Indigo / Indigo2 / Indy Memory Module

4.5.4 Onyx/Challenge Memory Modules

These memory modules are a proprietary, patented design by Silicon Graphics. Multiple third parties have been licensed to manufacture these memory modules. The modules have 200 pins and provide 144 bits of data, including bits used for ECC. They are available in 16 MB, 64 MB and 256 MB sizes.

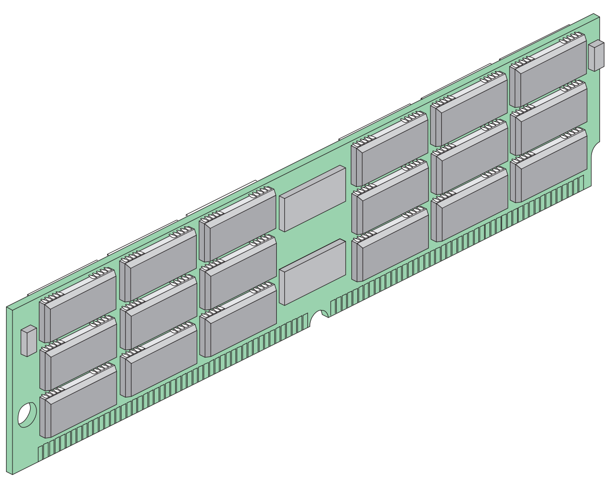


Figure 4-37 Onyx Challenge Memory Modules

4.5.5 O2 Memory Module

These DIMM style modules have 278 pins and come in capacities of 32 or 64 MB per module. This module includes bits used for ECC.

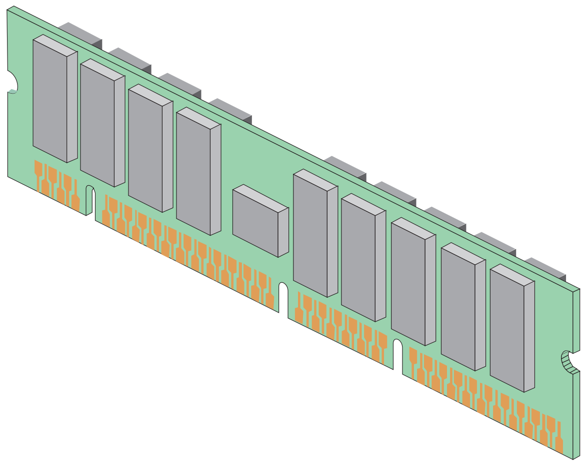


Figure 4-38 O2 Memory Module

4.5.6 OCTANE Memory Module

This 200 pin DIMM memory module is used only in the OCTANE. This memory module uses SDRAM (Synchronous DRAM) technology.

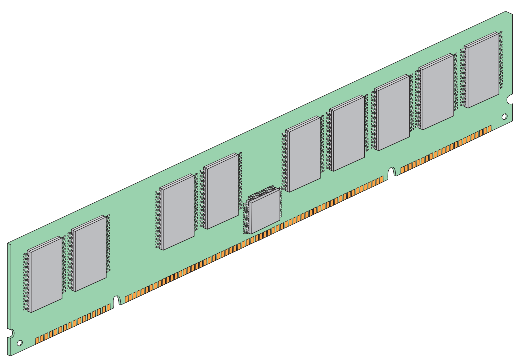


Figure 4-39 OCTANE Memory Module

4.5.7 Origin200/Origin2000/Onyx2 Memory Module

This 244 pin DIMM is used on all three of these platforms.

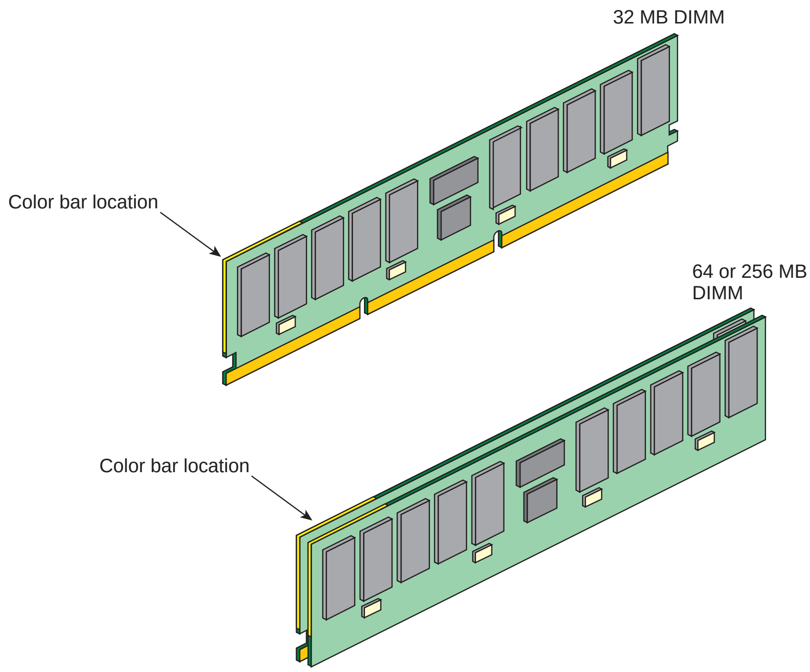


Figure 4-40 Origin200 / Origin2000 / Onyx2 Memory Module

4.6 Graphics Interfaces

There are a number of graphics related signals on IRIS systems. The one used most often is the monitor output. Others are Alpha channel output, genlock input and the stereo signal used by devices like the stereo glasses emitter. A summary of these graphics interfaces is shown in Table 4-33, on page 4-71.

There are three kinds of monitor connections used for IRIS systems - 3 or four BNC's, a 13W3 connector, or an HD-15 connector.

Where BNC's are used, only Red, Green, and Blue (RGB) and Sync graphics signals destined for the monitor are provided. Where the 13W3 connector is used, the cable carries the RGB signals as well as some blanking signals and information on the type of monitor that is attached to the system. See the section on the 13W3 (page 4-73) interface for more information about the monitor identification signals.

There is a connection for the Presenter flat panel display. This is shown in Table 4-33, but since the interface is proprietary to Silicon Graphics, it is not documented here.

Table 4-33 Graphics Interfaces on IRIS Systems

Chassis	Graphics Subsystem	Monitor Output			Alpha		Genlock		Stereo Signal	Flat Panel Adapter	Swap Ready
		BNC's	13W3	HD-15	Conn	In/ Out	Conn	In/ Out	Conn	Conn	Conn
Twin Tower	B, G	4									
	GT, GTX	4			BNC	In					
Diehard	GT, GTX	4			BNC	In					
	VGX, VGXT	4			BNC	In			PPP[2]		
Predator Rack		4									
Personal IRIS		3[5]	X[4]	X[3]			X	In	DB-15[1] Mini-DIN[6]		
Diehard2			X		X		X		PPP[2] 13W		
Terminator Rack/Eveready Deskside	RE, RE^2		X		X		BNC	Both	PPP[2] 13W3		BNC
Indigo	Starter		X	X							
	XS, XS24, XZ, Elan		X				BNC	In	Mini-DIN		
Indigo^2	XZ, Extreme		X				Mini Coax	In	Mini-DIN		
	XL		X						Mini-DIN		
	IMPACT		X						DB-9F		
Indy			X						Mini-DIN	68 Pin High Density	
O2				X					Mini-DIN[7]	68 Pin High Density	
OCTANE			X						DB-9M		
Onyx2			2/8[8]				BNC	Both	DB-9M		BNC

1. Stereo sync signal was available as a pin on the DB-15 Genlock connector for Personal IRIS systems with GR1.2 or GR1.5 graphics boards.
2. Stereo sync signal available via the Powered Peripheral port.
3. Only available on those systems with a GR1.5 graphics board.
4. Only on those systems with an Elan graphics board. For this situation there are no BNC's.
5. If the system has an Elan graphics board there are no BNC's.
6. Personal IRIS systems with Elan graphics boards have the stereo signal on a mini-DIN.
7. Stereo Connector available only on Flat panel adapter option.
8. Onyx2 has 2 monitor outputs normally, but can expand to 8 monitor outputs with options to the system.

4.6.1 BNC Monitor Output (R, G, B & Sync)

While most SGI systems have some sort of Sync output in addition to the RGB outputs, early IRIS systems had monitors that required a separate Sync signal rather than including the sync signal along with the Green signal as has now become the accepted norm.

Later monitors did not require the separate Sync signal, so only the R, G and B signals were used. In the table above, the number of BNC's found on the system is noted.

Some graphics subsystems could alter where or whether the Sync signal was sent out on one or more of the R, G or B signals. For more information on this capability consult the 'setmon' manual page.

4.6.1.1 Connector Drawing

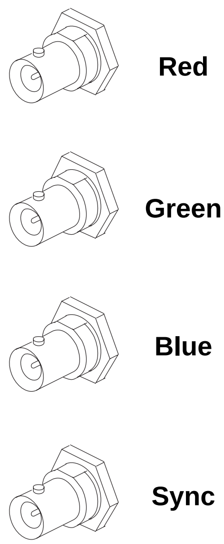


Figure 4-41 Typical RGB & Sync BNC Connectors

4.6.1.2 Output Levels

The output levels of the R, G and B signals are 714 millivolts peak to peak (from blank to white) not including sync. The sync signal is a 286 millivolt signal. When sync is present on Green the total peak to peak signal is 1.000 Volts.

4.6.2 13W3 Monitor Output

The 13W3 style of monitor connection contains not only the R, G and B signals, but may also incorporate horizontal and vertical blanking signals, monitor identification signals, and possibly a composite sync signal. While most of the signals on the 13W3 are identical on all systems, there are some signals that are found only on certain platforms. These differences are shown in Table 4-34, “13W3 Monitor Pinout”, on page 4-74.

The R, G and B signals are the same voltage levels as those specified in the section on BNC type connections.

4.6.2.1 Connector Drawing

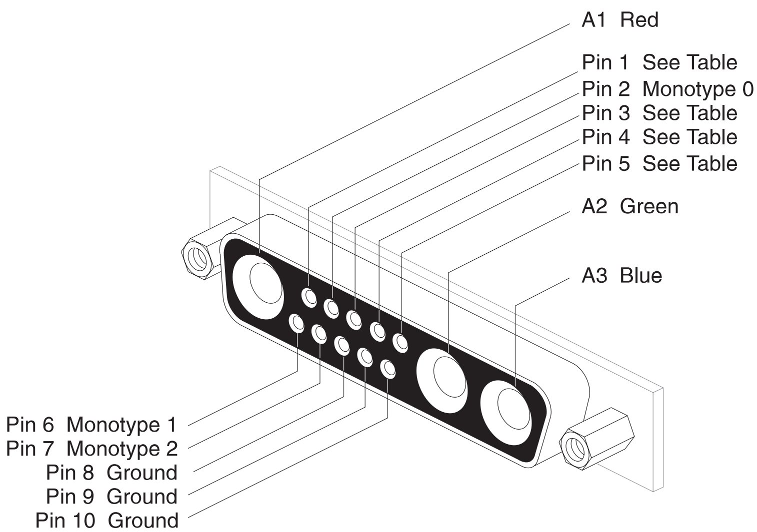


Figure 4-42 13W3 Monitor Output Connector

4.6.2.2 Monitor Identification Pins

The purpose of the monitor identification signals (a.k.a. Monitor ID or montype signals) is to tell the graphics subsystem what type of a monitor is connected to the machine. This is done with 4 lines that are either grounded or left floating at the monitor. This happens during the booting of the system. The graphics subsystem can then adjust its timing to correspond to the type of monitor attached to the system.

The newer systems have replaced the “Monitor ID” pins with an I^2C interface. This removes the limitations on supported monitor configurations imposed by the number Monitor ID pins available. See "Monitor Connections" page 4-57 for more information.

Not all of the systems equipped with 13W3 connectors support all of the monitors that are possible. The table on page 4-75 shows how to equate the states of the Monitor ID pins with the type of the monitor.

4.6.2.3 Pinout

Table 4-34 13W3 Monitor Pinout

Pin	Low End & Mid Range Systems (Indigo, Indigo^2, Indy)			Older High End Systems (Crimson, Onyx)			New High End Systems (Onyx2)		
	Signal Name	**Description**	**Input/ Output**	**SIgnal Name**	**Description**	**Input/ Output**	**Signal Name**	**Description**	**Input/ Output**
A1	Red	Red Signal	Output	Same					
A2	Green	Green Signal	Output	Same					
A3	Blue	Blue Signal	Output	Same					
1	Montype 3	Monitor type 3	Input		Cable Shield	-	SCL	Serial Clock	Output
2	Montype 0	Monitor type 0	Input	Same			SDA	Serial Data	Input/Output
3	CSYNC	Composite Sync	Output	N/C	No Connection	-	N/C	No Connection	-
4	HDRIVE	Horizontal Drive	Output	Stereo	Stereo Sync	Output	HDRIVE	Horizontal Drive	Output
5	VDRIVE	Vertical Drive	Output	Stereo Pwr	Power for Stereo emitter (+10V)	Output	VDRIVE	Vertical Drive	Output
6	Montype 1	Monitor type 1	Input	Montype 1	Monitor type 1	Input	DDC (+5)	?	?
7	Montype 2	Monitor type 2	Input	Montype 2	Monitor type 2	Input	DDC Gnd	?	?
8	GND	Ground	-	Same					
9	GND	Ground	-	Same					
10	GND	Ground	-	Same					

Table 4-35 Monitor ID Definitions

Description	ID Value[1]	Montype(n)					Scan Rates H/V	Size	Stereo?	Comments
		4[2]	3[3]	2	1	0				
		Pin 3	Pin 1	Pin 7	Pin 6	Pin 2				
Not Defined	0	N/A	Gnd	Gnd	Gnd	Gnd				
Multiscan -up to 1280x1024	1	N/A	Gnd	Gnd	Gnd	NC	30-82 kHz/ 76 Hz	19”	Yes	
Multiscan -up to 1280x1024	2	N/A	Gnd	Gnd	NC	Gnd	30-82 kHz/ 76 Hz	16”	Yes	
Not Defined	3	N/A	Gnd	Gnd	NC	NC				
Not Defined	4	N/A	Gnd	NC	Gnd	Gnd				
Not Defined	5	N/A	Gnd	NC	Gnd	NC				
Single Scan - 1024x768	6	N/A	Gnd	NC	NC	Gnd	48.48 kHz /60 Hz	15”	No	For Indy
Not Defined	7	N/A	Gnd	NC	NC	NC				
1280x1024	8	N/A	NC	Gnd	Gnd	Gnd	60 Hz only	19”	Yes (both 492 & 512 Lines)	Hitachi Monitor
Multiscan - 1280x1024	9	N/A	NC	Gnd	Gnd	NC	30-82 kHz/ 76 Hz	19”	Yes	Can also be a single scan 72 Hz Sony
1280x1024	10	N/A	NC	Gnd	NC	Gnd	30-82 kHz/ 76 Hz	16”	Yes	
Multiscan - 1280x1024 & 1024x768	11	N/A	NC	Gnd	NC	NC		21”	Yes (both 492 & 512 Lines)	
Dual Scan - 1280x1024 & 1024x768	12	N/A	NC	NC	Gnd	Gnd	63.9 & 48.48 kHz /60 Hz	19”	Yes (both 492 & 512 Lines)	Shipped with original Indigo
Dual Scan - 1280x1024 & 1024x768	13	N/A	NC	NC	Gnd	NC	63.9 & 48.48 kHz /60 Hz	16”	Yes (both 492 & 512 Lines)	Shipped with original Indigo
Single Scan - 1024x768	14	N/A	NC	NC	NC	Gnd	48.48 kHz /60 Hz	15”		For Indy
Single Scan- 1280x1024	15	N/A	NC	NC	NC	NC	63.9 kHz /60 Hz	19”	Yes	As shipped with Personal IRIS and 4D/xxx series

1. The Silicon Graphics system recognizes ID pins that are not connected as “high” and those grounded as “low”. Pins need not be pulled high, just left with no connection.
2. Montype4 pin not currently used. This pin (pin 3) is currently used for composite sync.
3. Monitor ID Values 0 - 7 used only by Indigo[2] (with XL graphics) and Indy. All other machines recognize Monitor ID Values of 8 - 15 only.

4.6.3 HD-15 Monitor Output

This is an output that conforms to the pinout used by PC compatibles for VGA (640 x 480) and Super VGA (800 x 600, 1024 x 768, 1280 x 1024) resolutions. On some systems this connector is referred to as the “composite” connector.

4.6.3.1 Connector Drawing

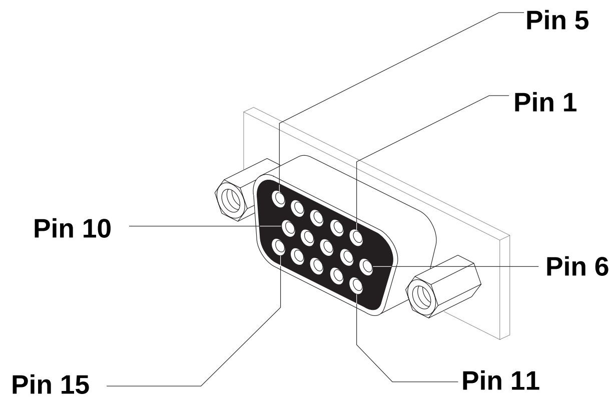


Figure 4-43 HD-15 Connector

4.6.3.2 Pinout

Table 4-36 HD-15 Monitor Output Pinout

Pin	Signal Name	Description
1	RED.OUT	Red Output
2	GREEN.OUT	Green Output
3	BLUE.OUT	Blue Output
4	N/C	No Connection
5	DIG GND	Digital Ground
6	ARTN	Analog Return
7	ARTN	Analog Return
8	ARTN	Analog Return
9	NO PIN or +5V	No Pin Installed[1]
10	DIG GND	Digital Ground
11	Montype 0	Monitor type 0
12	N/C or I^2C Data	No Connection or I^2C Data[2]
13	HDRIVE.OUT	Horizontal Drive (TTL)
14	VDRIVE.OUT	Vertical Drive (TTL)
15	N/C or I^2C Clock	No Connection or I^2C Clock[2]

1. Some systems use a connector that does not have a pin hole for this pin. The O2 uses this pin for a +5V connection. The current limit for this pin is 0.5 Amps (the fuse for this is also used for the mouse and keyboard).
2. The O2 and OCTANE systems use pins 12 and 15 to communicate with the monitor. Consult "Monitor Connections" page 4-57 for more information.

4.6.4 Graphics Output Timing Information

IRIS systems support a number of different output formats. For external equipment to operate properly it is important to know the timing of various portions of the sync signals.

Note that these specifications apply to the “Graphics Output” - that output normally sent to the graphics monitor. This is not to be confused with “Video Output” - an output sent to a piece of video equipment (like a Video Recorder). There are some *graphics output* formats that comply with standard *video* standards, for example NTSC or PAL. In these situations the *graphics output* may be connected to a suitably equipped *video device.*

The tables on the following pages show the timing specifications for the formats supported by IRIS systems. Since there many number associated with the specifications for each format, there are two tables. Table 4-37 covers the general format information and the Horizontal specifications, while Table 4-38 covers the Vertical specifications. The formats listed in both Table 4-37 and Table 4-38 are numbered to make cross references between tables easier.

It is important to note that there are some differences between the timing specifications for “high end” systems (VGX, Reality Engine, etc.) and those mid- and low-end systems (Indigo, Indigo^2 and Indy). These differences are shown in the tables with a format number with an “a” appended. For example, format “5” is the high-end video format while “5a” is the format for the mid- and low-end systems. In many cases the differences between the specifications are minor enough that a peripheral such as a monitor would work perfectly well with either. However, for some pieces of equipment these differences could be important. For each of these cases where the specs differ, the format number fields have been outlined to point out the two variations.

The most frequently encountered video output formats are lightly shaded. These formats, like 1280x1024 @ 60 Hz are those used by default by the system for the monitors supplied with the system.

Table 4-37 Graphics Output Timing Specifications - General & Horizontal Information

Format	General Format				Pixel Clock		Horizontal										
	Resolution	Frame Rate (Hz)	Interlaced?	Fields			Active Line Length		Nominal Line Period (total width)		Line Frequency (KHz)	Front Porch		Sync Duration		Back Porch	
					Frequency (MHz)	Period (nsec)	Pixels	µsec	Pixels	µsec		Pixels	µsec	Pixels	µsec	Pixels	µsec
1	1200x900	72	No	1	105.581160	9.471387	1200	11.37	1565	14.82	67.464	35	0.33	90	0.85	240	2.27
2	1280x1024	60	No	1	107.352000	9.315150	1280	11.92	1680	15.65	63.900	40	0.37	120	1.12	240	2.24
2a												30	0.28			250	2.33
3	1280x1024	50	No	1	87.948000	11.370355	1280	14.55	1680	19.10	52.350	40	0.45	120	1.36	240	2.73
3a					89.460000	11.178180		14.31		18.78	50.00	30	0.34		1.34	250	2.79
4	1280x1024	72	No	1	130.075920	7.687818	1280	9.84	1690	12.99	76.968	30	0.23	140	1.08	240	1.85
4a		72.3			130.000	7.692307		9.85		13.00	76.92						
5	1280x1024	30	Yes	2	53.609400	18.653445	1280	23.88	1580	29.47	33.930	40	0.75	130	2.42	130	2.42
5a					53.676000	18.630300		23.85		29.44	33.972						
6	1280x960	76	No	1	126.790800	7.887008	1280	10.10	1660	13.09	76.380	25	0.20	125	0.99	230	1.81
7	1280x960	30	Yes	2	49.717800	20.113521	1280	25.75	1620	32.58	30.690	40	0.80	150	3.02	150	3.02
8	1920x1035	30	No	1	74.250000	13.468013	1920	25.86	2200	29.63	33.750	45	0.61	90	1.21	145	1.95
9	1600x1200	60	No	1	156.375000	6.394884	1600	10.23	2085	13.33	75.000	45	0.29	120	0.77	320	2.05
10	1600x1200	50	No	1	130.312500	7.673861	1600	12.28	2085	16.00	62.500	45	0.35	120	0.92	320	2.46
11	1025x768	60	No	1	64.389600	15.530458	1025	15.92	1320	20.50	48.780	75	1.16	80	1.24	140	2.17
11a	1024x768	59.63			64.000000	15.625000	1024	16.00		20.63	48.485	76	1.19		1.25		2.19
12	640x1024	60	No	1	53.676000	18.630300	640	11.92	840	15.65	63.900	15	0.28	60	1.12	125	2.33
13	640x480	60	No	1	25.200000	39.682540	640	25.40	800	31.75	31.500	15	0.60	95	3.77	50	1.98
14	640x486	30	Yes	2	12.285000	81.400081	640	52.10	780	63.49	15.750	25	2.04	60	4.88	55	4.48

Table 4-37 (continued) Graphics Output Timing Specifications - General & Horizontal Information

Format	General Format				Pixel Clock		Horizontal										
	Resolution	Frame Rate (Hz)	Interlaced?	Fields	Frequency (MHz)	Period (nsec)	Active Line Length Pixels	Active Line Length µsec	Nominal Line Period (total width) Pixels	Nominal Line Period (total width) µsec	Line Frequency (KHz)	Front Porch Pixels	Front Porch µsec	Sync Duration Pixels	Sync Duration µsec	Back Porch Pixels	Back Porch µsec
15	640x496	60	No	1	25.200000	39.682540	640	25.40	800	31.75	31.500	15	0.60	95	3.77	50	1.98
16	640x512	60	No	1	26.640000	37.537538	640	24.02	800	30.03	33.300	20	0.75	55	2.06	85	3.19
17	640x640	60	No	1	33.565200	29.792762	640	19.07	830	24.73	40.440	10	0.30	80	2.38	100	2.98
18	645x486	30	Yes	2	12.285000	81.400081	645	52.50	780	63.49	15.750	20	1.63	60	4.88	55	4.48
18a	640x485				12.272727	81.481483	640	52.15		63.49	15.734				4.89	60	4.89
19	745x224	60	No	1	23.940000	41.771094	745	31.12	950	39.68	25.200	10	0.42	90	3.76	105	4.39
20	770x576	25	Yes	2	14.843750	67.368421	770	51.87	950	64.00	15.625	25	1.68	70	4.72	380	25.60
20a	780x575				15.000000	66.666667	780	52.00	960			20	1.33		4.67	90	6.00
21	850x850	60	No	1	59.070000	16.929067	850	14.39	1100	18.62	53.700	10	0.17	80	1.35	160	2.71
22	960x620	60	No	1	54.432000	18.371546	960	17.64	1260	23.15	43.200	20	0.37	95	1.75	185	3.40
23	960x680	60	No	1	54.432000	18.371546	960	17.64	1260	23.15	43.200	20	0.37	95	1.75	185	3.40
24	960x680	50	No	1	45.738000	21.863658	960	20.99	1260	27.55	36.300	20	0.44	95	2.08	185	4.04
25	960x802	30	Yes	2	30.975000	32.284100	960	30.99	1180	38.10	26.250	30	0.97	85	2.74	105	3.39
26	1280x1024	60	No	1	107.352000	9.315150	1280	11.92	1680	15.65	63.900	40	0.37	120	1.12	240	2.24
26a		59.94			118.087000	8.468332		10.84	1850	15.67	63.83	200	1.69		1.02	250	2.12
27	1280x1024	60	No	1	105.840000	9.448224	1280	12.09	1680	15.87	63.900	40	0.38	120	1.13	240	2.27
28	1280x1024	50	No	1	105.000000	9.523810	1280	12.19	1680	16.00	62.500	40	0.38	120	1.14	240	2.29
28a		49.99			97.750000	10.23017		13.09		17.19	58.18	30	0.31		1.23	250	2.56
29	1025x768	96	No	2	103.425120	9.668831	1025	9.91	1335	12.91	77.472	25	0.24	105	1.02	180	1.74

Table 4-37 (continued) Graphics Output Timing Specifications - General & Horizontal Information

Format	General Format				Pixel Clock		Horizontal										
	Resolution	Frame Rate (Hz)	Interlaced?	Fields	Frequency (MHz)	Period (nsec)	Active Line Length Pixels	Active Line Length µsec	Nominal Line Period (total width) Pixels	Nominal Line Period (total width) µsec	Line Frequency (KHz)	Front Porch Pixels	Front Porch µsec	Sync Duration Pixels	Sync Duration µsec	Back Porch Pixels	Back Porch µsec
30	640x512	120	No	2	54.048000	18.502072	640	11.84	800	14.80	67.560	20	0.37	55	1.02	85	1.57
31	815x611	120	No	2	83.070000	12.038040	815	9.81	1065	12.82	78.000	20	0.24	95	1.14	135	1.63
32	960x680	108	No	2	97.588800	10.247078	960	9.84	1255	12.86	77.760	20	0.20	95	0.97	180	1.84
33	1280x1024	25	Yes	2	105.000000	9.523810	1280	12.19	1680	16.00	62.500	40	0.38	120	1.14	240	2.29
34	1280x1024	30	Yes	2	105.840000	9.448224	1280	12.09	1680	15.87	63.000	40	0.38	120	1.13	240	2.27
35	1280x492	120	No	2	107.452800	9.306412	1280	11.91	1680	15.63	63.960	40	0.37	120	1.12	240	2.23
35a		119.89			107.352000	9.315150		11.92		15.65	63.90	30	0.28			250	2.33
36	1280x512	120	No	2	111.484800	8.969833	1280	11.48	1680	15.07	66.360	40	0.36	120	1.08	240	2.15
37	1920x1035	30	Yes	2	74.250000	13.468013	1920	25.86	2200	29.63	33.750	45	0.61	45	0.61	190	2.56
38	1920x1152	25	Yes	2	71.817500	13.924183	1920	26.73	2300	32.03	31.225	65	0.91	130	1.81	185	2.58
39	1920x1152	25	Yes	2	71.875000	13.913043	1920	26.71	2300	32.00	31.250	65	0.90	65	0.90	250	3.48
40	640x480	60	Yes	3	82.368000	12.140637	640	7.77	880	10.68	93.600	40	0.49	80	0.97	120	1.46
41	1280x960	30	Yes	6	164.736000	6.070319	1280	7.77	1760	10.68	93.600	80	0.49	160	0.97	240	1.46
A	1280x1024	75.025	No	1	135.000	7.407407	1280	9.481	1688	12.504	79.976	16	0.119	144	1.067	248	1.837
B	1280x1024	72.239	No	1	129.250	7.736943	1280	9.903	1680	12.998	76.935	32	0.248	140	1.083	228	1.764
C	1280x1024	59.943	No	1	107.250	9.324009	1280	11.935	1680	15.664	63.839	40	0.373	120	1.119	240	2.238
D	1280x1024	50.062	No	1	89.571	11.16432	1280	14.290	1680	18.756	53.316	32	0.357	120	1.340	248	2.769
E	1280x1024	75.924	No	1	140.250	7.130124	1280	9.127	1712	12.207	81.922	32	0.228	176	1.255	224	1.597
F	1024x768	75.029	No	1	78.750	12.69841	1024	13.003	1312	16.660	60.023	16	0.203	96	1.219	176	2.235

Table 4-37 (continued) Graphics Output Timing Specifications - General & Horizontal Information

Format	General Format				Pixel Clock		Horizontal											
	Resolution	Frame Rate (Hz)	Interlaced?	Fields	Frequency (MHz)	Period (nsec)	Active Line Length Pixels	Active Line Length μsec	Nominal Line Period (total width) Pixels	Nominal Line Period (total width) μsec	Line Frequency (KHz)	Front Porch Pixels	Front Porch μsec	Sync Duration Pixels	Sync Duration μsec	Back Porch Pixels	Back Porch μsec
G	1024x768	59.940	No	1	63.546	15.73663	1024	16.114	1304	20.521	48.732	72	1.133	76	1.196	132	2.077
H	800x600	60.317	No	1	40.000	25.000	800	20.000	1056	26.400	37.879	40	1.000	128	3.200	88	2.200
I	640x480	59.940	No	1	25.175	39.72194	640	25.422	800	31.778	31.469	16	0.636	96	3.813	48	1.907
J	1280x492	119.999	No	2	107.250	9.324009	1280	11.935	1680	15.664	63.839	40	0.373	120	1.119	240	2.238
K	1920x1035	60.194	No	1	159.923	6.253009	1920	12.006	2460	15.382	65.009	44	0.275	132	0.825	364	2.276
L	1600x1200	59.847	No	1	156.200	6.402048	1600	10.243	2088	13.367	74.808	22	0.282	120	0.768	324	2.074

Table 4-38 Graphics Output Timing Specifications - Vertical Information

Format	Vertical															Notes
	Field	Active Height	Lines Per Frame	Front Porch			Sync			Sync Pulse			Back Porch			
				Pixels	Lines	msec	Pixels	Lines	msec	Pixels	µsec	Count	Pixels	Lines	msec	
1	1	900	937	4695	3.0	0.04	6260	4.0	0.06	4695	44.47		46950	30.0	0.44	
2 & 2a	1	1024	1065	5040	3.0	0.05	5040	3.0	0.05	3360	31.30		58800	35.0	0.55	
3	1	1024	1047	5040	3.0	0.06	5040	3.0	0.06	3360	38.20		28560	17.0	0.32	
3a			1065			0.056			0.056				58800	35.0	0.657	
4	1	1024	1069	5070	3.0	0.04	5070	3.0	0.04	3380	25.98		65910	39.0	0.51	
4a			1064			0.039			0.039				57460	34.0	0.442	
5	1	1024	1131	6320	4.0	0.12	6320	4.0	0.12	4740	88.42		72680	46.0	1.36	
	2			5530	3.5	0.10	5530	3.5	0.10	5530	103.15					
5a	1			5530	3.5	0.103	6320	4.0	0.118				71890	45.5	1.339	
	2			6320	4.0	0.118							72680	46.0	1.354	
6	1	960	1005	4980	3.0	0.04	4980	3.0	0.04	3320	26.18		64740	39.0	0.51	
7	1&2	960	1023	4860	3.0	0.10	4860	3.0	0.10	710	14.28	6	42120	26.0	0.85	
8	1	1035	1125	11000	5.0	0.15	11000	5.0	0.15	8800	118.52		770000	35.0	1.04	
	2			12100	5.5	0.16	9900	4.5	0.13	9900	133.33					
9	1	1200	1250	10425	5.0	0.07	12510	6.0	0.08	10425	66.67		81315	39.0	0.52	
10	1	1200	1250	10425	5.0	0.08	12510	6.0	0.10	10425	80.00		81315	39.0	0.62	
11	1	768	813	3960	3.0	0.06	3960	3.0	0.06	2640	41.00		51480	39.0	0.80	
11a															0.80	
12	1	1024	1065	2520	3.0	0.05	2520	3.0	0.05	1680	31.30		29400	35.0	0.55	Pixel Replication
13	1	480	525	8000	10.0	0.32	1600	2.0	0.06	800	31.75		26400	33.0	1.05	

Table 4-38 (continued) Graphics Output Timing Specifications - Vertical Information

Format	Vertical															Notes
	Field	Active Height	Lines Per Frame	Front Porch			Sync			Sync Pulse			Back Porch			
				Pixels	Lines	msec	Pixels	Lines	msec	Pixels	µsec	Count	Pixels	Lines	msec	
14	1&2	486	525	2340	3.0	0.19	2340	3.0	0.19	335	27.27	6	10920	14.0	0.89	
15	1	496	525	1600	2.0	0.06	1600	2.0	0.06	800	31.75		20000	25.0	0.79	
16	1	512	555	2400	3.0	0.09	2400	3.0	0.09	1600	60.06		29600	37.0	1.11	
17	1	640	674	2490	3.0	0.07	2490	3.0	0.07	1660	49.46		23240	28.0	0.69	
18	1&2	486	525	2340	3.0	0.19	2340	3.0	0.19	335	27.27	6	10920	14.0	0.89	NTSC
18a		485														
19	1	224	420	87400	92.0	3.65	5700	6.0	0.24	860	35.92	6	93100	98.0	3.89	
20	1&2	576	625	2375	2.5	0.16	2375	2.5	0.16	405	27.28	5	19000	20.0	1.28	PAL
20a		575														
21	1	850	895	3300	3.0	0.06	3300	3.0	0.06	2200	37.24		42900	39.0	0.73	
22	1	620	720	41580	33.0	0.76	3780	3.0	0.07	2520	46.30		80640	64.0	1.48	
23	1	680	720	3780	3.0	0.07	3780	3.0	0.07	2520	46.30		42840	34.0	0.79	
24	1	680	726	3780	3.0	0.08	3780	3.0	0.08	2520	55.10		50400	40.0	1.10	
25	1&2	802	875	3540	3.0	0.11	3540	3.0	0.11	530	17.11	6	36580	31.0	1.18	
26	1	1024	1065	5040	3.0	0.05	5040	3.0	0.05	3360	31.30		58800	35.0	0.55	
26a				5550		0.047	5550		0.047				64750		0.548	4:3 Pixel Ratio
27	1	1024	1050	5040	3.0	0.05	5040	3.0	0.05	3360	31.75		33600	20.0	0.32	
28	1	1024	1250	5040	3.0	0.05	5040	3.0	0.05	3360	32.00		369600	220.0	3.52	
28a			1164	171360	102	1.753			0.051				58800	35	0.601	4:3 Pixel Ratio

Table 4-38 (continued) Graphics Output Timing Specifications - Vertical Information

Format	Field	Active Height	Lines Per Frame	Front Porch Pixels	Front Porch Lines	Front Porch msec	Sync Pixels	Sync Lines	Sync msec	Sync Pulse Pixels	Sync Pulse µsec	Count	Back Porch Pixels	Back Porch Lines	Back Porch msec	Notes
				Vertical												
29	1	1536	1614	4005	3.0	0.04	4005	3.0	0.04	2670	25.82		44055	33.0	0.43	New Style Stereo
	2									4005	38.72					
30	1	1024	1126	2400	3.0	0.04	2400	3.0	0.04	1600	29.60		36000	45.0	0.67	New Style Stereo
	2									2400	44.40					
31	1	1222	1300	3195	3.0	0.04	3195	3.0	0.04	2130	25.64		35145	33.0	0.42	New Style Stereo
	2									2400	44.40					
32	1	1360	1440	3765	3.0	0.04	3765	3.0	0.04	2510	25.72		42670	34.0	0.44	New Style Stereo
	2									3765	38.58					
33	1	2048	2500	5040	3.0	0.05	5040	3.0	0.05	3360	32.00		369600	220.0	3.52	Pixel Replication, Genlock, Framelock, Swap only on frame boundary
	2									5040	48.00					
34	1	2048	2100	5040	3.0	0.05	5040	3.0	0.05	3360	31.75		33600	20.0	0.32	Pixel Replication, Genlock, Framelock, Swap only on frame boundary
	2									5040	47.62					
35	1	1024	1066	5040	3.0	0.05	5040	3.0	0.05	3360	31.27		58800	35.0	0.55	Old-style Stereo
	2									5040	46.90					
35a						0.046			0.046						0.547	
36	1	1024	1106	5040	3.0	0.05	5040	3.0	0.05	3360	30.14		58800	35.0	0.53	Old-style Stereo
	2									5040	45.21					
37		1035	1125	Vertical Blanking Information Unavailable												
38	1	1152	1249	6900	3.0	0.10	4600	2.0	0.06	2300	32.03		98900	43.0	1.38	
	2			8050	3.5	0.11	3450	1.5	0.05	3450	48.04		101200	44.0	1.41	

Table 4-38 (continued) Graphics Output Timing Specifications - Vertical Information

Format	Vertical															Notes
	Field	Active Height	Lines Per Frame	Front Porch			Sync			Sync Pulse			Back Porch			
				Pixels	Lines	msec	Pixels	Lines	msec	Pixels	µsec	Count	Pixels	Lines	msec	
39	1&2	1152	1250	9515	4.1	0.13	1438400	625.4	20.01	575	8.00	2	102285	44.5	1.42	
40	1	480	1560	880	1.0	0.01	5280	6.0	0.06	800	9.71	6	29040	33.0	0.35	Field Sequential
	2						2640	3.0	0.03			3	31680	36.0	0.38	
	3															
41		960	3120	Vertical Blanking Information Unavailable												Field Sequential
A		1024	1066		1	0.013		3	0.038			1		38	0.475	
B		1024	1065		3	0.039		3	0.039					35	0.455	
C		1024	1065		3	0.047		3	0.047					35	0.548	
D		1024	1065		3	0.056		3	0.056					35	0.656	
E		1024	1079		3	0.037		3	0.037					49	0.598	
F		768	800		1	0.017		3	0.050					28	0.466	
G		768	813		3	0.062		3	0.062					39	0.800	
H		600	628		1	0.026		4	0.104					23	0.607	
I		480	532		10	0.318		2	0.064					33	1.049	
J		492	532		3	0.047		3	0.047					34	0.533	
K		1035	1080		3	0.046		10	0.154					32	0.492	
L		1200	1250		5	0.067		6	0.080					39	0.521	

4.6.5 Supported Graphics Modes

The previous section lists a number of different graphics output formats. Not all systems support all these output formats. There are also some formats that are referred to in the ‘man pages’ - specifically the ‘setmon’ man page - that are referred to by special names.

This section lists the graphics output modes supported by each type of graphics subsystem and shows the special name for those formats mentioned in the man pages.

Table 4-39 Supported Graphics Output Formats

Format Name	XS, XZ, Elan & Extreme	PI G and TG	Entry	Indy /XL	GT & GTX	GT & GTTX RV2	VGX & VGXT	VTX, RE, RE2	IMPACT	CRM	IR
30HZ	X	X			X	X	X	X			
30HZ_SG					X	X					
50HZ	X			X					X	X	
60HZ	X	X	X	X	X	X	X	X	X	X	
70HZ				X						X	
72HZ	X			X				X	X	X	
75HZ										X	
76HZ				X					X		
NTSC	X	X		X	X	X	X	X			
PAL	X	X		X	X	X	X	X			
HDTV							X	X			
IRIS3K	X			X							
STR_RECT	X	X		X		X	X	X	X	X	
STR_BOT	X	X[1]		X			X	X	X	X	
STR_TOP	X	X[1]		X			X	X	X	X	
343	X					X	X	X			
VOF				X							
VGA								X			
widthxheight_framerate								X	X		
format combinations											X

1 STR_BOT & STR_TOP supported only on RE2 and RE2 turbo

4.6.6 Alpha Output

This output provides an analog signal most often used for combining the graphics output with video signals.

Alpha is a output that is an analog representation of the data in the alpha bits of the frame buffer. It has the same electrical characteristics as the RGB signals. Sync can be added to the Alpha output using the ‘setmon’ command.

4.6.7 Genlock

Genlock is used to keep the RGB output in synchronization with some external piece of equipment (slave mode). Most IRIS systems only have a Genlock input. Some of the systems have Genlock outputs as well, making it possible to sync other equipment with the output rate of the IRIS.

Genlock on the slave systems is enabled using ‘setmon’. You have a choice between 300 mVolt or 4 Volt input sync levels. There is AGC on the genlock input, so it can lock between about 200 mVolt and 5 Volts. Genlock is required when driving stereo Head Mounted Displays from 2 Onyx’s, or anytime you need to use the Swap Ready signal, for drawing synchronization

There are two different connectors used for Genlock signals - a BNC or mini-coax (75Ω SMB) connector. There are two different connectors used for Genlock signals - a BNC or mini-coax (75 Ohm SMB) connector For both of these the signal itself is connected to the inner conductor while the outer conductor is used as a shield.

The genlock signal is an active-low, composite sync, 1 Volt Peak-to-peak signal. Although the input is clamped to 1 Volt, meaning a TTL input could be used, the 1 Volt signal is recommended.

4.6.8 Genlock Option

This connection is specific to the Personal IRIS series of systems. It contains an assortment of sync signal outputs, a sync signal input, the 5 LSB's of the Blue channel, and the stereo signal.

4.6.8.1 Connector Drawing

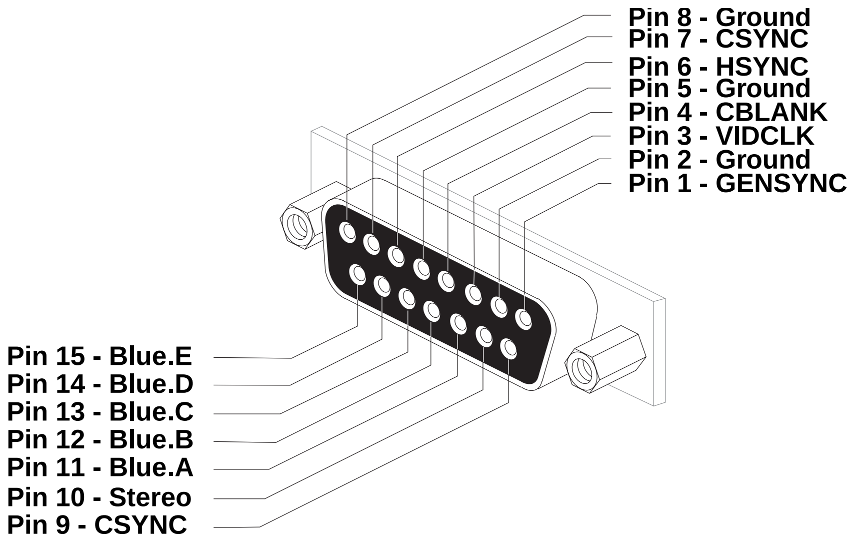


Figure 4-44 Genlock Option Connector

4.6.8.2 Pinout

Table 4-40 Genlock Option Connector Pinout

Pin	Signal Name	Description	Input/ Output
1	GENSYNC	Genlock Sync	Input
2	GND	Ground	-
3	VIDCLK	Video Clock	Output
4	CBLANK	Composite Blanking	Output
5	GND	Ground	-
6	HSYNC	Horiz. Sync	Output
7	CSYNC	Composite Sync	Output
8	GND	Ground	-

Pin	Signal Name	Description	Input/ Output
9	EXTCSYNC	Ext. Composite Sync	Output
10	STEREO	Stereo Signal	Output
11	BLUE.A	5 Least Significant Bits of Blue channel Used for generating a key	Output
12	BLUE.B		Output
13	BLUE.C		Output
14	BLUE.D		Output
15	BLUE.E		Output

4.6.9 Stereo Sync Signal

The stereo sync signal indicates when the system is changing between buffers used to portray images for the right and left eye. The stereo signal is a TTL signal where the "high" state indicated the left eye view is being shown.

As the table on page 4-71 shows, there are five different connectors used for the stereo sync signal - a DB-15 Genlock connector, the Powered Peripheral Port, a 3 pin mini-DIN, connector, a DB-9 connector, and as part of the 13W3 connector (only on some systems).

Depending on the system, the gender of the DB-9 will be either male (DB-9M), or female (DB-9F). The DB-9 used on the IMPACT graphics for Indigo^2 is female, the connector used for OCTANE and Onyx2 is male.

Since three of the five connectors are not used exclusively for the stereo sync signal, they are defined elsewhere. The pinout for the DB-15 Genlock Option connector is defined on page 4-87, the Powered Peripheral Port pinout is defined on page 4-20 and the pinout of the 13W3 is defined on page 4-73.

This section documents the 3 Pin Mini-DIN and DB-9 Stereo Sync connections.

4.6.9.1 Connector Drawing (3 Pin Mini-DIN)

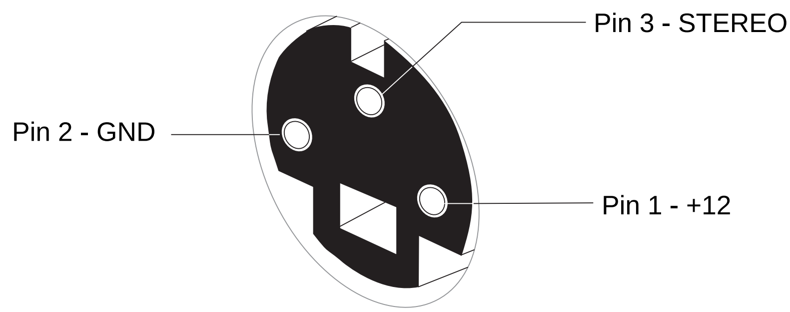


Figure 4-45 3 Pin Mini-DIN Stereo Sync Connector

4.6.9.2 Pinout (3 Pin Mini-DIN)

Table 4-41 3 Pin Mini-DIN Stereo Sync Connector Pinout

Pin	Signal Name	Description	Input/ Output
1	+12V	+12 Volts DC	Output
2	GND	Ground	-
3	STEREO	Stereo Sync	Output

4.6.9.3 Connector Drawings (DB-9F & DB-9M)

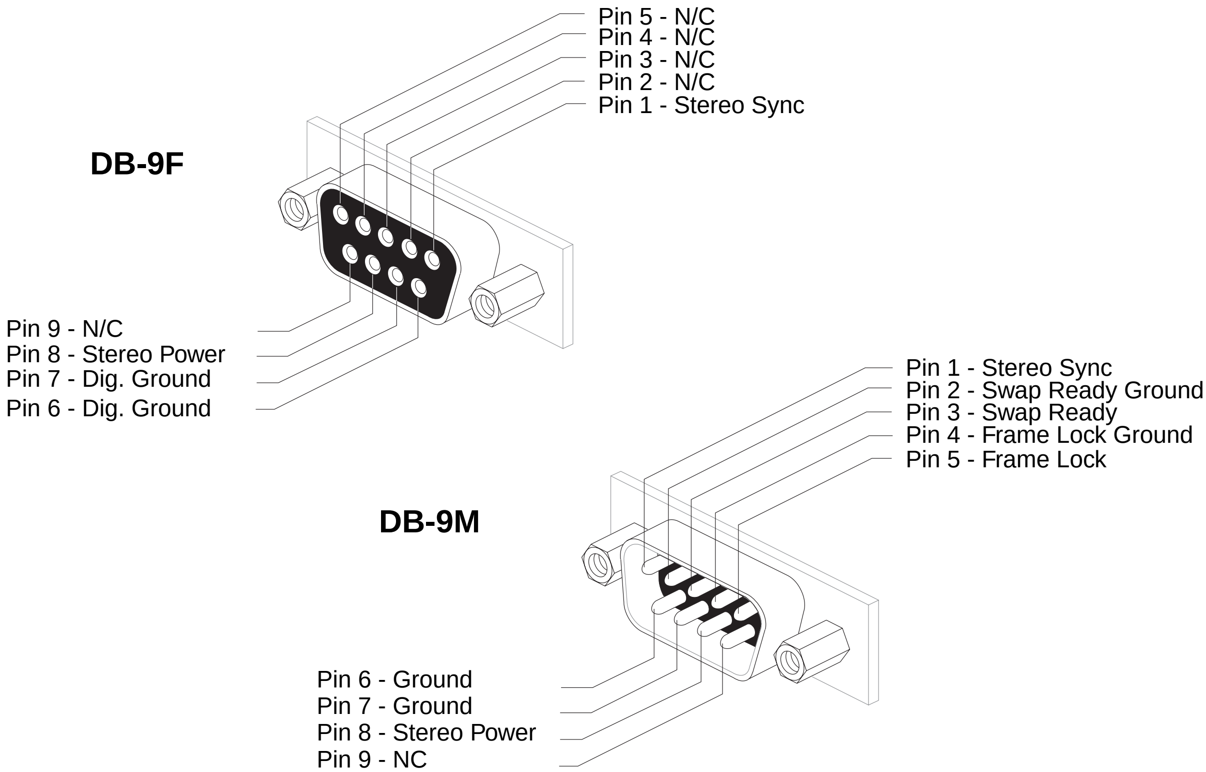


Figure 4-46 DB-9 Stereo Sync Connectors (Male and Female)

4.6.9.4 Pinout (DB-9F & DB-9M)

Table 4-42 DB-9 Stereo Sync Connector Pinouts

Pin	Signal Description	
	Male (DB-9M) OCTANE & Onyx2	Female (DB-9F) IMPACT
1	Stereo Sync - (1=left, 0=right)	
2	Not Used	Swap Ready Ground
3	Not Used	Swap Ready (for future use)
4	Not Used	Frame Lock Ground
5	Not Used	Frame Lock (for future use)
6	Digital Return Ground	
7	Digital Return Ground	
8	Stereo Power (+12Vdc, 0.5A)	
9	Not Used	

4.6.10 Swap Ready Output

The Swap Ready signal is used to synchronize several graphics heads to make sure they don't swap graphics buffers until all graphics heads are ready to change.

This is most often used on systems with 2 or 3 graphics heads. One graphics head may have a more complex scene to render, thus taking more time than the other (simpler) scene. The Swap Ready signal is used to keep the 2 (or 3) screens in sync with each other.

The signal is a TTL level, open collector Input / Output. It is internally pulled up. All graphics heads drive / listen to this input. When a head is ready, it drives this signal high. Only when all heads have driven this pin high will it be high (ready to swap). Under no circumstances should this pin ever be terminated!

4.7 Video Interfaces

There are a number of video interfaces available on IRIS systems and video options. Most are standard interfaces using standard connectors. Table 4-43 on page 4-92 shows these connections and where they can be found.

The Indy was the first base system to include any video input capability. The O2 builds on this by adding video output along with the video input.

Table 4-43 External Video Input Connections on SGI Systems

Chassis or VIdeo Option	Inputs					
	Composite	S-Video (Y/C)		Component (Y, R-Y, B-Y)	CCIR 601 Serial	CCIR 601 Parallel
	RCA Phono	4 Pin mini-DIN	7 Pin mini-DIN	BNC	BNC	DB-25
Indy	1	1				
Onyx						
O2	1		1			
Onyx2						
Indigo Video	3	3				
Galileo	3	3		1	1[2]	1[2]
Indigo^2 Video	3	3			1[2]	1[2]
Indy Video	2	1[3]				
Sirius	1	1		1	2	2
Video Creator	1 (BNC)	1		1		
Video Framer		1		1		1
CG3						

1.This connection only implements the connections required for the IndyCam (i.e. input only).

2.Available only with the Digital Breakout Box (D-BOB) option.

Table 4-44 External Video Output Connections on SGI Systems

Chassis or VIdeo Option	Outputs						I/O		Loopthru
	Composite	S-Video (Y/C)	Component (Y, R-Y, B-Y)	CCIR 601 Serial	CCIR 601 Parallel	Frame Grab	SGI Digital Video		Video Sync
	RCA Phono	4 Pin mini-DIN	BNC	BNC	DB-25	BNC	60 Pin Hi-Den	68 Pin Hi Density	BNC
Indy							1[1]		
Onyx	2 (BNC)	2				1			
O2	1	1						1	
Onyx2	1	1				1			2
Indigo Video	1	1							
Galileo	1	1	1	1[2]	1[2]	1[2]	1		
Indigo^2 Video	1	1		1[2]	1[2]	1[2]	1		
Indy Video	1	1					1[4]		
Sirius	1	1	1	1	1	1			
Video Creator	1 (BNC)	1	1						
Video Framer		1	1		1	1			
CG3	1								

4.7.1 Composite Input & Output

These signals comply with NTSC or PAL standards for composite video connections.

The connector type is either an RCA phono style or a BNC. The center conductor carries the signal itself and the outer conductor is used as a ground, or shield connection.

4.7.2 S-Video (Y/C) Input & Output

This signal format is identical to that used in the consumer video marketplace. The connectors used will either be the 4 Pin Mini-DIN type as used on consumer devices, via individual BNC's, or a 7 Pin Mini-DIN connector. On the O2 the 4 Pin Mini-DIN is used for S-Video output while the 7 Pin Mini-DIN is used for input. The additional three pins - SDA, SCL and 12V are used for communicating with external devices using the I^2C protocol.

4.7.2.1 Connector Drawing (4 Pin Mini-DIN)

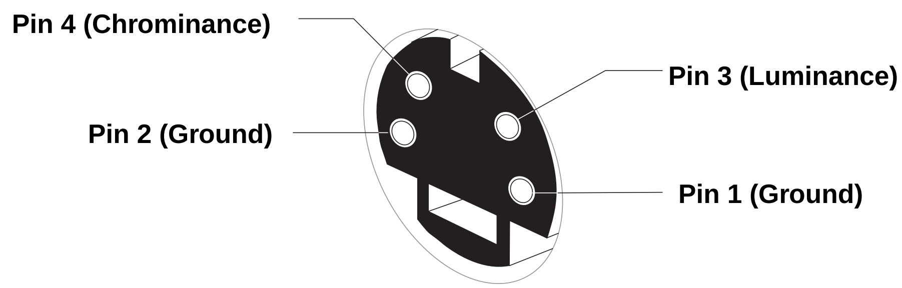


Figure 4-47 4 Pin Mini-DIN S-Video Connector

4.7.2.2 Pinout (4 Pin Mini-DIN)

Table 4-45 4 Pin Mini-DIN S-Video Connector Pinout

Pin	Signal Name	Description
1	GND	Ground
2	GND	Ground
3	Y	Luminance
4	C	Chrominance

4.7.2.3 Connector Drawing (7 Pin Mini-DIN)

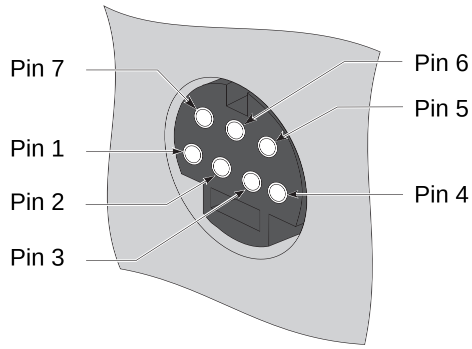


Figure 4-48 7 Pin Mini-DIN S-Video Input Connector

4.7.2.4 Pinout (7 Pin Mini-DIN)

Table 4-46 7 Pin Mini-DIN S-Video Input Pinout

Pin	Signal Name	Description
1	GND	Ground
2	SCL	Serial Clock
3	+5V	+5 Volts
4	GND	Ground
5	Y	Luminance
6	SDA	Serial Data
7	C	Chrominance

4.7.3 Analog Breakout Box Connection

This connection contains several analog video signals that will be broken out in an external breakout box.

4.7.3.1 Connector Drawing

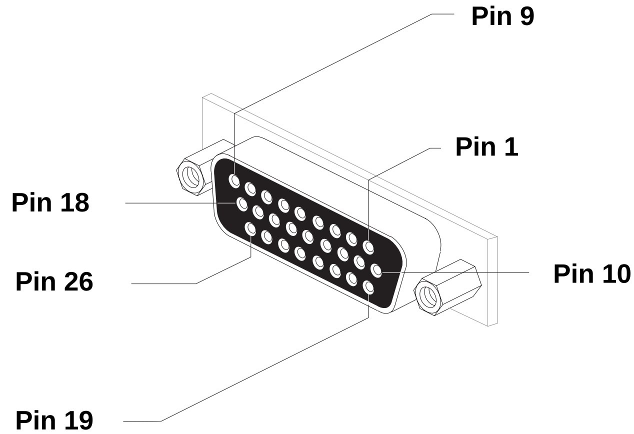


Figure 4-49 Analog Breakout Box Connector

4.7.3.2 Pinout

Table 4-47 Analog Breakout Box Connection

Pin	Signal Name	Description
1	BOUT	Blue Output
2	ROUT	Red Output
3	CSYNC	Composite Sync Out
4	YOUT	Luminance Output
5	COUT	Chrominance Output
6	YIN3	Luminance Input #3
7	CIN2	Chrominance Input #2
8	CIN1	Chrominance Input #1
9	YIN1	Luminance Input #1
10	GND	Ground
11	GND	Ground
12	GND	Ground
13	GND	Ground

Pin	Signal Name	Description
14	GND	Ground
15	GND	Ground
16	GND	Ground
17	GND	Ground
18	GND	Ground
19	GOUT	Green Output
20	GND	Ground
21	COMPOUT	Composite Video Output
22	GND	Ground
23	CIN3	Chrominance Input #3
24	GND	Ground
25	YIN2	Luminance Input #2
26	GND	Ground

4.7.4 Analog Component Video Input & Output

For this kind of connection, there are three signals - Y, R-Y and B-Y. Each signal is carried on an individual BNC connector where the center conductor carries the signal and the outer conductor is the ground, or shield.

4.7.5 CCIR 601 Serial Digital Video Input & Output

This connection is made via a BNC connector.

It complies with the CCIR 601 standard for digital video interfaces. For all options except Sirius Video it implements 8 bit digital video. The Sirius Video option is 10 bit digital video.

4.7.6 Frame Grab Output (BNC)

This signal is currently unused.

4.7.7 Video Sync Loopthru (BNC)

This is a video sync input and output pair. The system used the video sync signal to keep synchronized with external equipment - VTR's and other video gear. The signal loops through the system so it can be passed on to the next piece of equipment.

4.7.8 CCIR 601 Parallel Digital Video Input & Output

This connection is made via a DB-25 connector.

It complies with the CCIR 601 standard for digital video interfaces. For all options but the Sirius Video option it implements 8 bit digital video. The Sirius option uses all 10 bits.

4.7.8.1 Connector Drawing

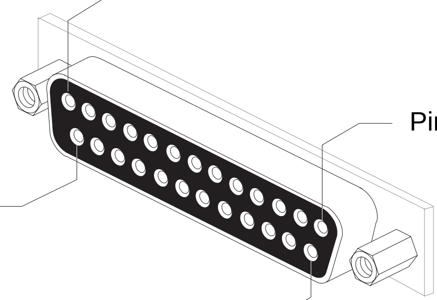


Figure 4-50 CCIR 601 Parallel Digital Video Connector

4.7.8.2 Pinout

Table 4-48 CCIR 601 Parallel Digital Video Connector Pinout

Pin	Signal Name	Description
1	CLK	Clock
2	GND	Ground
3	DATA9	Data Bit 9 (MSB)
4	DATA8	Data Bit 8
5	DATA7	Data Bit 7
6	DATA6	Data Bit 6
7	DATA5	Data Bit 5
8	DATA4	Data Bit 4
9	DATA3	Data Bit 3
10	DATA2	Data Bit 2
11	DATA1	Data Bit 1
12	DATA0	Data Bit 0
13	SHEILD	Cable Shield Connection

Pin	Signal Name	Description
14	CLK RET	Clock Return
15	GND	Ground
16	DATA9 RET	Data 9 Return
17	DATA8 RET	Data 8 Return
18	DATA7 RET	Data 7 Return
19	DATA6 RET	Data 6 Return
20	DATA5 RET	Data 5 Return
21	DATA4 RET	Data 4 Return
22	DATA3 RET	Data 3 Return
23	DATA2 RET	Data 2 Return
24	DATA1 RET	Data 1 Return
25	DATA0 RET	Data 0 Return

4.7.9 SGI Digital Video Interface

The SGI Digital Video Interface is one connector that incorporates two digital video ports. There are two variations on this connection. On the Indy one port is input only, while the other can be used for either input or output. The connector on the Indy is a high density, 60 pin connector. On the O2 one port is input, the other port is output. The connector used on the O2 is a 68 pin connector similar to the connector used for the external SCSI bus on the O2.

This protocol for this interface is similar, but not exactly the same as, the CCIR 601 Parallel Digital Video interface. For more detailed information on this interface, consult the SGI Digital Video Specification.

4.7.9.1 60 Pin Connector Drawing

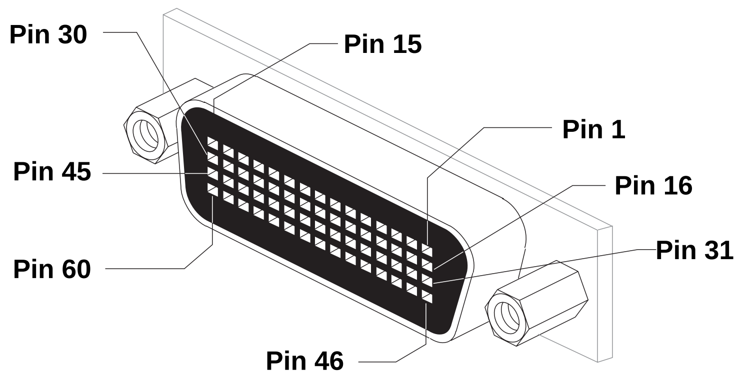


Figure 4-51 SGI Digital Video Connector

4.7.9.2 Connector Drawing (68 Pin)

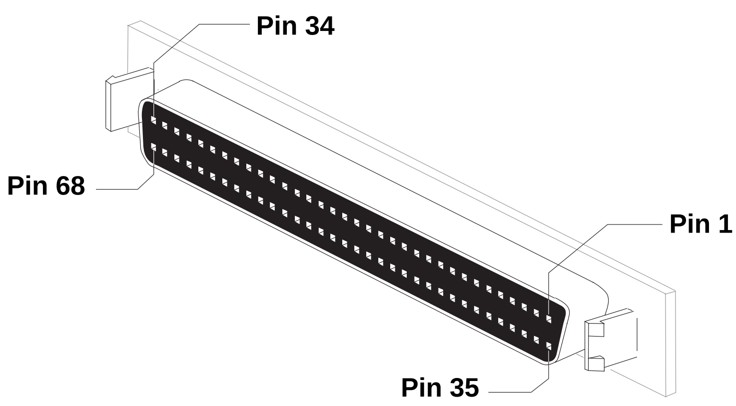


Figure 4-52 68 Pin Digital Video Connector

4.7.9.3 60 Pin Pinout

Table 4-49, shows the pinout for the SGI Digital Video Interface. The pins shown lightly shaded are those pins available at the IndyCam connector. The IndyCam connector does not support the second, input/output channel, of the Digital Video Interface.

Table 4-49 SGI Digital Video Connector Pinout

Pin	Signal Name	I/O	Pin	Signal Name	I/O
1	XDATAIO.0	I/O	31	XDATAIN.3	I
2	XDATAIO.0_RET	I/O	32	XDATAIN.3_RET	I
3	XDATAIO.1	I/O	33	XDATAIN.4	I
4	XDATAIO.1_RET	I/O	34	XDATAIN.4_RET	I
5	XDATAIO.2	I/O	35	XDATAIN.5	I
6	XDATAIO.2_RET	I/O	36	XDATAIN.5_RET	I
7	SDA_SEND	O	37	+12V_REC	I
8	DIR_SEND	O	38	+5V_REC	I
9	SCL_SEND	O	39	-12V_REC	I
10	TRIGIN_RET	I	40	*SPAREAIO_RET*	I/O
11	TRIGIN	I	41	*SPAREAIO*	I/O
12	XCLKIN_RET	I	42	XDATAIO.7_RET	I/O
13	XCLKIN	I	43	XDATAIO.7	I/O
14	*SPAREBIN_RET*	I	44	XDATAIO.6_RET	I/O
15	*SPAREBIN*	I	45	XDATAIO.6	I/O
16	XDATAIO.3	I/O	46	XDATAIN.0	I
17	XDATAIO.3_RET	I/O	47	XDATAIN.0_RET	I
18	XDATAIO.4	I/O	48	XDATAIN.1	I
19	XDATAIO.4_RET	I/O	49	XDATAIN.1_RET	I
20	XDATAIO.5	I/O	50	XDATAIN.2	I
21	XDATAIO.5_RET	I/O	51	XDATAIN.2_RET	I
22	+12V_SEND	O	52	SDA_REC	I
23	+5V_SEND	O	53	DIR_REC	I
24	-12V_SEND	O	54	SCL_REC	I
25	*SPAREAIN_RET*	I	55	TRIGOUT_RET	O
26	*SPAREAIN*	I	56	TRIGOUT	O
27	XDATAIN.7_RET	I	57	XCLKIO_RET	I/O
28	XDATAIN.7	I	58	XCLKIO	I/O
29	XDATAIN.6_RET	I	59	*SPAREBIO_RET*	I/O
30	XDATAIN.6	I	60	*SPAREBIO*	I/O

4.7.9.4 68 Pin Digital Video Pinout

Table 4-50 68 Pin Digital Video Connector Pinout

Pin	Signal Description
1	+5V
2	I^2C_SCL
3	GPI IN
4	GPI IN GND
5	OUTDATACLK
6	OUTDATACLKGND
7	INDATA9GND
8	INDATA9
9	INDATA8GND
10	INDATA8
11	INDATA7GND
12	INDATA7
13	INDATA6GND
14	INDATA6
15	INDATA5GND
16	INDATA5
17	INDATA4GND
18	INDATA4
19	INDATA3GND
20	INDATA3
21	INDATA2GND
22	INDATA2
23	INDATA1GND
24	INDATA1
25	INDATA0GND
26	INDATA0
27	INDATACLK
28	INDATACLKGND
29	RESERVED
30	-12V
31	RESERVED
32	RESERVED
33	RESERVED
34	RESERVED

Pin	Signal Description
35	+5V
36	I^2C_SDA
37	GPI OUT GND
38	GPI OUT
39	CAM MIC POS
40	CAM MIC NEG
41	OUTDATA9
42	OUTDATA9GND
43	OUTDATA8
44	OUTDATA8GND
45	OUTDATA7
46	OUTDATA7GND
47	OUTDATA6
48	OUTDATA6GND
49	OUTDATA5
50	OUTDATA5GND
51	OUTDATA4
52	OUTDATA4GND
53	OUTDATA3
54	OUTDATA3GND
55	OUTDATA2
56	OUTDATA2GND
57	OUTDATA1
58	OUTDATA1GND
59	OUTDATA0
60	OUTDATA0GND
61	RESERVED
62	RESERVED
63	RESERVED
64	+12V
65	RESERVED
66	RESERVED
67	RESERVED
68	RESERVED

4.8 Audio Interfaces

Starting with the Personal IRIS, IRIS systems started to include audio in and out capabilities as part of, or an option to, the basic system. Actually, in fact, there was hardware for audio output as early as the IP4 processor, but there was never software support for this hardware.

The basic complement of audio input/output for a system is: stereo line in, stereo line out, stereo microphone input, stereo headphone output, and AES Stereo Digital Audio input/output. Most of the systems use stereo mini-jacks for these connections, but RCA, BNC and even ADAT optical connections are now used for some audio connections. Some systems have augmented the basic capability by adding the ability to input or output four channels of audio at one time.

Table 4-51 shows the chassis that have analog audio capabilities and Table 4-52 shows the chassis with digital audio capabilities. Shaded boxes indicate that audio capability is not available. Numbers indicate the number of input or output channels that are available. Unless noted otherwise, all connections on the table are via stereo mini-jacks.

Table 4-51 Analog Audio Inputs and Outputs on SGI Systems

Chassis	Model	Inputs		Outputs	
		Line In	Microphone	Line Out	Headphone
Twin Tower	All				
Diehard	All				
Predator	All				
Diehard2	All				
Eveready	All[1]	2	2	2	2
Terminator	All[1]	2	2	2	2
Personal IRIS	4D/20, 25[2]	1	1	1	
	4D/30, 35[3]	2	2	2	2
Indigo	All	2	2	2	2
Indigo[2]	All	4	2	4	2
Indy	All	4	2	4	2
O2	All	2 (RCA)	2	4 (2 RCA, 1 stereo mini-jack)	2
OCTANE	All	2 (RCA)	2	2 (RCA)	2
Onyx2	Al	2 (RCA)	2	2 (RCA)	2

1. With the addition of the Audio/Serial Option card. or Vigra audio card
2. Audio on the 4D/20, 25 was 8 bit µ-law, all others are 16 bit linear.
3. Audio capability could be added to a 4D/30 or 4D/35 with an optional add-in audio card.

Terminator and Eveready systems may add audio capability by using an add-in card co-engineered by SGI and Vigra or by purchasing the Audio / Serial Option (ASO) card from Silicon Graphics.

Table 4-52 Digital Audio Inputs and Outputs on SGI Systems

Chassis	Model	I/O		Speaker Power
		AES Digital	Optical Digital	
Twin Tower	All			
Diehard	All			
Predator	All			
Diehard2	All			
Eveready	All[1]	2		
Terminator	All[1]	2		
Personal IRIS	4D/20, 25[2]			
	4D/30, 35[3]	2		
Indigo	All	2		
Indigo²	All	2		
Indy	All	2		
O2	All			
OCTANE	All	2 (RCA)	2 (ADAT)	1
Onyx2	Al	2 (BNC)	2 (ADAT)	1

4.8.1 Connector Notation

Many of the connectors used for audio are one of only a two types, the two most commonly used connectors will be shown here rather than repeated for each connection type. In addition, since the notations “tip”, “ring” and “sleeve” come from the names given an audio plug, a drawing of a typical stereo audio plug will be shown for reference. Each interface will make references to the these notations.

4.8.1.1 Stereo Audio Jack and Plug Drawing

Unless otherwise noted these jacks are 1/8” (3.5mm) jacks and plugs.

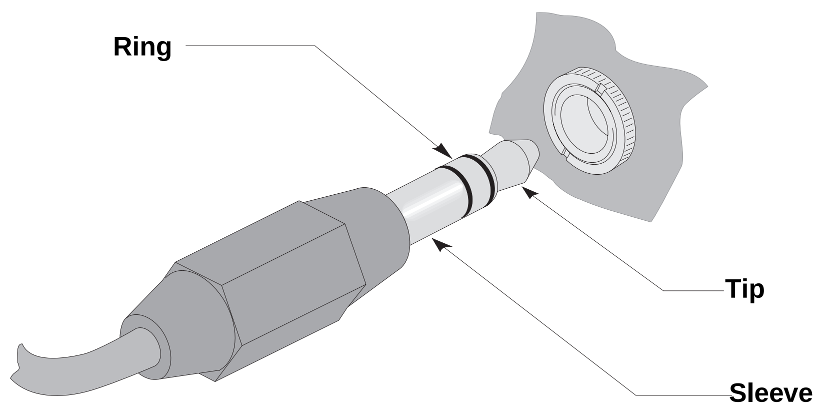


Figure 4-53 Audio Jack & Plug

4.8.1.2 RCA “Phono” Jack Drawing

The RCA style “phono” jack is the same as found in many consumer products. The center lead is the signal lead while the outside lead is the shield. The colored insert designates the use for the connector - audio right channel, audio left channel, or video

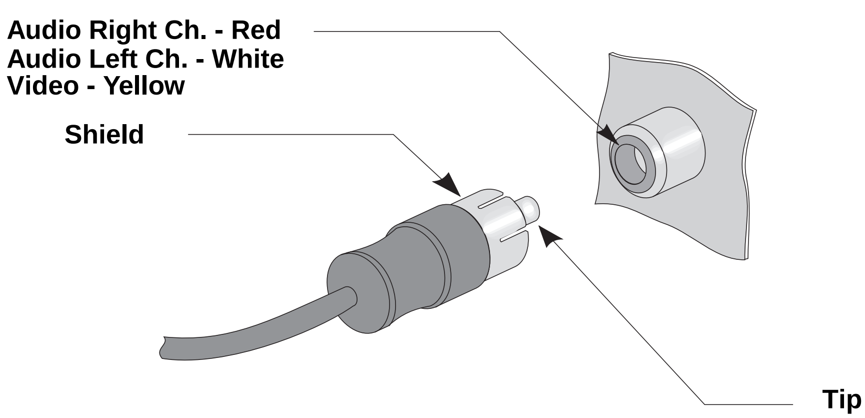


Figure 4-54 RCA “Phono” Jack

4.8.2 Audio Line In and Line Out Connections

Characteristics for the Line In and Line Out connections are shown in the table below.

Table 4-53 Audio Line Input and Output Characteristics

Model	Line Inputs		Line Outputs	
	Impedance	Full Scale Amplitude	Impedance	Full Scale Amplitude
Personal IRIS 4D/20/25	5kΩ	1 Vpp to 10 Vpp	600Ω	6 Vpp
Personal IRIS 4D/30, 35	5kΩ	1 Vpp to 10 Vpp	600Ω	6 Vpp
Indigo	5kΩ	1 Vpp to 10 Vpp	600Ω	6 Vpp
Indigo^2	20kΩ	0.63 Vpp to 8.4 Vpp	600Ω	4.7 Vpp
Indy	10kΩ	0.63 Vpp to 8.4 Vpp	600Ω	4.7 Vpp

4.8.2.1 Pinout

Table 4-54 Line In and Line Out Connection Pinout

Pin	Signal Name	Description
Tip	L	Left Channel Input or Output
Ring	R	Right Channel Input or Output
Sleeve	GND	Ground

4.8.3 Microphone Input and Headphone Output

Characteristics for the Microphone inputs and Headphone outputs are shown in the table below.

Table 4-55 Microphone Input and Headphone Output Characteristics

Model	Microphone Inputs		Headphone Outputs	
	Impedance	Full Scale Amplitude	Impedance	Level
Personal IRIS 4D/20/25	600Ω		8Ω	
Personal IRIS 4D/30, 35	2kΩ	0.25 Vpp to 2.5 Vpp	16Ω	200 mW into 32Ω load
Indigo	2kΩ	0.25 Vpp to 2.5 Vpp	16Ω	200 mW into 32Ω load
Indigo[2]	1.5kΩ	0.063 Vpp to 0.84 Vpp	10Ω	57 mW into 32Ω load
Indy	2kΩ	0.063 Vpp to 0.84 Vpp	10Ω	57 mW into 32Ω load

4.8.3.1 Microphone Pinout

Table 4-56 Microphone Connection Pinout

Pin	Signal Name	Description
Tip	L	Left Channel Microphone Input
Ring	R	Right Channel Microphone Input
Sleeve	GND	Ground

4.8.3.2 Headphone Pinout

Table 4-57 Headphone Connection Pinout

Pin	Signal Name	Description
Tip	L	Left Channel Headphone Output
Ring	R	Right Channel Headphone Output
Sleeve	GND	Ground

4.8.4 AES Stereo Digital Audio Input/Output

This connection provides a stream of digital audio data that complies with the AES3 / AES11 / SPDIF digital audio specification.

The connector used for this signal is either a stereo audio jack (as shown in Figure 4-53), an RCA jack, or a BNC connector. If the connector is a stereo audio jack, the pinout is as specified in Table 4-59. If the connector is an RCA or BNC, the center conductor is the signal and outside conductor is ground. In this case one connector is used for input and another is used for output.

Table 4-58 AES Stereo Digital Audio Input / Output Characteristics

Model	Input		Output	
	Impedance	**Full Scale Amplitude**	**Impedance**	**Level**
Personal IRIS 4D/20/25	Not Available			
Personal IRIS 4D/30, 35	Not Available			
Indigo, Indigo², Indy, OCTANE, Onyx2	75Ω (transformer coupled)	0.5 Vpp nominal	75Ω (transformer coupled)	0.5 Vpp into 75Ω load

4.8.4.1 Pinout

Table 4-59 AES Stereo Digital Audio Connection Pinout

Pin	Signal Name	Description
Tip	Out	AES Stereo Digital Output
Ring	In	AES Stereo Digital Input
Sleeve	GND	Ground

4.8.5 ADAT Optical Digital Audio Input/Output

This audio connection is made via a fiber-optic cable and connector. One connector is used for input and a separate one used for output. The format of the data complies with the AES3 / IEC958 stereo 24-bit digital, optical 24-bit stereo SPDIF, or 24-bit 8-channel ADAT. The connector type is a 12.8 Mb / sec EIJA RCZ-6901

4.8.5.1 Connector Drawing

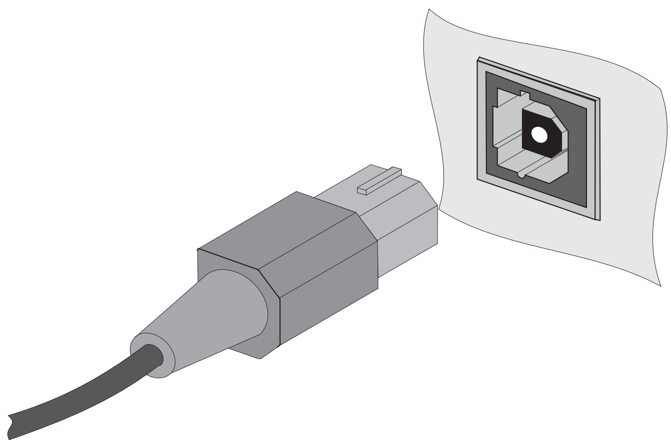


Figure 4-55 Optical Digital Audio Connector

4.8.6 Speaker Power Connection

The Onyx2 and OCTANE systems incorporate a Speaker Power output for use with external speakers. The voltage available at the connector is 10 Volts and can supply a maximum current of 0.5 Amps. The connector used for this is a 3.5mm mini-jack with two contacts (tip and shield only, no ring). The tip contact is connected to +10 Volts, the shield is connected to ground.

4.9 CPU Interfaces

Starting with the Onyx and Challenge machines Interrupt Inputs and Outputs have been available on the high end systems. These interfaces can be used to synchronize two or more machines. Table 4-60 shows the systems where these interfaces are available.

Table 4-60 CPU Interrupt Interfaces

Chassis	CPU Input(s)	CPU Output(s)
Onyx	2	4
Challenge L & XL	2	4
Origin 2000	1	1
Onyx2	1	1

4.9.1 3 Conductor Audio Jack and Plug

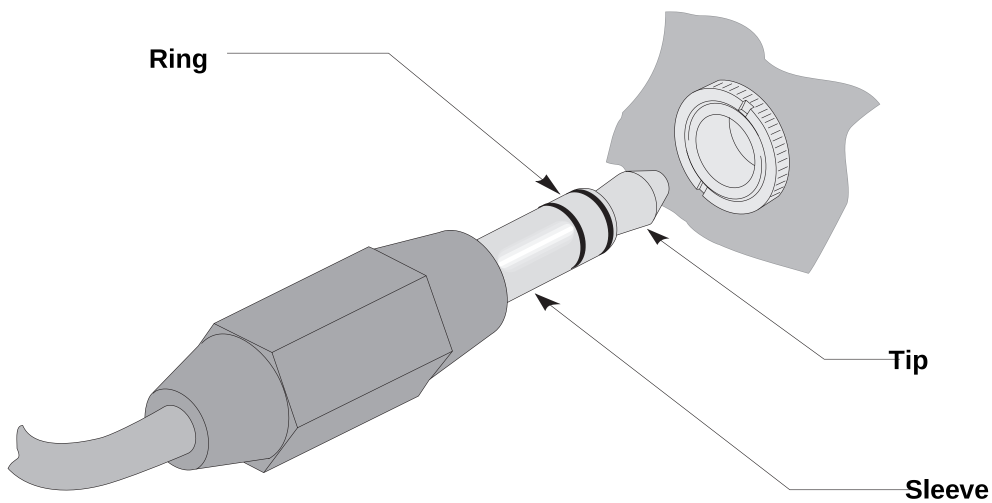


Figure 4-56 Interrupt Jack and Plug

4.9.2 Pinout

Table 4-61 Interrupt Input/Output Pinout

Pin	Signal
Tip	Interrupt Input/Output (active low)
Ring	+5 Volts
Sleeve	Chassis Ground/ Cable Shield

4.9.3 Interrupt Inputs

These inputs allow an interrupt signal generated by another machine to directly control the system. For example, a particular action in software could be programmed to wait for the receipt of an interrupt signal from another machine.

These inputs are opto-isolated and operate as an open collector current loop. The source resistance is 420 ohms pulled up to +5 Volts. The connections are via a 3 conductor 1/8" audio jack. The connector pinouts are shown in Table 4-61.

On those systems with more than one interrupt input the system does not distinguish between a signal received at either of the two input connections. Therefore it is unimportant which connector is used for an input interrupt. For more information on this signal consult the 'ei' (external interrupt) manpage.

4.9.4 Interrupt Outputs

There are four interrupt outputs. The interrupt outputs are used to send an interrupt signal to another machine for synchronization purposes. Some systems have one interrupt output, others have four outputs (see Table 4-60). Unlike the Interrupt Inputs, the outputs can be individually driven.

Like the inputs, the outputs are opto-isolated and operate as an open collector current loop. The source resistance is 420 ohms pulled up to +5 Volts. The connections are via a 3 conductor 1/8" audio jack. The connector pinouts are shown in Table 4-61.

For more information on this signal consult the 'ei' (external interrupt) manpage.

4.10 Bus Interfaces

There are six buses supported by IRIS systems - VME, GIO, EISA, PCI, IBUS and XIO bus. The VME, GIO, EISA and PCI buses are buses that developers can create boards for. The IBUS and XIO buses are proprietary buses developed by Silicon Graphics and not generally available for developers to design to.

Most of the early systems supported VME where add-in cards could be either 6U or 9U sized. 6U sized cards were added using an extender board. Although the card slots for Twin Tower, Single Tower, Deskside and Rack systems are all 9U sized, not all of these slots are configured as VME slots. This is covered in more detail in the section on backplanes starting on page 4-133. The Personal IRIS supported one 6U VME card.

Starting with the Indigo, the GIO (Graphics I/O) bus became the bus for expansion. There are three variations of the GIO bus. Two are physically identical, differing only in the bus protocol (GIO32 and GIO32-bis). The board size for these two is roughly 3" by 6". The third, GIO64, is a much larger board and, as can be noted from the name, is 64 bits wide instead of 32 bits wide. Boards for this bus are roughly the same size as EISA boards since both GIO64 boards and EISA boards live in the same backplane. The outline of the board does differ from a standard EISA board however. A more detailed description of the GIO bus protocols, electrical requirements and pinouts is documented in the GIO Bus Specification. This document is available (under non-disclosure) from the Developer Program.

The IBUS is the connection that is available on the IO4 board. Silicon Graphics makes several "mezzanine" boards available that use this interface. An example is the Audio/Serial Option (ASO) board (see Section 4.1.4 and Table 4-51). Due to the complexity and cost of design this bus is not generally available for developers for design purposes.

The EISA bus is the industry standard bus as used by the PC community. It's data paths are 32 bits wide. The Indigo^2 is the only chassis that supports the EISA bus. With the introduction of the Indigo^2 systems with IMPACT graphics, the number of EISA and GIO connectors changed due to additional components and connectors on the backplane.

The newer series of systems (O2, OCTANE, Origin200, Origin2000 & Onyx2) include PCI bus capability. The PCI bus supports both 32 and 64 bit PCI cards. The "PCI Developer Guide", available from the Developer Program, documents the PCI bus and the architectures where it can be found.

The XIO bus is also used in the newer series of systems (with the exception of the O2 and Origin200). This is a proprietary bus of very high bandwidth. Some of the subsystems of the OCTANE, Origin2000 and Onyx2 are implemented as XIO modules. A good example is the graphics for OCTANE, the Server Base I/O module for the Origin2000 and the Graphics Base I/O module for the Onyx2. Again, due to the complexity and cost of design this bus is not generally available for developers for design purposes.

A simple comparison of bus bandwidths is shown in Table 4-62.

Table 4-62 Bus Bandwidths

Bus	Bus WIdth	Maximum Bandwidth
VME	32 bits	26 - 28 MB/sec
GIO32 or GIO32-bis	32 bits	100 MB/sec
GIO64 (Indigo^2)	64 bits	200 MB./sec
EISA (Indigo^2)	32 bits	18 - 21 MB/sec
PCI	32 bits 64 bits	100 MB/sec 200 MB/sec
IBUS	64	280 MB/sec
XIO	16	800 MB/sec

Table 4-63 shows which busses are supported by IRIS chassis. Numbers in the table indicate how many boards or slots are available but not necessarily the total number of slots contained in the chassis. For VME systems many of the 9U slots are used by CPU or graphics cards that do not have a VME pinout (or in some cases VME-like connectors).

The table also does not address the number of boards or slots available in large multi-rack systems such as the Origin2000 and Onyx2. The numbers quoted in the table reflect the number of boards or slots in a single rack module.

Specific notes related to Table 4-63 are:

1. These slots are also used by the CPU, disk controllers, ethernet and any memory boards.
2. Predator Servers have 2 VME busses. Bus A has 6 slots, Bus B has 5 slots.
3. The Onyx system may add either an expansion VME card cage providing 20 additional VME64 slots, or a graphics expansion card cage providing 6 additional VME64 slots (as well as additional graphics slots).
4. The Challenge XL system may add an expansion VME card cage providing 20 additional VME64 slots.
5. GIO64 and EISA boards in an Indigo^2 share 4 *physical* slots.
6. VME 64 slots on Eveready and Terminator chassis do not support VSB pins.
7. The backplane for the IMPACT has four physical GIO64 connections, but there are only two logical GIO64 connections.
8. The PCI Card Cage is an option on the OCTANE, Origin2000 and Onyx2 systems

Table 4-63 Bus Interfaces on IRIS Systems

Chassis	Model/ Graphics	VME 32		VME 64	IBUS	GIO32	GIO32-bis	GIO64	EISA	PCI		XIO
		9U	6U	9U						1/2	Full	
Twin Tower12 Slot	All	8[1]										
Twin Tower15 Slot	All	4										
Diehard	All	4										
Predator	GTX, VGX, VGXT	6										
	Server	6 + 5[2]										
	SkyWriter	4										
Diehard2	Crimson	4										
Personal IRIS	All		1									
Eveready	Onyx - VTX, RE[2]			3	2 per IO4 board							
	Challenge L Server			5								
Terminator	Onyx - VTX, RE[2]			3 + 20 or 6[3]								
	Challenge XL Server			5 + 20[4]								
Indigo	R3000					2						
	R4000						2					
Indigo[2]	Extreme, XZ & XL							2[5]	4[5]			
	IMPACT							2[7]	3			
Indy	All						2					
O2	All									1		
OCTANE	All									1[8]	2[8]	4
Origin200	All										3	
Origin2000	Deskside, Rackmount									1[8]	2[8]	12
Onyx2	Deskside									1[8]	2[8]	6
	Rackmounts									1[8]	2[8]	12

4.10.1 VME32 (9U)

The VME32 slots can accept either 9U or 6U sized boards. 6U boards may be either installed directly into the backplane in P1 and P2 connectors, or can be installed on an extender.

Note that VME cards for SGI systems do not require front panels. Front panels are normally required for EMI sealing and connector mounting. Since all the system using VME (with the exception of the Personal IRIS) rely on the I/O Panel for EMI sealing, front panels are necessary. In fact, installing a 6U card with a front panel directly into the backplane will almost certainly cause the front panel to short out against any card in the slot to the right of the board.

Systems supporting VME32 have backplane pins that allow VSB connections to be made. VME64 slots do not.

4.10.1.1 Board Outline

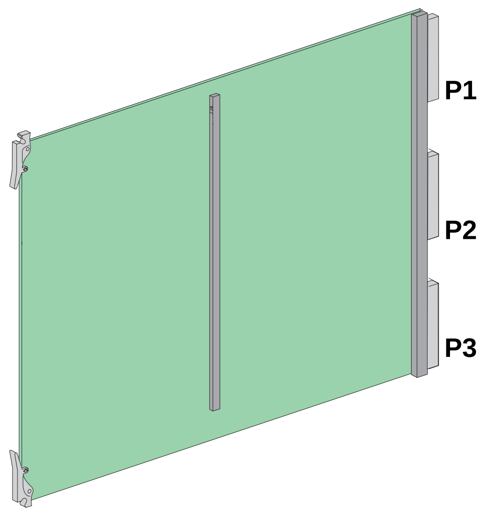


Figure 4-57 9U VME Board

4.10.1.2 Backplane Jumpering

VME backplanes require the four Bus Grant In & Out lines and the Interrupt Acknowledge line to be passed from one card slot to the next. On the early IRIS backplanes (specifically the 12 slot Twin Tower chassis) required jumpers to be put in place for these 5 signals for every empty slot to allow proper operation of the system. The 5 jumpers must removed for every slot where a board is installed.

Starting with the 15 Slot Twin Tower chassis, the backplanes were designed so that, in most cases, jumpers were not required. If VME cards were installed starting in the leftmost VME slot and with additional cards going into the next VME slot to the right, no jumpers would be required. If, however, an empty slot was left between two slots, or if the first VME card was not in the leftmost VME slot, jumpers would be required for each empty slot.

4.10.1.3 Power Budget

The table below shows the maximum current available for each of the supply voltages on the VME connectors.

Table 4-64 VME32 Power Budget (Twin & Single Towers)

Voltage	Max Current	Power
+ 5 V	5 A	25 W
+12 V	0.1 A	1.2 W
- 12 V	0.1 A	1.2 W
Total Power Budget (per slot)		**28 W**

An exception to this is that some DieHard chassis have one slot that complies with “Sun VME” power requirements. It’s power allocation is shown below:

Table 4-65 VME32 Power Budget (Diehard & Diehard2)

Voltage	Max Current	Power
+ 5 V	7 A	35 W
+12 V	0.1 A	1.2 W
- 12 V	0.1 A	1.2 W
-5.2 V	0.1 A	0.52 W
Total Power Budget (per slot)		**41 W**

4.10.1.4 Pinout

Table 4-66 VME32 Pinout

Pin	P1			P2			P3		
	A	B	C	A	B	C	A	B	C
1	D00	BBSY*	D08		+5V		+5V		GND
2	D01	BCLR*	D09		GND		+5V		GND
3	D02	ACFAIL	D10		RES.		+5V		GND
4	D03	BG0IN*	D11		A24		+5V		GND
5	D04	BG0OUT*	D12		A25		+5V		GND
6	D05	BG1IN*	D13		A26		+5V		GND
7	D06	BG1OUT*	D14		A27		+5V		GND
8	D07	BG2IN*	D15		A28		+5V		GND
9	GND	BG2OUT*	GND		A29		+5V		GND
10	SYSCLK	BG3IN*	SYSFAIL*		A30		+5V		GND
11	GND	BG3OUT*	BERR*	U	A31	U	+5V	U	GND
12	DS1*	BR0*	SYSRESET*	S	GND	S	+5V	S	GND
13	DS0*	BR1*	LWORD*		+5V		+5V		GND
14	WRITE*	BR2*	AM5	E	D16	E	+5V	E	GND
15	GND	BR3*	A23	R	D17	R	+5V	R	GND
16	DTACK	AM0	A22		D18		+5V		GND
17	GND	AM1	A21	D	D19	D	+5V	D	GND
18	AS*	AM2	A20	E	D20	E	+5V	E	GND
19	GND	AM3	A19	F	D21	F	+5V	F	GND
20	IACK*	GND	A18	I	D22	I	+5V	I	GND
21	IACKIN*	SERCLK	A17		D23		+5V		GND
22	IACKOUT*	SERDAT*	A16	N	GND	N	+5V	N	GND
23	AM4	GND	A15	E	D24	E	+5V	E	GND
24	A07	IRQ7*	A14	D	D25	D	+5V	D	GND
25	A06	IRQ6*	A13		D26		+5V		GND
26	A05	IRQ5*	A12		D27		+12V		+12V
27	A04	IRQ4*	A11		D28		+12V		+12V
28	A03	IRQ3*	A10		D29		-12V		-12V
29	A02	IRQ2*	A09		D30		-12V		-12V
30	A01	IRQ1*	A08		D31		Vee		Vee
31	-12V	+5STDBY	+12V		GND		Vee		Vee
32	+5V	+5V	+5V		+5V		Vee		Vee

4.10.2 VME32 (6U)

The Personal IRIS has one 6U sized VME slot. It's pinout is identical to the P1 and P2 pinouts described in Table 4-66, "VME32 Pinout", on page 4-116.

Access to the user defined pins of P2 is available in one of two different means depending on the Personal IRIS model. In the 4D / 20 or 4D / 25 access to the P2 user defined pins is only available inside the E-Module. A Eurocard style connector (AMP part number 650473-5) connects to the back of the VME slot P2 connector. This connection can, if necessary, be brought out of the E-Module via a blank panel just above the audio jacks on the I / O panel area.

On the 4D / 30 and 4D / 35, access to the user defined P2 pins are available via a high density 100 pin connector on the I / O panel area of the E-Module. This interface is documented in the next section.

For EMI purposes, VME boards must have an I / O Panel that provides a seal against the E-Module. The opening for the VME slot requires a panel different than the panels found on most "standard" VME boards (which, by their design do not provide any EMI sealing). A "standard" VME board will install into the single slot without any problem - but it will not provide any EMI sealing.

4.10.2.1 Board Outline

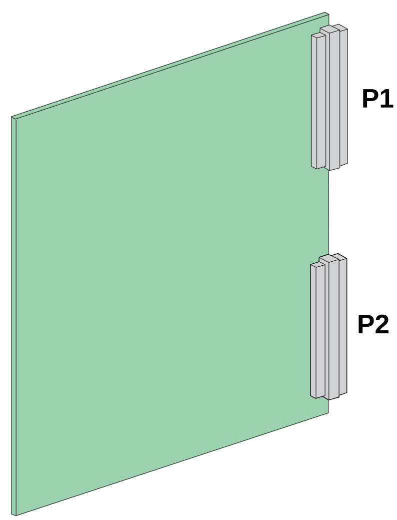


Figure 4-58 6U VME Board

4.10.2.2 Backplane Jumpering

Since there is only one slot in the Personal IRIS, there are no backplane jumpering considerations.

4.10.2.3 Power Budget

The table below shows the maximum current available for each of the supply voltages on the VME connectors.

Table 4-67 VME32 Power Budget (Personal IRIS)

Voltage	Max Current	Power
+ 5 V	5 A	25 W
+12 V	0.1 A	1.2 W
- 12 V	0.1 A	1.2 W
Total Power Budget (per slot)		**28 W**

4.10.3 VME P2 Expansion

Access to the user defined pins of the VME P2 connector is possible on most all of the IRIS systems that support VME. In the case of the Twin Tower, Diehard, Diehard2 and Eveready this is done by connecting to connector pins on the back of the backplane.

For the Personal IRIS two methods are used to connect to these pins. One, on the 4D/20 and 4D/25 is via a connection on the back of the P2 connector inside the E-Module. Using a Eurocard style connector will accomplish this.

On the 4D/30 and 4D/35 the user defined pins, as well as some power and ground connections are brought out to a high density 100 pin connector in the I/O Panel area of the E-Module. This section documents that interface.

4.10.3.1 Connector Drawing

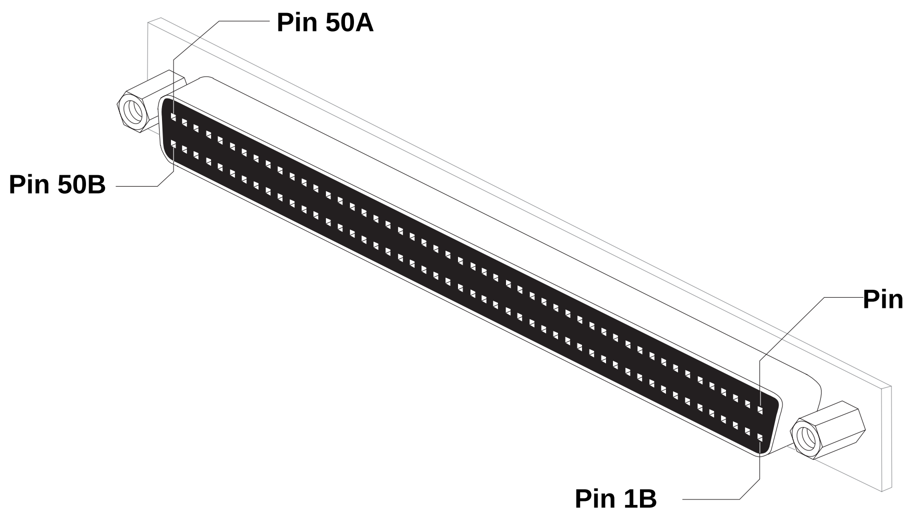


Figure 4-59 VME P2 Expansion Connector

4.10.3.2 Power Availability

The maximum current available at this connector for the voltages supplied is shown in the table below.

Table 4-68 VME P2 Expansion Power Budget

Voltage	Current	Power
+ 5 V	2.0 A	10 W
+12 V	2.0 A	24 W
- 12 V	2.0 A	24 W
Total Power Budget (per slot)		**58 W**

4.10.3.3 Pinout

Table 4-69 VME P2 Expansion Pinout (Personal IRIS)

Pin	SIgnal
1A	GND
2A	+5V
3A	GND
4A	+5V
5A	GND
6A	-12V
7A	GND
8A	-12V
9A	GND
10A	P2, A1
11A	P2, A2
12A	P2, A3
13A	P2, A4
14A	P2, A5
15A	P2, A6
16A	P2, A7
17A	P2, A8
18A	P2, A9
19A	P2, A10
20A	P2, A11
21A	P2, A12
22A	P2, A13
23A	P2, A14
24A	P2, A15
25A	P2, A16

Pin	Signal
1B	GND
2B	+5V
3B	GND
4B	+5V
5B	GND
6B	-12V
7B	GND
8B	-12V
9B	GND
10B	P2, C1
11B	P2, C2
12B	P2, C3
13B	P2, C4
14B	P2, C5
15B	P2, C6
16B	P2, C7
17B	P2, C8
18B	P2, C9
19B	P2, C10
20B	P2, C11
21B	P2, C12
22B	P2, C13
23B	P2, C14
24B	P2, C15
25B	P2, C16

Pin	Signal
26A	P2, A17
27A	P2, A18
28A	P2, A19
29A	P2, A20
30A	P2, A21
31A	P2, A22
32A	P2, A 23
33A	P2, A 24
34A	P2, A25
35A	P2, A26
36A	P2, A27
37A	P2, A28
38A	P2, A29
39A	P2, A30
40A	P2, A31
41A	P2, A32
42A	GND
43A	+5V
44A	+5V
45A	GND
46A	-12V
47A	GND
48A	+12V
49A	GND
50A	+12V

Pin	Signal
26B	P2, C17
27B	P2, C18
28B	P2, C19
29B	P2, C20
30B	P2, C21
31B	P2, C22
32B	P2, C23
33B	P2, C24
34B	P2, C25
35B	P2, C26
36B	P2, C27
37B	P2, C28
38B	P2, C29
39B	P2, C30
40B	P2, C31
41B	P2, C32
42B	GND
43B	+5V
44B	+5V
45B	GND
46B	-12V
47B	GND
48B	+12V
49B	GND
50B	+12V

4.10.4 VME64 (9U)

The VME64 slots available in the Onyx and Challenge systems are the same physical size as those found in other IRIS systems. However, they have additional data signals making the data bus 64 bits wide. These slots do not support VSB connections.

4.10.4.1 Board Outline

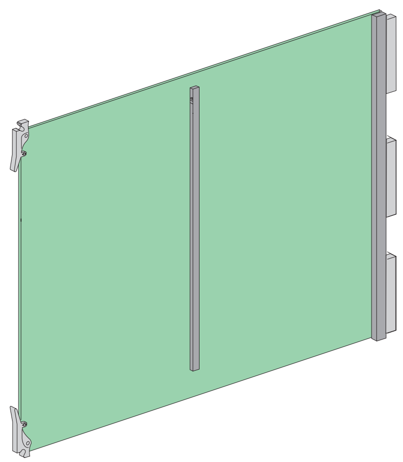


Figure 4-60 9U VME64 Board

4.10.4.2 Backplane Jumpering

Jumpering the Bus Grant In & Out and Interrupt Acknowledge signals follow the same rules as the VME slots in previous Single Tower and Rack systems.

In most cases, jumpers are not required. If VME cards are installed starting in the leftmost VME slot and with additional cards going into the next VME slot to the right, no jumpers would be required. If, however, an empty slot is left between two slots, or if the first VME card is not in the leftmost VME slot, jumpers are required for each empty slot.

4.10.4.3 Power Budget

Table 4-70 VME64 Power Budget (Onyx and Challenge)

Voltage	Current	Power
+ 5 V	8A	40 W
+12 V	0.2 A	2.4 W
- 12 V	0.2 A	2.4 W
-5.2 V	0.2 A	1 W
Total Power Budget (per slot)		**48 W**

4.10.4.4 Pinout

Table 4-71 VME64 Pinout

Pin	P1 A	P1 B	P1 C	P2 A	P2 B	P2 C	P3 A	P3 B	P3 C
1	D00	BBSY*	D08		+5V		+5V		GND
2	D01	BCLR*	D09		GND		+5V		GND
3	D02	ACFAIL	D10		RES.		+5V		GND
4	D03	BG0IN*	D11		A24		+5V		GND
5	D04	BG0OUT*	D12		A25		+5V		GND
6	D05	BG1IN*	D13		A26		+5V		GND
7	D06	BG1OUT*	D14		A27		+5V		GND
8	D07	BG2IN*	D15		A28		+5V		GND
9	GND	BG2OUT*	GND		A29		+5V		GND
10	SYSCLK	BG3IN*	SYSFAIL*		A30		+5V		GND
11	GND	BG3OUT*	BERR*	U	A31	U	+5V	U	GND
12	DS1*	BR0*	SYSRESET*	S	GND	S	+5V	S	GND
13	DS0*	BR1*	LWORD*	E	+5V	E	+5V	E	GND
14	WRITE*	BR2*	AM5		D16		+5V		GND
15	GND	BR3*	A23	R	D17	R	+5V	R	GND
16	DTACK*	AM0	A22		D18		+5V		GND
17	GND	AM1	A21	D	D19	D	+5V	D	GND
18	AS*	AM2	A20	E	D20	E	+5V	E	GND
19	GND	AM3	A19	F	D21	F	+5V	F	GND
20	IACK*	GND	A18	I	D22	I	+5V	I	GND
21	IACKIN*	SERCLK	A17		D23		+5V		GND
22	IACKOUT*	SERDAT*	A16	N	GND	N	+5V	N	GND
23	AM4	GND	A15	E	D24	E	+5V	E	GND
24	A07	IRQ7*	A14	D	D25	D	+5V	D	GND
25	A06	IRQ6*	A13		D26		+5V		GND
26	A05	IRQ5*	A12		D27		+12V		+12V
27	A04	IRQ4*	A11		D28		+12V		+12V
28	A03	IRQ3*	A10		D29		-12V		-12V
29	A02	IRQ2*	A09		D30		-12V		-12V
30	A01	IRQ1*	A08		D31		Vee		Vee
31	-12V	+5STDBY	+12V		GND		Vee		Vee
32	+5V	+5V	+5V		+5V		Vee		Vee

4.10.5 GIO32/32-bis

The GIO32 or GIO32-bis buses are used in the Indigo and Indy products (see Table 4-63, "Bus Interfaces on IRIS Systems", on page 4-113 for specific details). Since the two GIO slots on these systems are both attached to the motherboard, or CPU board, it is possible to design a board that takes up both slot spaces.

GIO slots have a fixed address space. Slot 0 always occupies a particular address space while Slot 1 occupies a different address space. This is unlike VME where settings on the board itself determine the address the board responds to.

The I/O panels for Indigo and Indy are different. There is more space for connectors on the Indigo I/O panel. However, if a board is designed to fit the Indy I/O panel space, it will also fit in an Indigo - provided it has the appropriate I/O panel. This single wide board in the drawing below shows the Indy style I/O panel, while the double wide board shows the Indigo style I/O panel. Dimensions for both of these panels are available in the GIO Bus Specification.

4.10.5.1 Board Outline

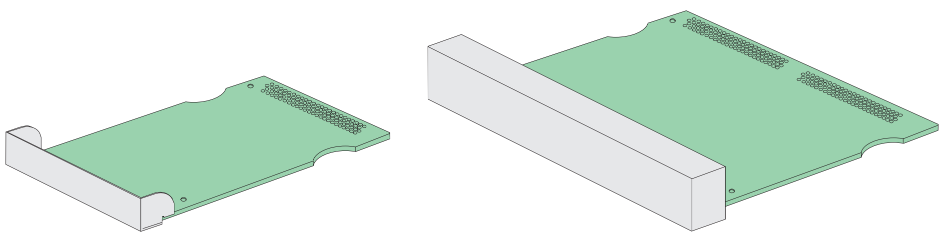


Figure 4-61 Single & Double GIO32/32-bis Boards

4.10.5.2 Power Budget

The following table shows the maximum current draw for voltages in a GIO slot.

Table 4-72 GIO32/32-bis Power Budget

Voltage	Current	Power
+ 5 V	2 A	10 W
+12 V	0.15 A	1.8 W
- 12 V	0.15 A	1.8 W
Total Power Budget (per slot)		**13.6 W**

4.10.5.3 Pinout

Consult the "GIO Bus Specification" for a complete pinout of the GIO32/32-bis bus.

4.10.6 GIO64 Bus

A GIO64 board is the same size as an EISA board. This is due to the fact that the two buses share four physical slots in the Indigo[2] (consult page 4-139 for a drawing and explanation).

The I/O panel space for a GIO64 board is identical to that for an EISA board.

4.10.6.1 Board Outline

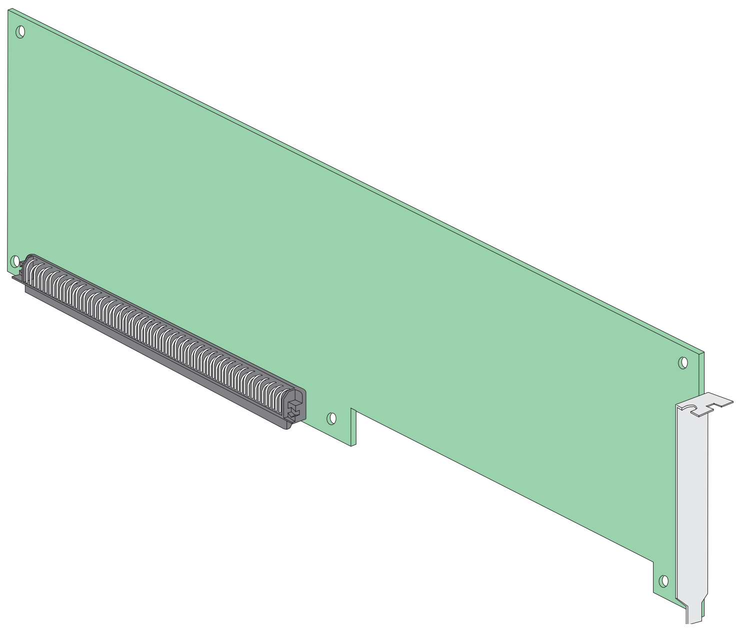


Figure 4-62 GIO64 Board

4.10.6.2 Power Budget

The following table shows the maximum current draw for voltages in a GIO64 slot.

Table 4-73 GIO64 Power Budget

Voltage	Current	Power
+ 5 V	4.5 A	22.5 W
+12 V	1 A	12 W
- 12 V	0.2 A	2.4 W
Total Power Budget (per slot)		**36.9 W**

4.10.6.3 Pinout

Consult the "GIO Bus Specification" for a complete pinout of the GIO64 bus.

4.10.7 EISA Bus

This is the same bus used by PC compatibles. EISA bus boards share four physical slots with GIO64 boards in the Indigo^2 (consult the section on backplanes for a drawing and explanation).

Since the EISA bus is a superset of the ISA bus, ISA boards will also fit into the Indigo^2.

An EISA or ISA board must have a software driver to integrate it with the IRIX operating system. This driver can be a user level driver or a kernel level driver. For more information about drivers in general, and EISA / ISA drivers specifically, consult the "IRIX Device Driver Programming Guide".

4.10.7.1 Board Drawing

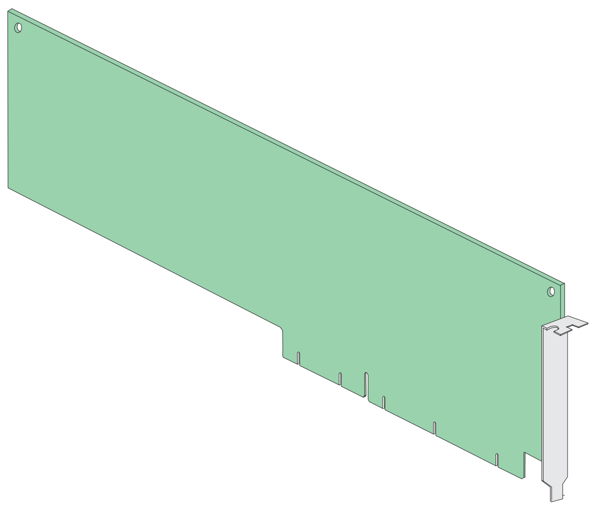


Figure 4-63 EISA Board

4.10.7.2 Power Budget

The following table shows the maximum current draw for voltages in an EISA slot.

Table 4-74 EISA / ISA Power Budget

Voltage	Current	Power
+ 5 V	4.5 A	22.5 W
- 5 V	0.1 A	0.5 W
+12 V	0.25 A	3.0W
- 12 V	0.08 A	1.0 W
Total Power Budget (per slot)		**27.0 W**

4.10.7.3 Pinout

Table 4-75 EISA / ISA Connector Pinout (Large Connector)

Row F	Row B	Pin	Row A	Row E
GND	GND	1	IOCHK*	CMD*
+5 V	RESET	2	SD7	START*
+5 V	+5 V	3	SD6	EXRDY
Reserved	IRQ9	4	SD5	EX32*
Reserved	-5 V	5	SD4	GND
Key	DRQ2	6	SD3	Key
Reserved	-12 V	7	SD2	EX16*
Reserved	SRDY*	8	SD1	SLBURST*
+12 V	+12 V	9	SD0	MSBURST*
M-IO	GND	10	IOCHRDY	W-R
LOCK	SMEMW*	11	AENx	GND
Reserved	SMEMR*	12	SA19	Reserved
GND	IOW*	13	SA18	Reserved
Reserved	IOR*	14	SA17	Reserved
BE3*	DACK3*	15	SA16	GND
Key	DRQ3	16	SA15	Key
BE2*	DACK1*	17	SA14	BE1*
BE0*	DRQ1	18	SA13	LA31*
GND	REFRESH*	19	SA12	GND
+5 V	BCLK	20	SA11	LA30*
LA29*	IRQ7	21	SA10	LA28*
GND	IRQ6	22	SA9	LA27*
LA26*	IRQ5	23	SA8	LA25*
LA24*	IRQ4	24	SA7	GND
Key	IRQ3	25	SA6	Key
LA16	DACK2*	26	SA5	LA15
LA14	TC	27	SA4	LA13
+5 V	BALE	28	SA3	LA12
+5 V	+5 V	29	SA2	LA11
GND	OSC	30	SA1	GND
LA10	GND	31	SA0	LA9
	Standard ISA Connections			
Extended ISA (EISA) Connections				

Table 4-76 EISA / ISA Connector Pinout (Small Connector)

Row H	Row D	Pin	Row C	Row G
LA8	MEMCS16*	1	SBHE*	LA7
LA6	IOCS16*	2	LA23	GND
LA5	IRQ10	3	LA22	LA4
+5 V	IRQ11	4	LA21	LA3
LA2	IRQ12	5	LA20	GND
Key	IRQ15	6	LA19	Key
DATA16	IRQ14	7	LA18	DATA17
DATA18	DACK0*	8	LA17	DATA19
GND	DRQ0	9	MEMR*	DATA20
DATA21	DACK5*	10	MEMW*	DATA22
DATA23	DRQ5	11	SD8	GND
DATA24	DACK6*	12	SD9	DATA25
GND	DRQ6	13	SD10	DATA26
DATA27	DACK7*	14	SD11	DATA28
Key	DRQ7	15	SD12	Key
DATA29	+5 V	16	SD13	GND
+5 V	MASTER16*	17	SD14	DATA30
+5 V	GND	18	SD15	DATA31
MAKx*		19		MREQx*
	Standard ISA Connections			
		Extended ISA (EISA) Connections		

4.10.8 PCI Bus

The Silicon Graphics systems which support PCI bus cards comply with the PCI 2.1 revision of the PCI Specification. The boards are +5 Volt cards and the bus runs at 33 MHz. The systems will accept either 32 or 64 bit boards. The “PCI Developer Guide” covers the details of the PCI bus on Silicon Graphics systems. This document is available from the Developer Program.

As with other boards, a driver specific to the IRIX operating system is required to integrate a PCI board into a Silicon Graphics system. For information about writing device drivers for the IRIX operating system, consult the “IRIX Device Driver Programming Guide”. This document is available from Silicon Graphics Sales offices.

As shown in Table 4-63, there are both half size and full size PCI slots in the systems. These sizes comply with the sizes specified in the PCI Bus Specification. See the “Reference Information” in the Appendix.

4.10.8.1 Board Drawings

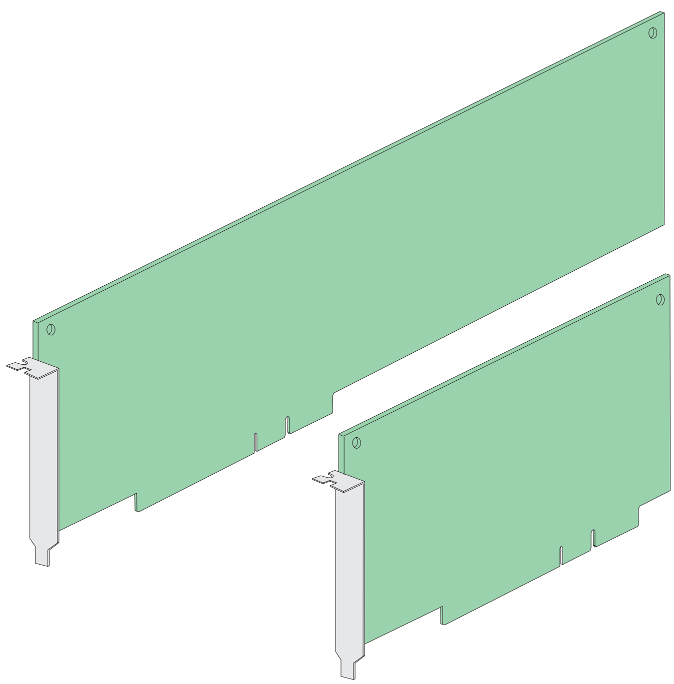


Figure 4-64 PCI Half-size and Full Size Boards

4.10.8.2 Power Budget

The available power for the systems that support PCI is shown in table below.

The O2, with its one half-size PCI slot has less power available than the other systems that support PCI. The O2 is a 5 Volt only environment - if 3.3 Volts is required on the board, it must be generated by an on-board regulator from either the 5 Volt of 12 Volt supply lines.

For OCTANE's three slots there is a total of 45 Watts of 5 Volt power available. There is also 3.3 Volts available on the bus. From Table 4-77, it is possible to exceed the total power budget for all slots by combining the 5 Volt power and 3.3 Volt power. This is not allowed. A card may not use more than 15 Watts of combined power from either 5 Volts or 3.3 Volts.

The Origin200, Origin2000 and Onyx2 are similar to the OCTANE in that the total power from both 5 Volt and 3.3 Volt sources may not exceed the per slot power budget.

Table 4-77 PCI Power Budget

System	Total Watts		Current Available (per slot)	
	All Slots	Per Slot	5 Volts	3.3 Volts
O2	10 W	10 W	2.0 Amps	
OCTANE	45 W	15 W	3.0 Amps	3.3 Amps
Origin200	75 W	25 W	5.0 Amps	3.3 Amps
Origin2000	75 W	25 W	5.0 Amps	2.2 Amps
Onyx2	75 W	25 W	5.0 Amps	2.2 Amps

4.10.8.3 Connector Pinout

Table 4-78 shows the pinout for the PCI connector used on Silicon Graphics systems. The pins shown in the shaded area of the table are those required only for 64 bit PCI cards.

Table 4-78 PCI Connector Pinout

Pin	Signal Name	Description
A1	TRST	Test Logic Reset
A2	+12V	+12 VDC
A3	TMS	Test Mde Select
A4	TDI	Test Data Input
A5	+5V	+5 VDC
A6	INTA	Interrupt A
A7	INTC	Interrupt C
A8	+5V	+5 VDC
A9	RESV01	Reserved VDC
A10	+5V	+V I/O
A11	RESV03	Reserved VDC
A12	GND03	Ground or Open (Key)
A13	GND05	Ground or Open (Key)
A14	RESV05	Reserved VDC
A15	RESET	Reset
A16	+5V	+V I/O
A17	GNT	Grant PCI use
A18	GND08	Ground
A19	RESV06	Reserved VDC
A20	AD30	Address/Data 30
A21	+3.3V01	+3.3 VDC
A22	AD28	Address/Data 28
A23	AD26	Address/Data 26
A24	GND10	Ground
A25	AD24	Address/Data 24
A26	IDSEL	Initialization Device Select
A27	+3.3V03	+3.3 VDC
A28	AD22	Address/Data 22
A29	AD20	Address/Data 20
A30	GND12	Ground
A31	AD18	Address/Data 18
A32	AD16	Address/Data 16
A33	+3.3V05	+3.3 VDC
A34	FRAME	Address or Data phase
A35	GND14	Ground
A36	TRDY	Target Ready
A37	GND15	Ground
A38	STOP	Stop Transfer Cycle
A39	+3.3V07	+3.3 VDC
A40	SDONE	Snoop Done
A41	SBO	Snoop Backoff
A42	GND17	Ground
A43	PAR	Parity
A44	AD15	Address/Data 15
A45	+3.3V10	+3.3 VDC
A46	AD13	Address/Data 13
A47	AD11	Address/Data 11
A48	GND19	Ground
A49	AD9	Address/Data 9
A50	(OPEN)	Ground or Open (Key)

Pin	Signal Name	Description
B1	-12V	-12 VDC
B2	TCK	Test Clock
B3	GND	Ground
B4	TDO	Test Data Output
B5	+5V	+5 VDC
B6	+5V	+5 VDC
B7	INTB	Interrupt B
B8	INTD	Interrupt D
B9	PRSNT1	Reserved
B10	RES	+V I/O
B11	PRSNT1	Present
B12	GND	Ground or Open (Key)
B13	GND	Ground or Open (Key)
B14	RES	Reserved VDC
B15	GND	Reset
B16	CLK	Clock
B17	GND	Ground
B18	REQ	Request
B19	+5V	+V I/O
B20	AD31	Address/Data 31
B21	AD29	Address/Data 29
B22	GND	Ground
B23	AD27	Address/Data 27
B24	AD25	Address/Data 25
B25	+3.3V	+3.3VDC
B26	C/BE3	Command, Byte Enable 3
B27	AD23	Address/Data 23
B28	GND	Ground
B29	AD21	Address/Data 21
B30	AD19	Address/Data 19
B31	+3.3V	+3.3 VDC
B32	AD17	Address/Data 17
B33	C/BE2	Command, Byte Enable 2
B34	GND13	Ground
B35	IRDY	Initiator Ready
B36	+3.3V06	+3.3 VDC
B37	DEVSEL	Device Select
B38	GND16	Ground
B39	LOCK	Lock bus
B40	PERR	Parity Error
B41	+3.3V08	+3.3 VDC
B42	SERR	System Error
B43	+3.3V09	+3.3 VDC
B44	C/BE1	Command, Byte Enable 1
B45	AD14	Address/Data 14
B46	GND18	Ground
B47	AD12	Address/Data 12
B48	AD10	Address/Data 10
B49	GND20	Ground
B50	(OPEN)	Ground or Open (Key)

Table 4-78 PCI Connector Pinout

Pin	Signal Name	Description
A51	(OPEN)	Ground or Open (Key)
A52	C/BE0	Command, Byte Enable 0
A53	+3.3V11	+3.3 VDC
A54	AD6	Address/Data 6
A55	AD4	Address/Data 4
A56	GND21	Ground
A57	AD2	Address/Data 2
A58	AD0	Address/Data 0
A59	+5V	+V I/O
A60	REQ64	Request 64 bit
A61	VCC11	+5 VDC
A62	VCC13	+5 VDC
A63	GND	Ground
A64	C/BE[7]#	Command, Byte Enable 7
A65	C/BE[5]#	Command, Byte Enable 5
A66	+5V	+V I/O
A67	PAR64	Parity 64
A68	AD62	Address/Data 62
A69	GND	Ground
A70	AD60	Address/Data 60
A71	AD58	Address/Data 58
A72	GND	Ground
A73	AD56	Address/Data 56
A74	AD54	Address/Data 54
A75	+5V	+V I/O
A76	AD52	Address/Data 52
A77	AD50	Address/Data 50
A78	GND	Ground
A79	AD48	Address/Data 48
A80	AD46	Address/Data 46
A81	GND	Ground
A82	AD44	Address/Data 44
A83	AD42	Address/Data 42
A84	+5V	+V I/O
A85	AD40	Address/Data 40
A86	AD38	Address/Data 38
A87	GND	Ground
A88	AD36	Address/Data 36
A89	AD34	Address/Data 34
A90	GND	Ground
A91	AD32	Address/Data 32
A92	RES	Reserved
A93	GND	Ground
A94	RES	Reserved

Pin	Signal Name	Description
B51	(OPEN)	Ground or Open (Key)
B52	AD8	Address/Data 8
B53	AD7	Address/Data 7
B54	+3.3V12	+3.3 VDC
B55	AD5	Address/Data 5
B56	AD3	Address/Data 3
B57	GND22	Ground
B58	AD1	Address/Data 1
B59	VCC08	+5 VDC
B60	ACK64	Acknowledge 64 bit
B61	VCC10	+5 VDC
B62	VCC12	+5 VDC
B63	RES	Reserved
B64	GND	Ground
B65	C/BE[6]#	Command, Byte Enable 6
B66	C/BE[4]#	Command, Byte Enable 4
B67	GND	Ground
B68	AD63	Address/Data 63
B69	AD61	Address/Data 61
B70	+5V	+V I/O
B71	AD59	Address/Data 59
B72	AD57	Address/Data 57
B73	GND	Ground
B74	AD55	Address/Data 55
B75	AD53	Address/Data 53
B76	GND	Ground
B77	AD51	Address/Data 51
B78	AD49	Address/Data 49
B79	+5V	+V I/O
B80	AD47	Address/Data 47
B81	AD45	Address/Data 45
B82	GND	Ground
B83	AD43	Address/Data 43
B84	AD41	Address/Data 41
B85	GND	Ground
B86	AD39	Address/Data 39
B87	AD37	Address/Data 37
B88	+5V	+V I/O
B89	AD35	Address/Data 35
B90	AD33	Address/Data 33
B91	GND	Ground
B92	RES	Reserved
B93	RES	Reserved
B94	GND	Ground

4.10.9 XIO Bus

The XIO bus is a very high speed bus implemented in the most recent systems. The XIO boards can be single slot, double slot, or may be double wide - like the IO6 BaseIO boards for the Origin2000 and Onyx2. The optional PCI card cages that are available for OCTANE, Origin2000 and Onyx2 are really XIO boards that take one of the wide XIO slots.

The XIO modules for Origin2000 and Onyx2 differ from the XIO modules for the OCTANE in the latching mechanisms they use. Also, the location of the latching mechanism will determine in which slots a particular board can be installed. An example of this is the module in Figure 4-65 that has a latch lever on the bottom of the module, not the top.

Figure 4-65 shows an example of each of these types of boards.

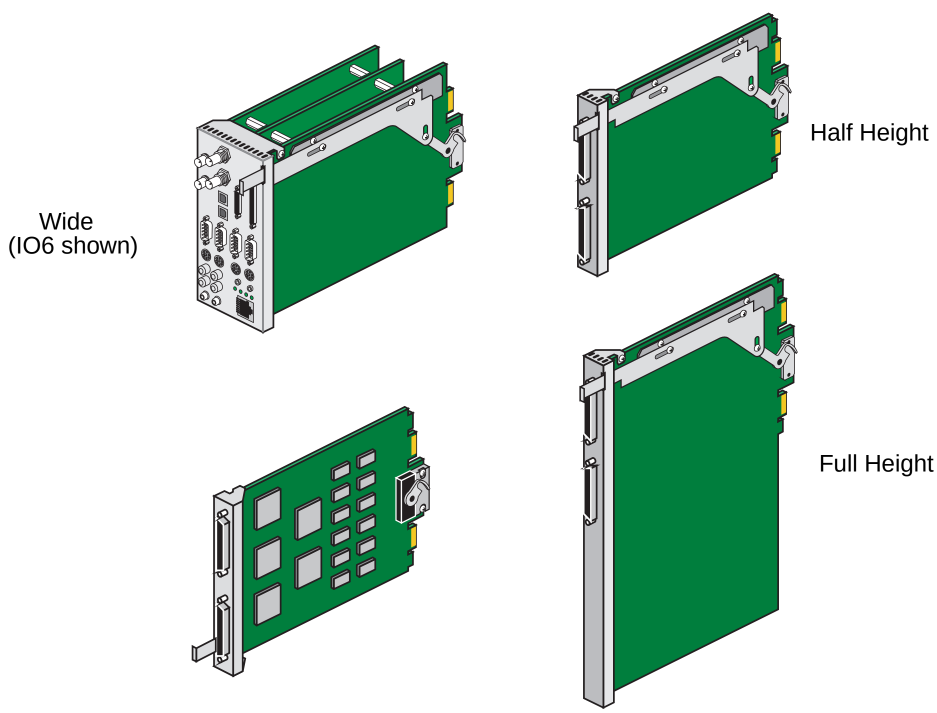


Figure 4-65 XIO Boards

4.11 Backplanes and Board Slots

It's important to know which slots in the machines are available for add-in VME, GIO, EISA, PCI or XIO boards. The purpose of this section is to show the slot layout and nomenclature for each system so that they are familiar.

4.11.1 9U VME Backplanes

The table below shows the various configurations of 9U VME backplanes in SGI systems. Areas of the backplane reserved for CPU, Memory and I/O cards are shown shaded in light grey. Areas of the backplane reserved for Graphics boards are shown shaded in a darker grey. Notations in the table are the names of the SGI boards normally located in that slot.

4.11.1.1 Twin Tower Backplanes

Table 4-79 Twin Tower Backplanes

Slot	12 Slot		15 Slot			
	B, G	GT	B, G	GT	GTX	VGX
1	CPU	CPU			VME	VME
2	Ethernet	Ethernet			VME	VME
3	ESDI Disk Controller	ESDI Disk Controller			VME	VME
4	VME	VME			VME	VME
5	VME	VME			IO2	IO2
6	VME	VME			CPU or MC2	CPU or MC2
7	VME	VME			CPU or MC2 (opt.)	CPU or MC2 (opt.)
8	VME	GE			CPU or MC2 (opt.)	CPU or MC2 (opt.)
9	DE	GM			CPU or MC2 (opt.)	CPU or MC2 (opt.)
10	GF	RM			GM	GM
11	TB	RV		GE	GE	GE
12	ZB[1]	RM	DE	GM	RM	RM
13			GF	RM	RV	RM
14			TB	RV	RM	DG
15			ZB[1]	RM	Video Option	Video Option

1.The ZB board was only included in the "G" versions of the graphics set.

Server versions of the 12 and 15 slot chassis were available. For those systems the graphics slots were left empty.

4.11.1.2 Diehard, Diehard2 and Eveready Backplanes

Table 4-80 Diehard, Diehard2 and Eveready Backplanes

Slot	GT, GTB	GTX, GTXB	Server	VGX, VGXT	RE	VTX	RE^2
1	CPU	VME	VME	VME	VME	CPU	CPU
2	Ethernet	VME	VME	VME	VME	IMB	IMB
3	VME	VME	VME	VME	VME	PC2	PC2
4	VME	VME	VME	VME	VME	VME64	VME64
5	VME	IO2 or IO3	IO2 or IO3	IO3	IO3	VME64	VME64
6	VME	CPU	CPU	CPU	CPU	VME64	VME64
7	VME	CPU	CPU	CPU	CPU	GE	GE
8	VME	Memory	Memory	Memory	Memory	DG	DG
9	GE	GM	Not Used	GM	GE	RM	RM
10	RM	GE	Not Used	GE	DG		RM (opt.)
11	RM	RM	Not Used	RM	RM		RM (opt.)
12	RV	RV	Not Used	DG	Not Used		RM (opt.)
13	VIdeo Option	RM	Not Used	RM	RM		
14		Video Option	Not Used	Video Option	Not Used		

4.11.1.3 Predator Backplanes

Table 4-81 Predator Backplanes

Slot	Power Center	Power Series			SkyWriter	
	Server	**GTX, GTXB**	**VGX, VGXT**	**RE**	**VGX, VGXT**	**RE**
1	VME A	VME	VME	VME	VME	VME
2	VME A	VME	VME	VME	VME	VME
3	VME A	VME	VME	VME	VME	VME
4	VME A	VME	VME	VME	VME	VME
5	VME A	VME	VME	VME	DG	Not Used
6	VME A	VME	VME	VME	RM	RM
7	IO3A	IO2 or IO3	IO2 or IO3	IO2 or IO3	RM	Not Used
8	CPU	CPU	CPU	CPU	Video Option	RM
9	CPU	CPU	CPU	CPU	GE	DG
10	CPU	CPU	CPU	CPU	GM	GE
11	CPU	CPU	CPU	CPU	IO2 or IO3	IO3
12	Memory	Memory	Memory	Memory	CPU	CPU
13	Memory	Memory	Memory	Memory	CPU	CPU
14	IO3B	GM	GM	GE	Memory	Memory
15	VME B	GE	GE	DG	GM	GE
16	VME B	RM	RM	RM	GE	DG
17	VME B	RV	RM	RM	Video Option	RM
18	VME B	RM	DG	RM	RM	RM
19	VME B	Video Option	Video Option	RM	RM	RM
20					DG	RM

4.11.1.4 Eveready (Deskside) Backplanes

Table 4-82 Eveready (Deskside) Backplanes

Slot	Challenge L	Onyx	
	Server	**VTX**	**RE^2**
1	MC3 (memory)	MC3	MC3
2	CPU or MC3 or IO4	CPU	CPU
3	CPU or MC3 or IO4	IO4	IO4
4	CPU or MC3 or IO4	VCAM or GCAM	VCAM or GCAM
5	IO4 (main)	VME64	VME64
6	VCAM or GCAM	VME64 or Extreme Graphics	VME64 or Extreme Graphics
7	VME64	VME64 or Extreme Graphics	VME64 or Extreme Graphics
8	VME64	GE or Extreme Graphics	GE or Extreme Graphics
9	VME64 or Extreme Graphics	DG	DG
10	VME64 or Extreme Graphics	RM	RM
11	VME64 or Extreme Graphics		RM (opt.)
12	Does not exist		RM (opt.)
13	Does not exist		RM (opt.)

4.11.1.5 Terminator (Rack) Backplanes

Table 4-83 Terminator (Rack) Backplanes

Slot	Challenge XL	Onyx	
	Server	VTX	RE^2
1	CPU or IMB or PC2	CPU or IMB or PC2	CPU or IMB or PC2
2	CPU or IMB	CPU or IMB	CPU or IMB
3	CPU or IMB or PC2	CPU or IMB or PC2	CPU or IMB or PC2
4	CPU or IMB	CPU or IMB	CPU or IMB
5	CPU or IMB or PC2	CPU or IMB or PC2	CPU or IMB or PC2
6	CPU or IMB	CPU or IMB	CPU or IMB
7	CPU or IMB or PC2	CPU or IMB or PC2	CPU or IMB or PC2
8	CPU or IMB	CPU or IMB	CPU or IMB
9	CPU or IMB or PC2	CPU or IMB or PC2	CPU or IMB or PC2
10	CPU or IMB	CPU or IMB	CPU or IMB
11	CPU or IMB or PC2	PC2	PC2
12	CPU or IMB	VME64	VME64
13	CPU or IMB or PC2	VME64	VME64
14	CPU or IMB	VME64	VME64
15	PC2	GE	GE
16	VME64	DG	DG
17	VME64	RM	RM
18	VME64		RM
19	VME64		RM
20	VME64		RM

4.11.2 GIO32/32-bis Board Slots

As shown in the drawing below, in both the Indigo and Indy the GIO32/32-bis slots are side-by-side. This allows installation of a “double wide” GIO board.

4.11.2.1 Board Location Drawings

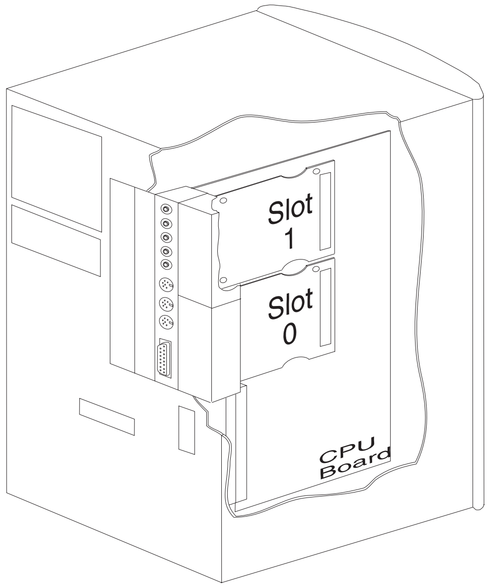


Figure 4-66 Indigo GIO Board Slots

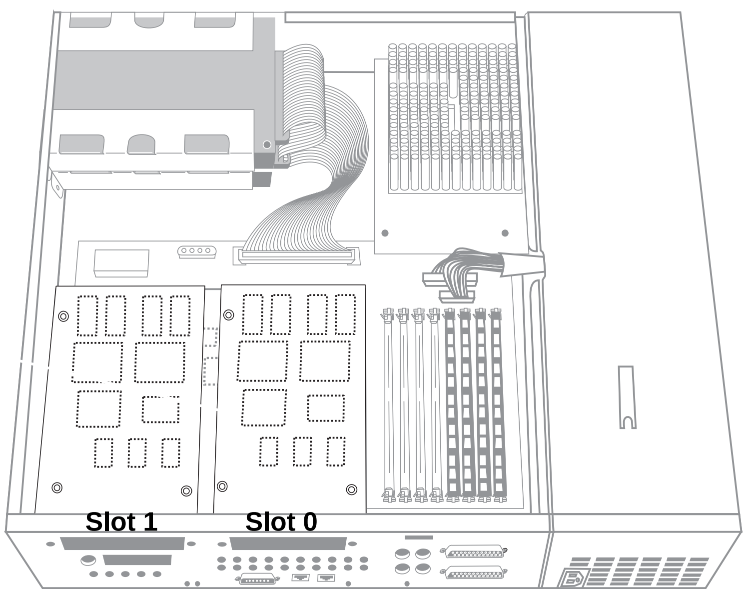


Figure 4-67 Indy GIO Board Slots

4.11.3 EISA/GIO64 Backplane

There are four physical slots in the Indigo2. The backplane is designed such that for some of the slots either an EISA board or a GIO64 board may be installed.

There are two different configurations of backplanes for the Indigo2. The systems with the Extreme, XZ and XL graphics card(s) shipped with one backplane configuration - called the “Extreme” backplane in this document. The systems with the IMPACT graphics cards shipped with the “IMPACT” backplane. Past a particular point in time all systems were shipped with the “IMPACT” style backplane regardless of what graphics option was installed. You will not be able to determine the backplane used without actually looking at the system.

Unlike the GIO32 and GIO32-bis slots in the Indigo and Indy, the GIO64 slots in the Indigo2 are used for the graphics boards for the system. Some of these boards take up more that one physical slot even though their connection to the GIO64 bus is through only one connector. This results in some of the physical slots being used by the graphics and, therefore, not available for either an additional GIO board or additional EISA board. The sections below show the connector locations and configuration options for the two types of backplanes.

4.11.3.1 “Extreme” Backplane Layout

Note that while there are three GIO64 connectors, two of them are wired identically. This makes it possible to only install two different GIO64 boards.

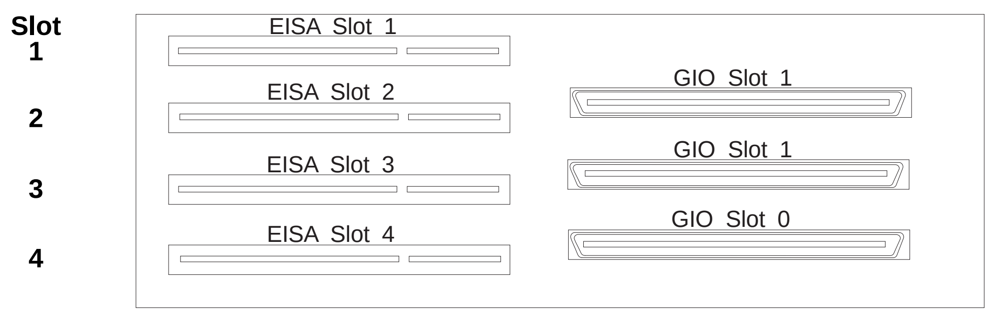


Figure 4-68 “Extreme” EISA / GIO Backplane

4.11.3.2 “Extreme” Backplane Board Combinations

The table below shows the various combinations of graphics boards, video boards and available option slots.

Table 4-84 EISA / GIO64 Backplane Board Combinations

<table>
<tr><th>Slot</th><th colspan="2">Extreme</th><th colspan="3">XZ</th><th colspan="3">XL</th></tr>
<tr><td>1</td><td>EISA</td><td rowspan="3">Extreme</td><td>EISA</td><td>EISA</td><td rowspan="2">XZ</td><td>EISA</td><td>EISA</td><td>EISA</td></tr>
<tr><td>2</td><td rowspan="3">Extreme</td><td>EISA/ GIO</td><td rowspan="2">XZ</td><td>EISA/ GIO[1]</td><td>EISA</td><td>XL</td></tr>
<tr><td>3</td><td rowspan="2">XZ</td><td>EISA</td><td>EISA/ GIO[1]</td><td>XL</td><td>EISA</td></tr>
<tr><td>4</td><td>EISA/ GIO</td><td>EISA/ GIO</td><td>EISA/ GIO</td><td>XL</td><td>EISA/ GIO</td><td>EISA/ GIO</td></tr>
</table>

1.In this case, only one GIO64 board could be installed between the two slots. The other remaining slot of the two could be used for an EISA board.

4.11.3.3 “IMPACT” Backplane Layout

The main difference between this backplane and the “Extreme” backplane is that there are now 4 GIO connectors and only 3 EISA connections. The number of physical GIO connectors has increased, but the number of logical (or electrical) GIO slots is still two. GIO slots 1A & 1B are wired identically, as are slots 0A and 0B.

The addition of circuitry required on the backplane board necessitated the removal of the fourth EISA connector. The 3.3V connectors required for the IMPACT graphics card(s) had the effect of changing the GIO64 board outline slightly. Care should be taken when installing an “old” GIO64 card into a system with an “IMPACT” backplane. If components are placed in the area of the 3.3V connectors, problems will be created with possible damage to the card, the system, or both.

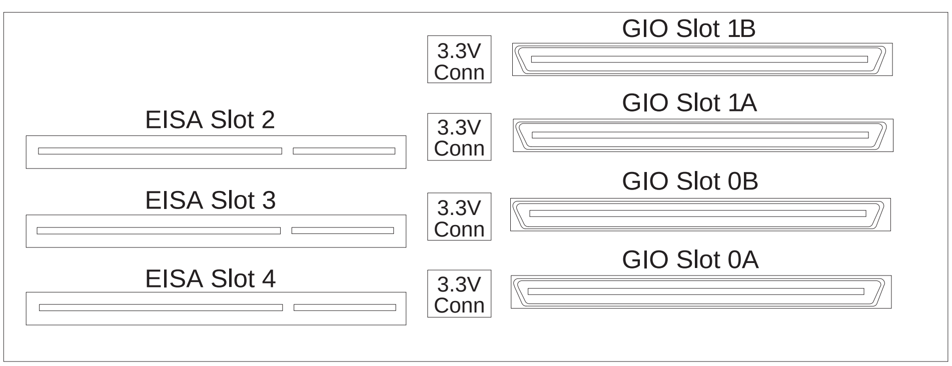


Figure 4-69 “IMPACT” EISA / GIO Backplane

4.11.4 O2 PCI Card Slot

The O2 has one half-size card slot. The PCI slot is part of the CPU Motherboard assembly. The location of the PCI slot is slightly different between the R5000 based O2 and the R10000 based O2 due to the additional module width of the R1000 processor board assembly. Both the R5000 and R10000 versions are shown in Figure 4-70.

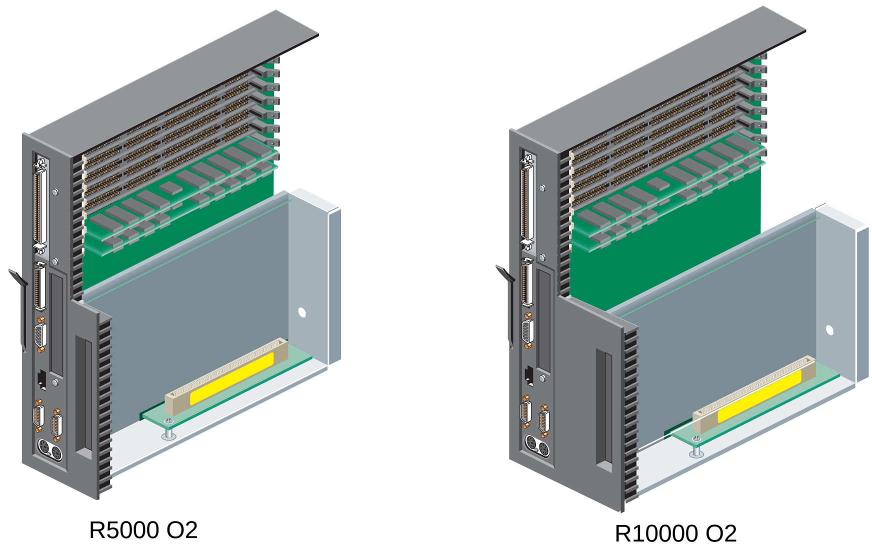


Figure 4-70 O2 PCI Slot

4.11.5 OCTANE PCI Slot Location

The OCTANE has an optional PCI Card Cage that can be inserted into the rear of the machine. The card cage can hold one half-size PCI card and two full size PCI cards. Figure 4-71 shows the card cage and the ID numbers of the slots. The half-size slot is the bottom slot.

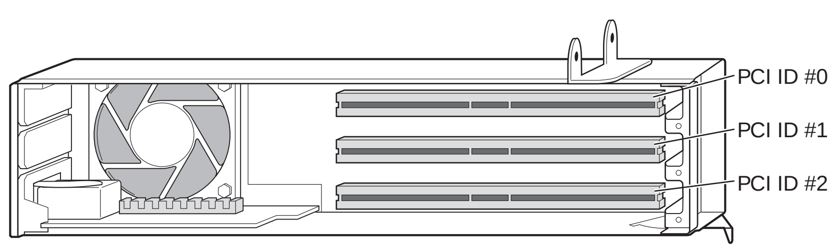


Figure 4-71 OCTANE PCI Card Cage and Slots

4.11.6 Origin200 PCI Slot Location

The Origin200 has three PCI slots located inside the chassis. All three slots can accept full size PCI cards. Figure 4-72 shows the location and orientation of these slots.

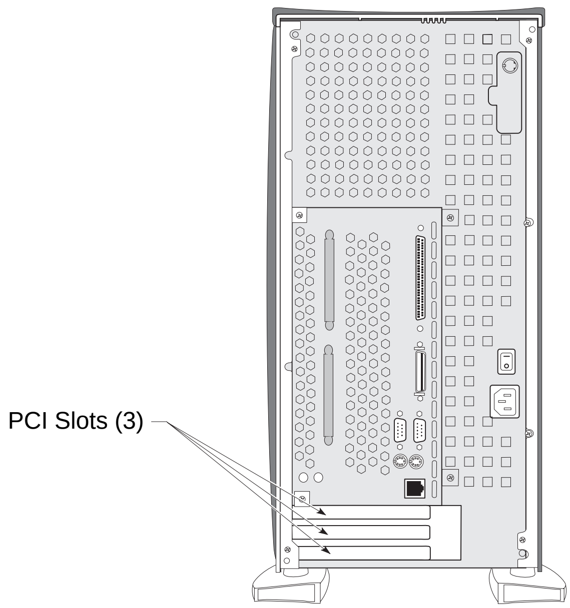


Figure 4-72 Origin200 PCI Slots

4.11.7 Origin2000 and Onyx2 PCI Slots

The Origin2000 and Onyx2 systems have an optional PCI Card Cage that can be installed in the system. The card cage holds one half-size PCI card and two full size PCI cards. Figure 4-73 shows the location and orientation of the PCI slots.

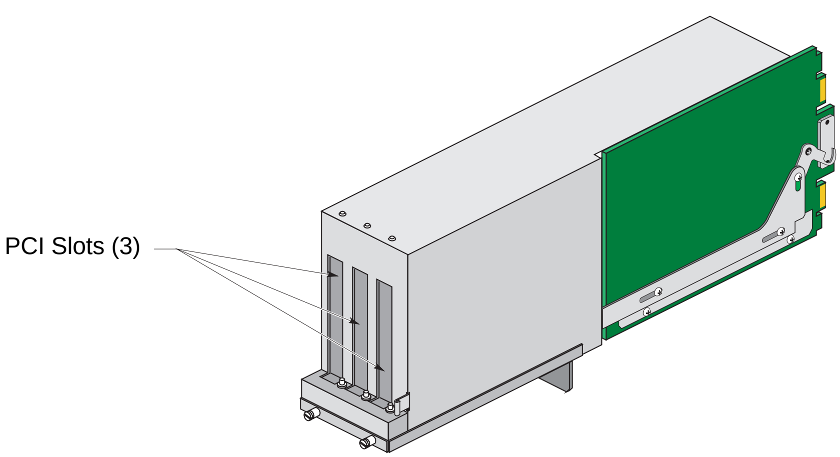


Figure 4-73 Origin2000 and Onyx2 PCI Slots

4.11.8 OCTANE XIO Slots

The OCTANE has four XIO slots. Depending on the graphics subsystem installed, either one or two slots are used for graphics leaving the other two slots available for additional XIO modules.

OCTANE XIO modules are not compatible with Origin2000 and Onyx2 XIO modules. They have different latching mechanisms.

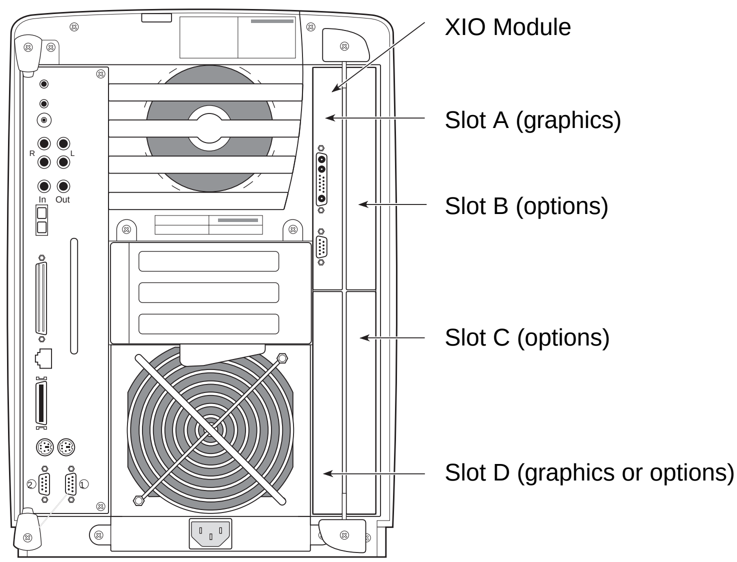


Figure 4-74 OCTANE XIO Module Locations

4.11.9 Origin2000 XIO Slots

The Origin2000 has 12 XIO slots. Figure 4-75 shows the slot allocation when viewed from the back of the system. Slot 1 is typically used for the Base IO module. The circles and triangles represent which nodes support which XIO slots.

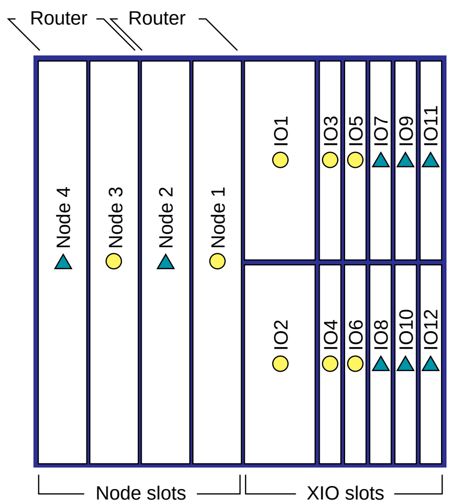


Figure 4-75 Origin2000 XIO Module Locations

4.11.10 Onyx2 XIO Slots

The Onyx2 has 6 XIO slots in the deskside configuration. Figure 4-76 shows the slot allocation when viewed from the back of the system. When the Onyx2 is in a rack configuration, there are two modules - one is a processor module that has the layout as shown in Figure 4-75 above, the other module is graphics only and has no XIO slots.

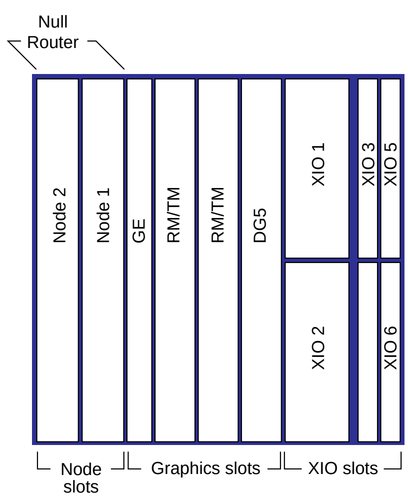


Figure 4-76 Onyx2 XIO Module Locations

4.12 Network Connections

While there are a number of optional networking products available for IRIS systems, this section will cover the four interfaces included with the systems - Ethernet AUI connection, ethernet 10Base-T connection, ethernet 10/100Base-T connection, and ISDN. The table below shows the systems that include these three interfaces as part of the base system.

Table 4-85 Network Connections on IRIS systems

System	Ethernet			ISDN
	AUI	10Base-T	10/100Base-T	
Twin Tower	X			
SIngle Tower (Diehard, Diehard2, Eveready)	X			
Rack (Predator & Terminator	X			
Personal IRIS	X			
Indigo	X			
Indigo^2	X	X		
Indy	X	X		X
O2			X	
OCTANE			X	
Origin200			X	
Origin2000			X	
Onyx2			X	

4.12.1 Ethernet AUI Connection

This is the most common ethernet connection found on IRIS systems. It typically connects to some kind of transceiver box. This transceiver box could connect the system to a “thick ethernet” type of network, a “thin net” (i.e. coax) network, or a twisted pair network.

4.12.1.1 Connector Drawing

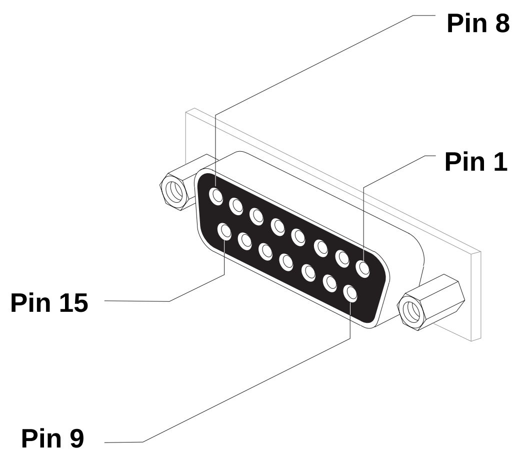


Figure 4-77 Ethernet AUI Connector

4.12.1.2 Pinout

Table 4-86 Ethernet AUI Connector Pinout

Pin	Signal Name	Pin	Signal Name
1	GND	9	COLLISION-
2	COLLISION+	10	TRANSMIT-
3	TRANSMIT+	11	GROUND
4	GROUND	12	RECEIVE-
5	RECEIVE+	13	+12V
6	GROUND	14	GROUND
7	(Reserved)	15	(Reserved)
8	GROUND		

4.12.2 Ethernet RJ-45 Connection

The same connector type and pinout is used for both the 10Base-T ethernet connections and the 10/100Base-T connections found on the newer systems.

On those systems with both the AUI and the RJ-45 ethernet connection (Indigo2 and Indy), this connector can be used instead of the ethernet AUI style connection. It cannot be used at the same time as the other ethernet connection.

4.12.2.1 Connector Drawing

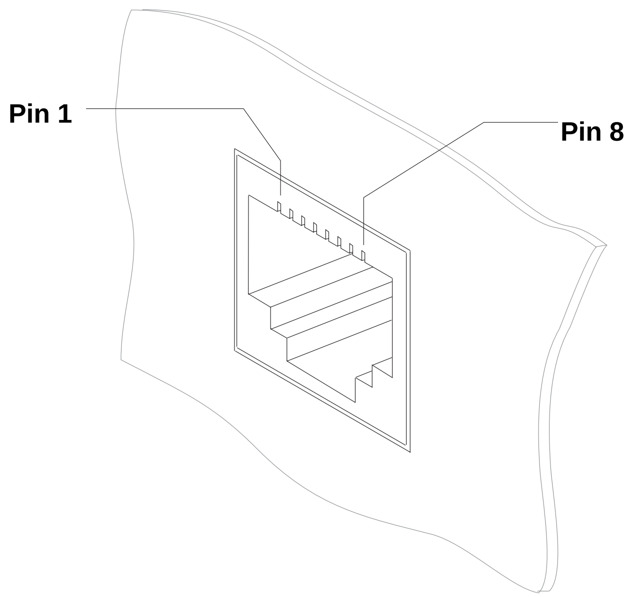


Figure 4-78 10-Base T Connector

4.12.2.2 Pinout

Table 4-87 Ethernet 10Base-T Connector Pinout

Pin	Signal Name	Pin	Signal Name
1	TRANSMIT+	5	(Reserved)
2	TRANSMIT-	6	RECEIVE-
3	RECEIVE+	7	(Reserved)
4	(Reserved)	8	(Reserved)

4.12.3 ISDN Connection (RJ-45)

4.12.3.1 Connector Drawing

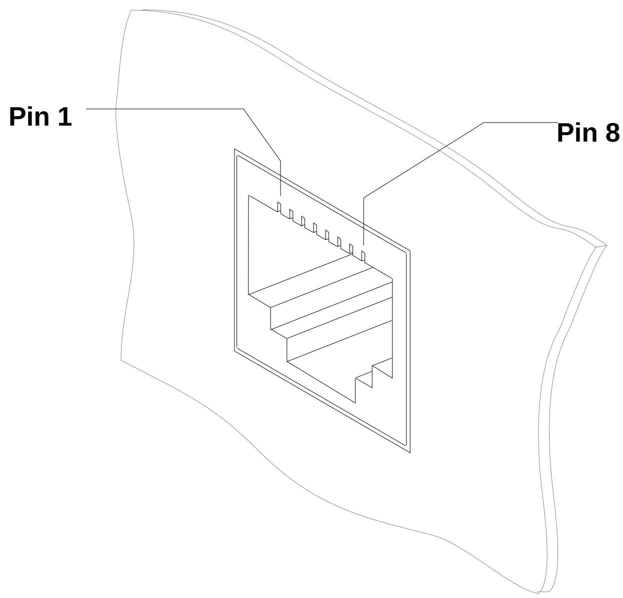


Figure 4-79 ISDN Connector

4.12.3.2 Pinout

Table 4-88 ISDN Port Connector Pinout

Pin	Signal Name	Pin	Signal Name
1	(Reserved)	5	RECEIVE-
2	(Reserved)	6	TRANSMIT-
3	TRANSMIT+	7	(Reserved)
4	RECEIVE+	8	(Reserved)

4.12.4 Craylink Interconnect

This interface is used in the Origin200, Origin2000 and Onyx2 systems for interconnecting nodes. The Craylink interface is very fast - either 800 MB/sec or 1600 MB/sec. It does not require arbitration and is not limited by contention. The Craylink interconnect offers very fast switching and can be configured as multiple point-to-point links in various topologies. This interface is proprietary to Silicon Graphics and Cray.

4.13 I/O Panel Plates

For all VME based systems, one or more I/O panels exist for use by add-in boards. These I/O Panels Plates typically screw into on opening on the I/O Panel and then connect to the internal board. There are four different styles of I/O Panel Plates on the various IRIS systems. The table below shows the types and the chassis where they can be found.

Starting with the Indigo, systems do not have any I/O Panel Plates other than the openings available for either GIO, EISA, PCI or XIO boards.

Table 4-89 I/O Panel Plate Styles on IRIS Systems

Chassis Style	Type I	Type II	Type III	Type IV
Twin Tower	X		X	
Single Tower (DIehard)	X		X	
Rack (Predator)	X		X	
Personal IRIS		X		
Single Tower (Diehard2)	X		X	
Rack (Terminator)				X
Single Tower (Eveready)				X

4.13.1 Type I I/O Panel Plate

4.13.1.1 Plate Drawing

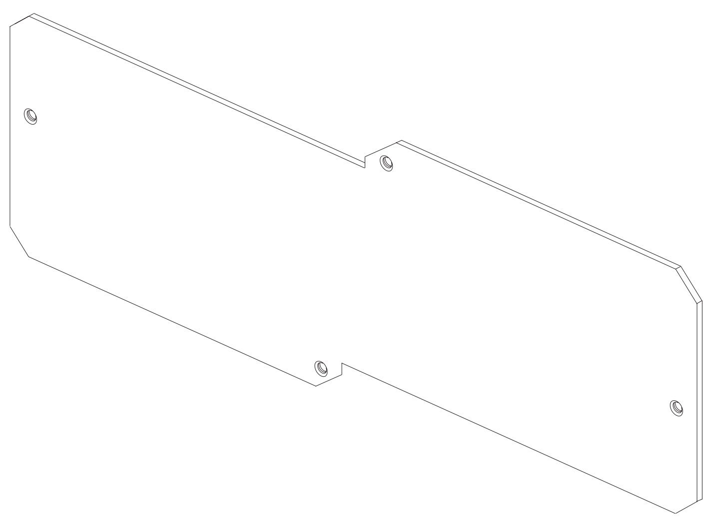


Figure 4-80 Type I I/O Plate

4.13.2 Type II I/O Panel Plate

4.13.2.1 Plate Drawing

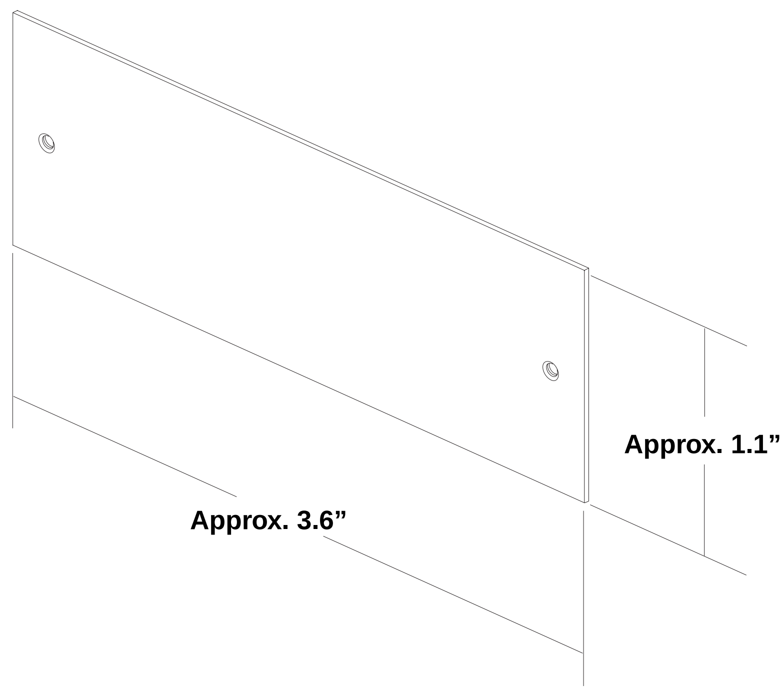


Figure 4-81 Type II I/O Plate

4.13.3 Type III I/O Panel Plate

This plate takes the place of the Type I plate. It can replace the earlier design, but because it does not have the “jogs” in the shape, it cannot be used next to an older, Type I, plate.

4.13.3.1 Plate Drawing

Figure 4-82 Type III I/O Plate

4.13.4 Type IV I/O Panel Plate

4.13.4.1 Plate Drawing

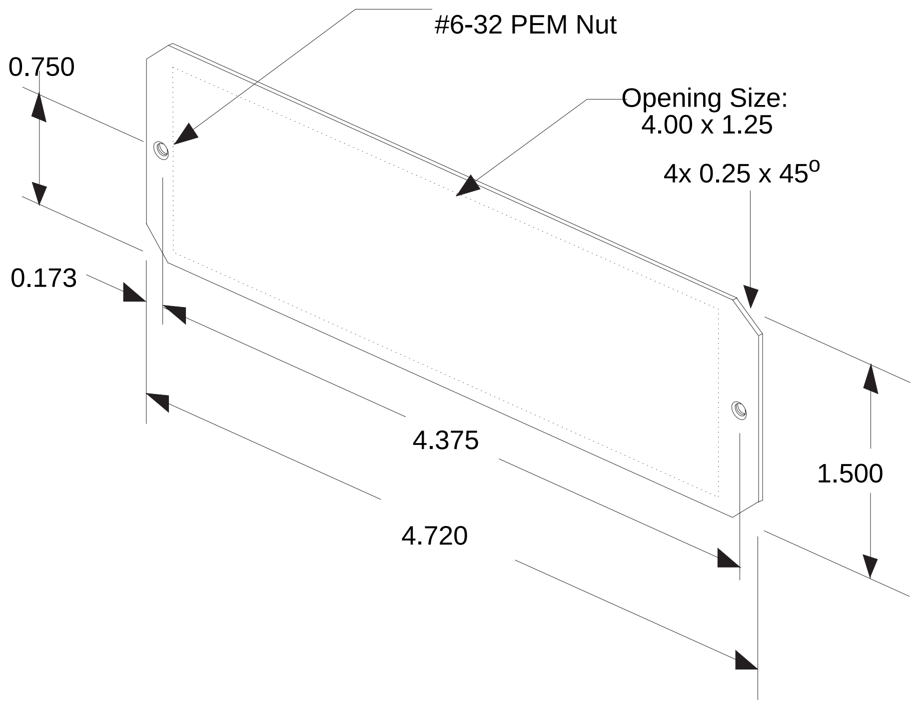


Figure 4-83 Type IV I/O Plate

4.14 Drive Sleds/Modules and Drive Mounting

There are a number of ways of installing disk drives and other SCSI devices in IRIS systems. The most frequently encountered is the Drive Sled or Drive Module. But some chassis have locations where additional devices may be mounted in a fixed, or “captive” fashion.

There are several different drive sleds and / or modules used on IRIS systems. All of them were designed by Silicon Graphics. All the designs are proprietary. All these designs share one aspect - they allow drives to be installed or removed from the system without taking the covers off of the system.

There are some differences between the way the drives were jumpered for various systems. For the early 4D systems (Twin Tower, Single Tower, and Predator) the drives would be jumpered to spin up as soon as power was applied to the drive. For systems starting with the Personal IRIS, drives were jumpered so that drives would spin up one at a time while the system was booting. This saved on power supply load during the boot process.

The systems which have some sort of “captive” disk mounting are not included in Table 4-90, but are documented in sections 4.14.8 through 4.14.12. These sections include the captive drives found in the 15 Slot Twin Tower chassis, the Predator Rack, the Personal IRIS, the Indy and the 5.25”drive carrier in the Origin200.

Table 4-90, on page 4-154 denotes which style is used for the various IRIS chassis.

Table 4-90 Drive Sleds on IRIS Systems

Chassis Style	Twin Tower Module	Personal IRIS	Indigo	$Indigo^2$	Onyx/ Challenge	O2	OCTANE/ Origin/ Onyx2
Maximum Drive Size	**5.25”**	**5.25”**	**3.5”**	**5.25” or 3.5”**	**5.25” or 3.5”**	**3.5” (1” high)**	**3.5”**
Twin Tower (All)	X						
Single Tower (Diehard)		X					
Rack (Predator)							
Single Tower (Diehard2)		X					
Rack (Terminator)					X		
Single Tower (Eveready)					X		
Personal IRIS		X					
Indigo			X				
$Indigo^2$				X			
O2						X	
OCTANE							X
Origin200							X
Origin2000							X
Onyx2							X

4.14.1 Twin Tower Drive Module

This module design accommodates a single 5.25” full height drive. A SCSI (8 bit, SCSI-1) connection was available via the paddle card that connected the drive module to the power supply module. This paddle card connection also carried the +5V and +12 V power for the drive.

For ESDI drives, data and control connections were made via a panel on the back of the module. For an example of this panel, consult the section on the ESDI Disk Drive interface, page 4-43.

The drive modules included a power lock out switch that would prevent the power supply from working unless the top hat was in place.

4.14.1.1 Twin Tower Drive Module Drawing

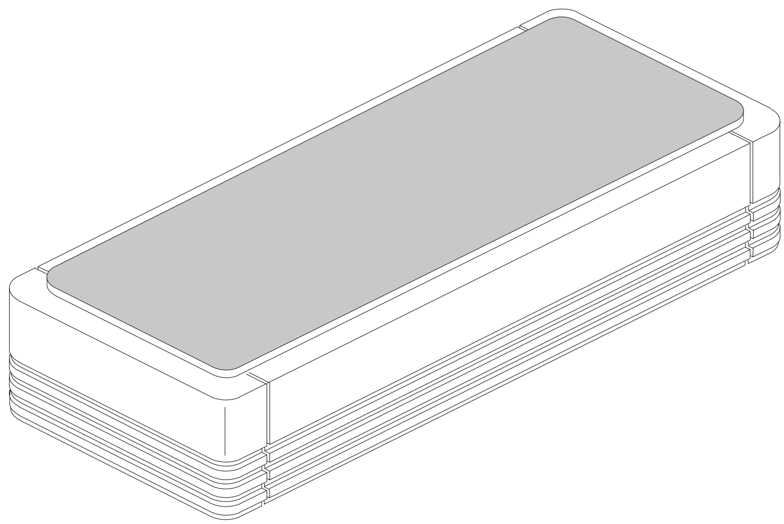


Figure 4-84 Drive Module for Twin Tower Chassis

4.14.2 Personal IRIS Drive Sled

This drive sled arrangement would accommodate either a half-height or full height 5.25" SCSI based drive. The connection to the chassis was via a 3 row, 50 pin "D" type connector. Power for the drive was via a 4 pin molex style connector.

Some, but not all, drive modules provided by SGI had small selector switches used for defining the SCSI ID number of the drive. Drives in Personal IRIS chassis were jumpered for drive spin up on command while those drives in Diehard and Diehard2 chassis were jumpered for immediate drive spin up.

4.14.2.1 Personal IRIS Drive Sled Drawing

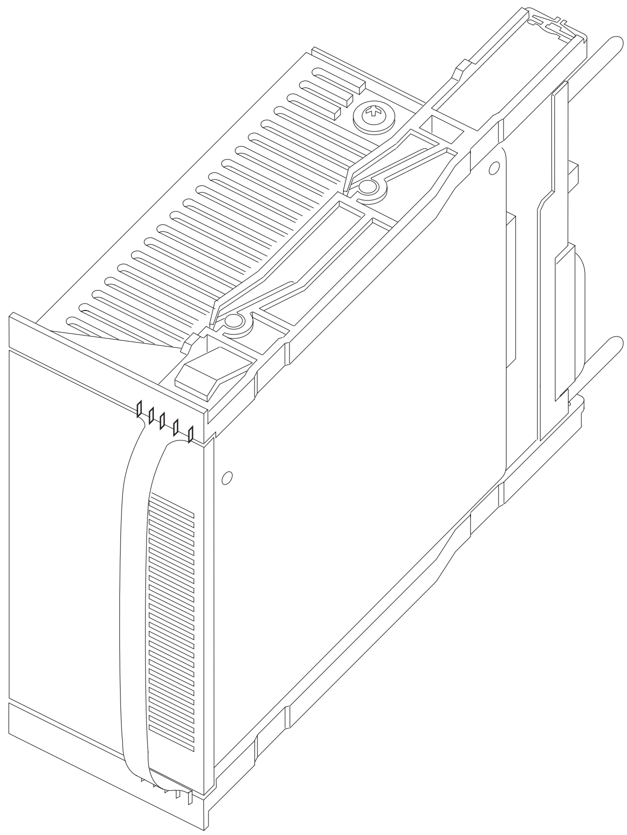


Figure 4-85 Personal IRIS Drive Sled

4.14.3 Indigo Drive Sled

This drive sled accommodates a single 3 1/2” drive. It connects to the SCSI bus and derives power from the Indigo backplane. Rather than have SCSI ID switches on the drive module, the design connects the ID signals from the drive to the backplane. The backplane defines the ID number by it’s location - SCSI ID 1 is always the bottom of the three drive slots, SCSI ID 2 is the middle slot, and ID 3 is always the top slot. External drives can set their own SCSI ID’s as long as they don’t conflict with any ID’s used in the Indigo chassis.

4.14.3.1 Indigo Drive Sled Drawing

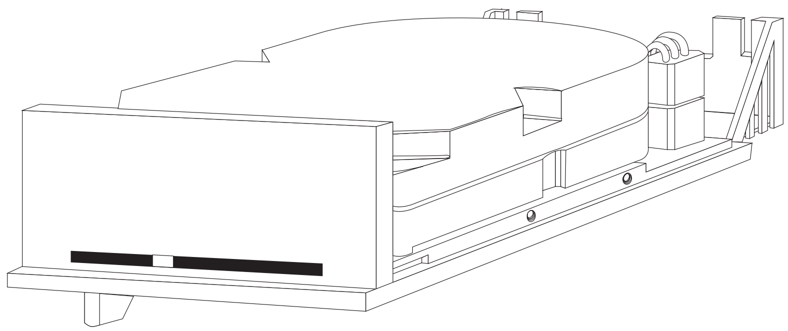


Figure 4-86 Indigo Drive Sled

4.14.4 Indigo^2 Drive Sled

There are actually two drive sleds for Indigo^2. One is for 5.25”, half height drives. The other is for 3 1/2” drives. The Indigo^2 has two 3 1/2” drive slots and one 5.25” drive slot.

In a manner similar to the Indigo, the SCSI ID for the three available drive slots is determined by their physical location. The bottom 3 1/2” drive slot is always SCSI ID 1. The upper 3 1/2” drive slot is always SCSI ID 2 and the 5.25” drive slot is always SCSI ID 3. The SCSI bus these internal drives use (controller 0) is not brought out to the outside of the chassis. The SCSI connection on the back of the Indigo^2 (controller 1) is available for external drives or devices.

The 80 pin connector and pinout used for both of these sleds is identical to the new SCA type connector and pinout used on the O2, OCTANE, Origin200/2000 and Onyx2 systems. The location of the connector on the back of these sleds does not allow an SCA drive to be plugged directly into the connector of the Indigo^2.

4.14.4.1 Indigo^2 Drive Sled Drawings

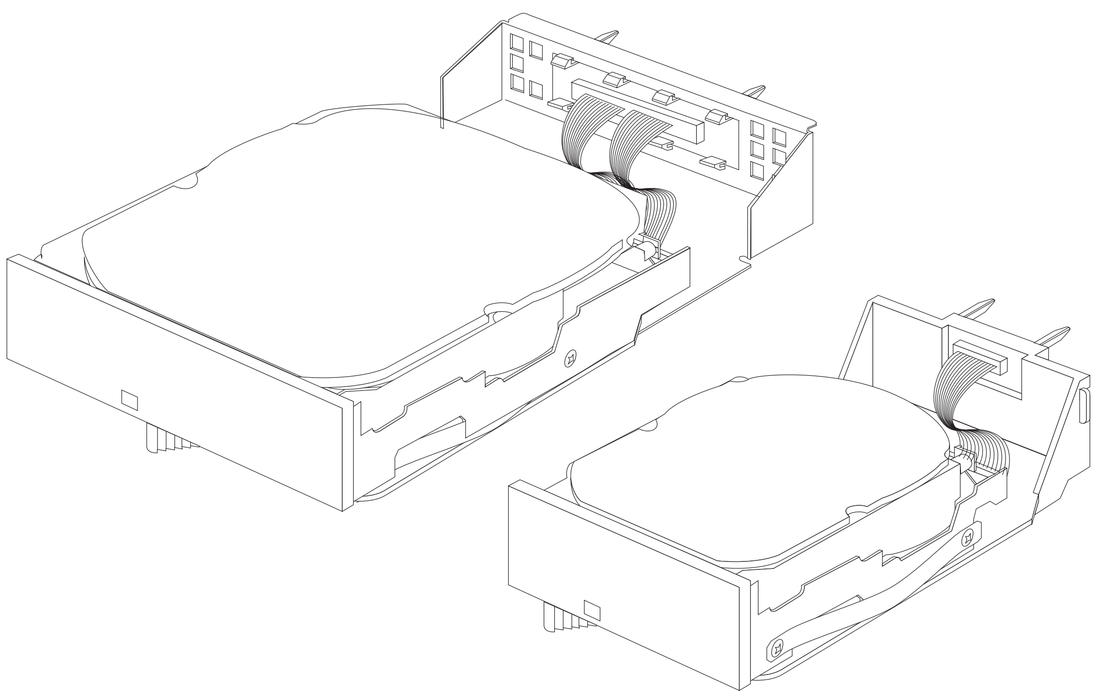


Figure 4-87 Indigo^2 Drive Sleds

4.14.5 Onyx/Challenge Drive Sled

This sled was designed to accommodate 5.25” and 3.5” (Full Height) drives. The interface connector (a 152 pin connector - 144 signal pins and 8 wide power pins) and the interface board on the rear of the drive was created to allow single-ended and differential devices to be connected to one of two internal SCSI buses. Configuration of the drive is done at the rear of the sled using jumpers.

4.14.5.1 Onyx/Challenge Drive Sled Drawing

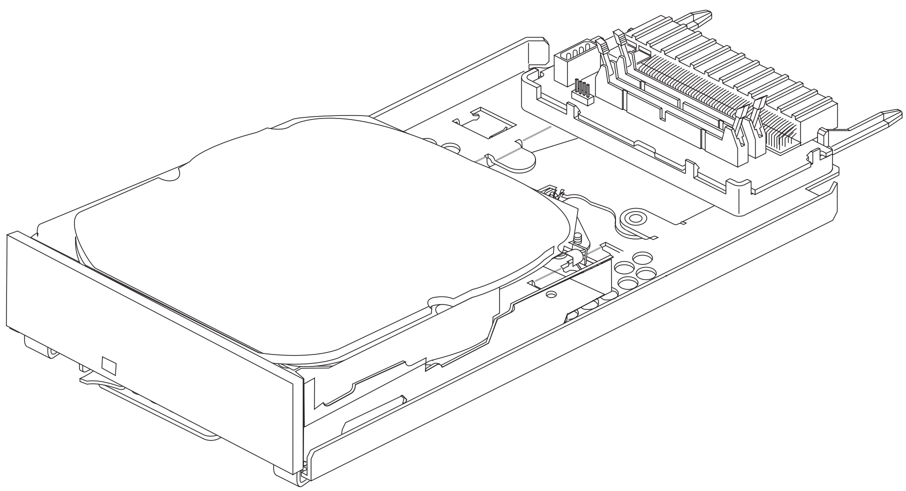


Figure 4-88 Onyx/Challenge Drive Sled

4.14.6 O2 (SCA) Drive Sled

The drives used in the O2 are SCA (Single Connector Assembly). The drive sled is just a mechanical device that aligns the drive with the frontplane connectors and locks it into the chassis. This sled will accept 3.5” devices that are no taller than 1”.

4.14.6.1 O2 Drive Sled Drawing

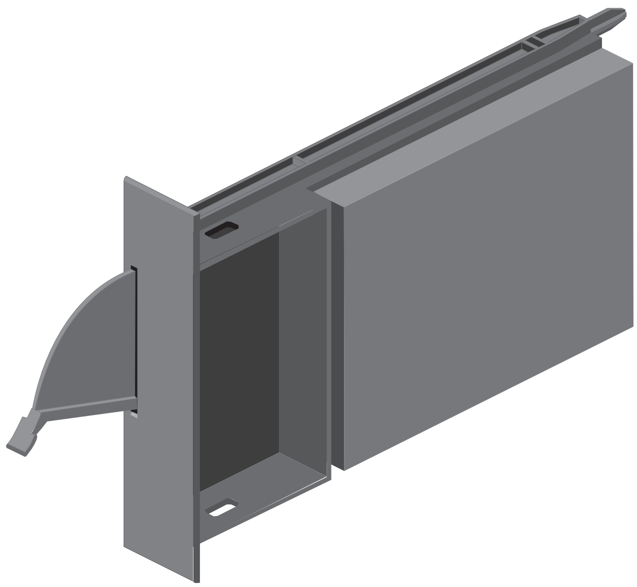


Figure 4-89 O2 (SCA) Drive Sled

4.14.7 OCTANE/Origin/Onyx2 (SCA) Drive Sled

The drives used in the OCTANE, Origin200, Origin2000 and Onyx2 systems are SCA type devices. The drive sled provides the alignment with the system and a method of locking the device in the chassis.

4.14.7.1 OCTANE/Origin/Onyx2 Drive Sled Drawing

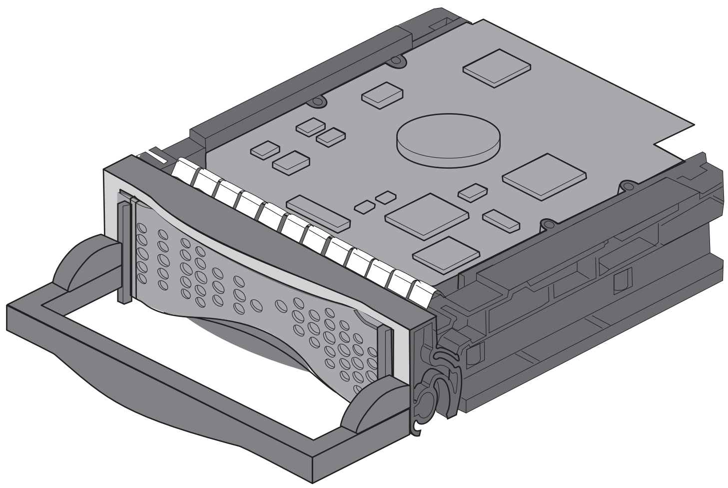


Figure 4-90 OCTANE / Origin / Onyx2 Drive Sled

4.14.8 15 Slot Twin Tower Captive Drive

The 15 Slot Twin Tower chassis included a location for one, full-height 5.25” disk drive in the drive tower. This was normally the boot disk. Twin Tower Drive Modules could then be added on top of the drive tower for additional disk storage.

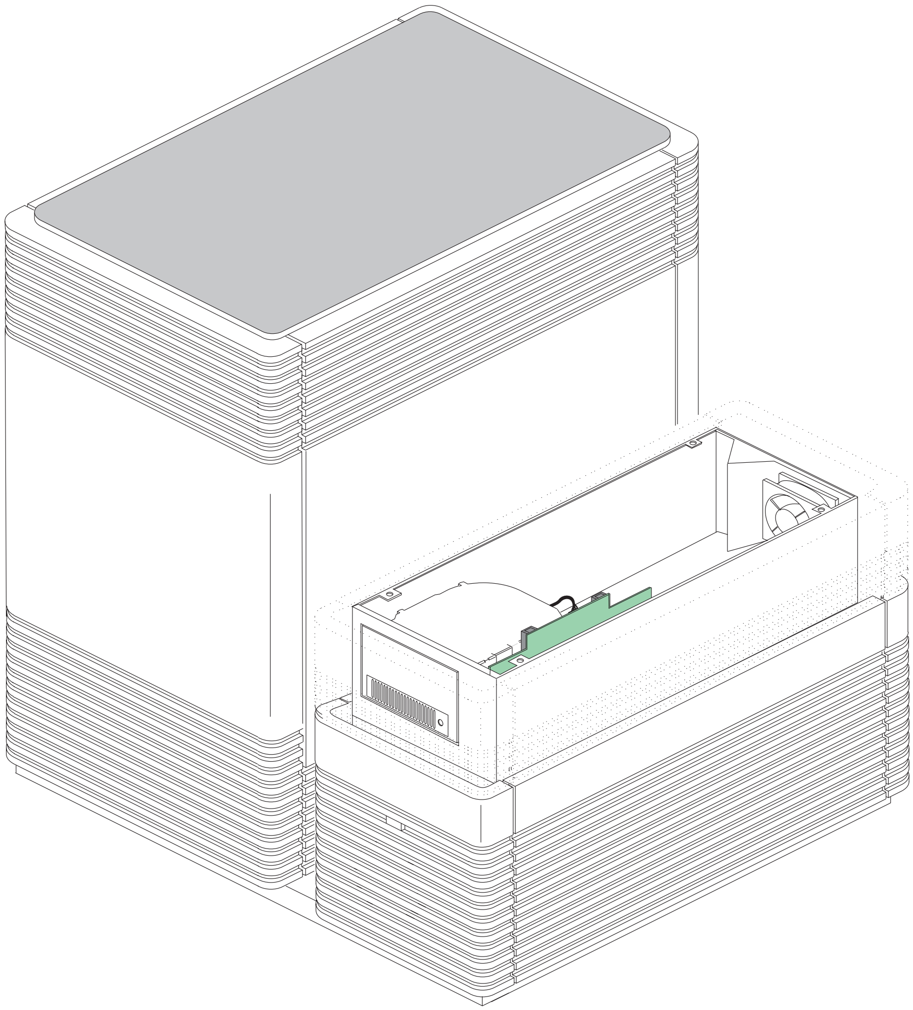


Figure 4-91 15 Slot Twin Tower Captive Drive Location

4.14.9 Predator Captive Drives

The Predator rack chassis has three locations for disk or tape drives to be installed in the System Controller assembly. There is space for one full-height 5.25” drive inside the chassis that is not accessible from the front panel and one full-height and one half-height 5.25” drive opening on the front panel. Systems were normally configured with a full-height disk inside the bay, an Exabyte tape drive and a half-height QIC tape drive. The disk was configured as the boot disk. This configuration is shown in Figure 4-92.

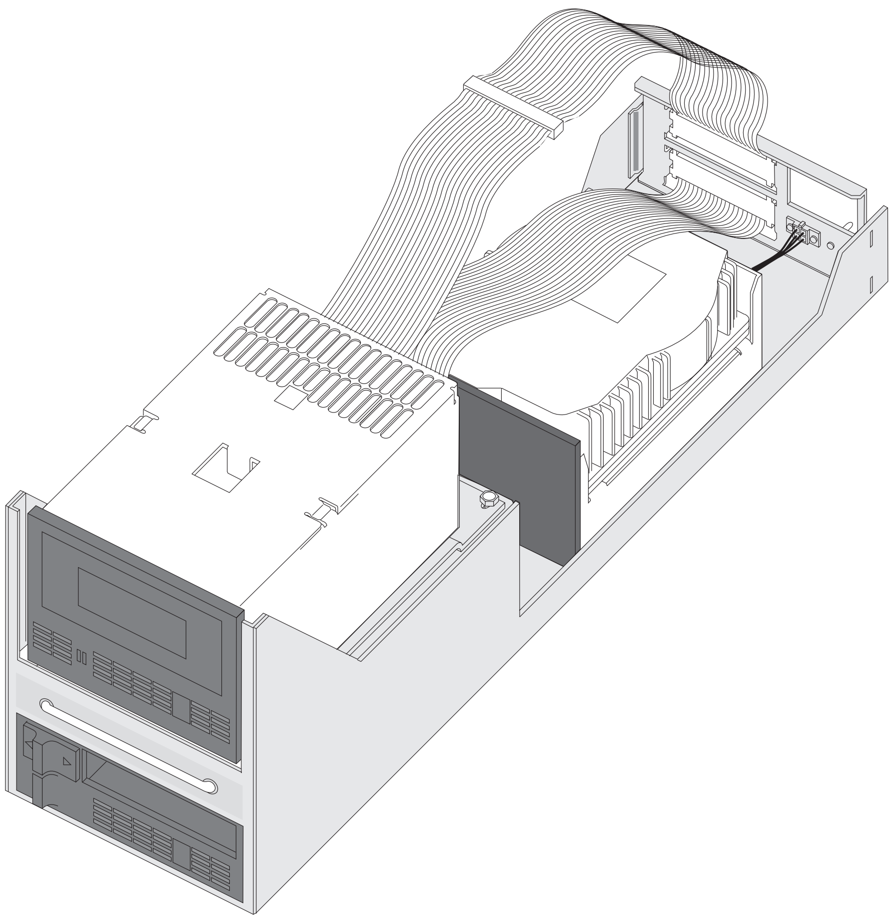


Figure 4-92 Location of Captive Drive in Predator Chassis

4.14.10 Personal IRIS Captive Drive

Prior to the creation of the TFLU chassis for the Personal IRIS, the system disk was permanently located inside the chassis. It was located on the other side of the system from the E-module and just above the power supply.

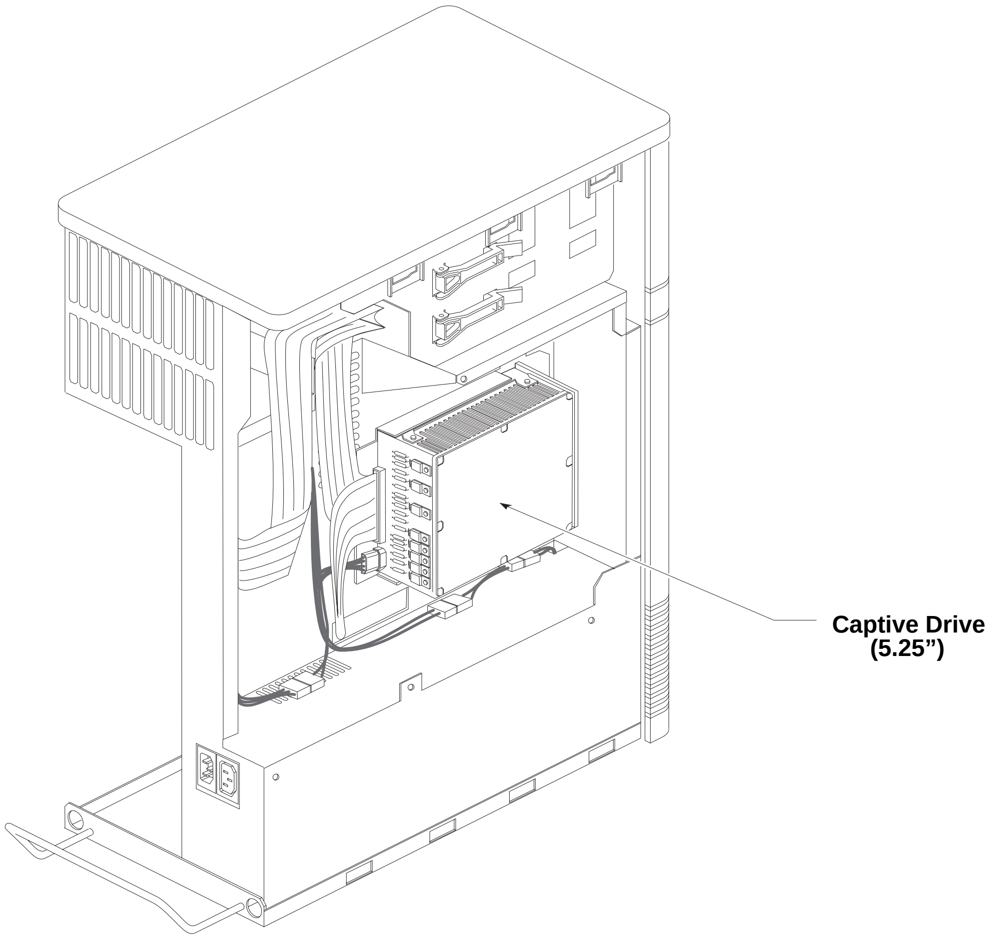


Figure 4-93 Personal IRIS Captive Drive Location

4.14.11 Indy Captive Drives

The Indy chassis includes space for two 3.5” x 1” high disks. These disks are mounted to metal trays which interlock with each other and are then slipped into the chassis and are attached with screws.

The top drive tray can hold a 3.5” floppy or floptical disk drive. The chassis and skins of the machine are made to allow the diskette to be inserted into the drive from the outside.

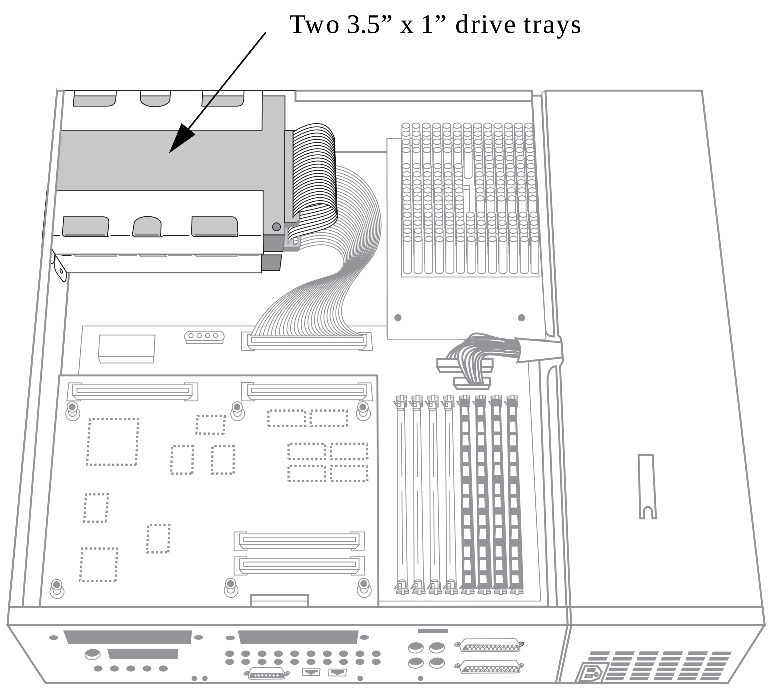


Figure 4-94 Location of Captive Drives in the Indy Chassis

4.14.12 Origin200 5.25” Drive Carrier

The Origin200 chassis can accept one full-height or two half-height 5.25” devices. The devices are mounted to a carrier which is then installed in the chassis.

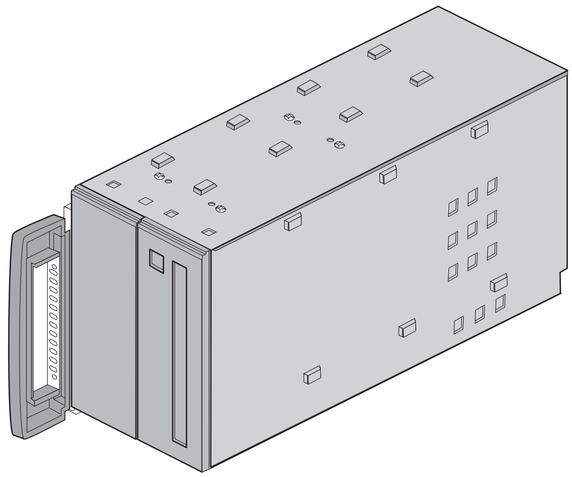


Figure 4-95 Origin200 5.25” Drive Carrier

Chapter 5

Understanding Hardware Inventory (*hinv*) Output

There is a great deal of information about a system's configuration that can be obtained by running the 'hinv' program. With the number of systems and options that exist, understanding the output from this program can be potentially confusing. This chapter details the history of processors in Silicon Graphics systems and explains how to interpret the output from the 'hinv' program.

Each table shows some category of possible output from the 'hinv' program. For each possible output line, valid values for certain parts of the output are shown and any comments that would help understand what this line tells you.

Here is a list of the tables in this chapter and the categories they discuss:

5.1 Understanding CPU Types

The CPU type is one of the key pieces of information used to determine what kind of system you are looking at. Table 5-2 shows the history of Silicon Graphics processor boards. However, there are some cases where the output from the ‘hinv’ command might lead you astray.

This introduces the concept of “hardware CPU” and “software CPU” types. The hardware CPU type describes the physical CPU board itself and what this board is called during the design and manufacturing of the board. The software CPU type describes the architecture of the CPU board that the software sees. In almost all cases the IP number reported by the ‘hinv’ command reflects both the software and hardware CPU type.

The best way to understand this is with an example. The processor boards in the Indigo^2 and the Indy are completely different when viewed from a physical point of view. If they were to be set side by side, they would not be mistaken for each other. The Indigo^2 processor board (using the R4000 or R4400 MIPS processor) is called the IP22. The Indy’s processor board is called the IP24.

Running ‘hinv’ on an Indigo^2 and an Indy will show that each report the presence of an IP22 processor (assuming you aren’t dealing with an Indigo^2 with an R8000 or R10000 processor). While the boards are very different physically, their architecture from a software point of view in terms of the processor and logical location of certain pieces of the hardware architecture are identical. In fact, the Indy processor board uses many of the same ASIC components that were used in the Indigo^2. One way to tell if the IP22 system is an Indigo^2 is to check the hinv output for the line “EISA bus: adapter 0”. If this is in the hinv output, the system is an Indigo^2 - the only SGI system with an EISA bus.

This underscores the fact that the ‘hinv’ program reports the software CPU type, not the hardware CPU. Hopefully, this will not be a problem in many cases, but there are occasions where knowing the difference between the software and hardware CPU types can be handy.

There are only a few instances where the hardware and software CPU types differ. Table Table 5-1 shows these instances.

Table 5-1 Hardware/Software CPU Differences

Hardware CPU	Software CPU
IP4.5	IP4
IP7, IP9	IP5
IP10	IP6
IP13, IP15	IP7
IP14	IP12
IP24	IP22
IP29	IP27

Table 5-2 Processor History

Processor (Hardware CPU)	Used in	Chassis	Software CPU Type (if different from hardware type)	Number of Micro-processors per board	Micro-processor	CPU Speed	Comments
R2300	4D/60	Twin Tower		1	R2300	8 MHz	
IP4	4D/70				R2000	12.5 MHz	
IP4	4D/50				R2000	8 MHz	
IP4.5	4D/80				R2000	16 MHz	
IP4.5	4D/85	Single Tower			R2000	20 MHz	
IP5	4D/1x0	Twin Tower		2	R2000	16 MHz	
IP6	4D/20	Personal IRIS		1	R2000	12.5 MHz	
IP7	4D/2x0	Single/Twin Tower/ Predator		2	R3000?	25 MHz	
IP9	4D/210	Single/Twin Tower	IP7	1	R3000	25 MHz	
IP10	4D/25	Personal IRIS	IP6		R2000	20 MHz	
HP1	Indigo	Indigo	IP12		R3000	33 MHz	
IP13	4D/3x0	Single/Twin Tower/ Predator	IP7	1 or 2	R3000	33 MHz	
IP14	4D/30	Personal IRIS	IP12	1	R3000	30 MHz	
IP14	4D/35				R3000	36 MHz	
IP15	4D/4x0	Single/Twin Tower/ Predator	IP7	2	R3000	40 MHz	
IP17	Crimson	Diehard2		1	R4000	100, 150 MHz	
IP19	Onyx/Challenge L XL	Eveready/Terminator		1, 2 or 4	R4400	150, 200 MHz	

Table 5-2 Processor History

Processor (Hardware CPU)	Used in	Chassis	Software CPU Type (if different from hardware type)	Number of Micro-processors per board	Micro-processor	CPU Speed	Comments
HP2	Indigo R4K	Indigo	IP20	1	R4000	100 MHz	
					R4400	100, 150 MHz	
IP21	Power Onyx/Challenge	Eveready/Terminator		1 or 2	R8000	75, 90 MHz	
IP22	Indigo^2	Indigo^2		1	R4000	100 MHz	
					R4400	100, 150, 200 MHz	
IP22					R4600SC	133 MHz	
IP24	Indy	Indy	IP22	1	R4000PC	100, 133MHz	
					R4000SC	100 MHz	
					R4400SC	150, 175 MHz	
					R4600SC	133 MHz	
IP25	Onyx/Challenge	Eveready/Terminator			R10000	194 MHz	
IP26	Power Indigo^2	Indigo^2		1	R8000	75 MHz	
IP27	Origin200/Origin2000/ Onyx2	Origin200/Origin2000/ Onyx2			R10000	180, 195 MHz	
IP28	Indigo^2 R10K	Indigo^2		1	R10000	195 MHz	
IP30	OCTANE	OCTANE		2	R10000	175, 195 MHz	
IP32	O2	O2		1	R5000	180 MHz	
					R10000	150, 174 MHz	

Table 5-3 Processor Boards

hinv Output	Where valid values are:		Comments
	N (Quantity)	***SP*** (Speed in MHz)	
N SP MHZ IP4 Processor	1	8,12,16	Original processor board for 4D series. Found in 4D/50 and 4D/70
N SP MHZ IP5 Processor(s)	2,4	16	Used in 4D/120
N SP MHZ IP6 Processor	1	12,20	Processor board in the 4D/20 Personal IRIS
N SP MHZ IP7 Processor(s)	1,2,3,4,6,8	25,33,40	Dual processor board used in 4D/200 series
N SP MHZ IP9 Processor	1	25	Single processor board used in 4D/200 series (i.e. 4D/210)
N SP MHZ IP12 Processor	1	30,33,36,40	R3000 based processor in both the 4D/30 Personal IRIS and Indigo
N SP MHZ IP17 Processor	1	50,100,150	Processor used in the Crimson series
N SP MHZ IP19 Processor	1,2,4,8,10,12,15, 16,20,24	100,150,200	Processor used in the Onyx/Challenge series
N SP MHZ IP20 Processor	1	50,100,150	R4000 based processor used in the Indigo series
N SP MHZ IP21 Processor	1,2,4,6,8,18	70,75,94	R8000 based processor used in the Power Onyx and Power Challenge Systems
N SP MHZ IP22 Processor	1	100,132,134,150, 176,200,222	Processor used in the Indigo^2, Challenge M and Indy systems
N SP MHZ IP25 Processor	2,4,6,8,10,12...24	194	R10K based processor used in the Onyx/Challenge systems
N SP MHZ IP26 Processor	1	75	R8000 based processor used in the Indigo^2 chassis
N SP MHZ IP27 Processor	2, 4, 6, 8 ...	195	Processor used in the Origin200/Origin2000/Onyx2 systems
N SP MHZ IP28 Processor	1	195	R10K based processor used in the Indigo^2 system
N SP MHZ IP30 Processor	1,2	195	Processor board used in the OCTANE systems
N SP MHZ IP32 Processor	1	134, 174, 180	Processor board used in the O2. Processor type could be either R5000 or R10000 (134MHZ speed was only for pre-MR systems)
Processor ***N***: ***SP*** MHZ IP7	0-7	25/33/40	Dual processor board used in 4D/200 series
Processor ***N***: ***SP*** MHZ IP19	0-27	100,150	Processor used in the Onyx/Challenge series
Processor ***N***: ***SP*** MHZ IP21	0-15	70,75	R8000 based processor used in the Power Onyx and Power Challenge Systems

Table 5-4 CPU & FPU Types

hinv Output	***REV***	Comments
CPU: MIPS R2000 Processor Chip Revision: ***REV***	5.0	
CPU: MIPS R2000A/R3000 Processor Chip Revision: ***REV***	1.6, 2.0, 3.0	
CPU: MIPS R4000 Processor Chip Revision: ***REV***	2.2, 3.0, 5.0	
CPU: MIPS R4400 Processor Chip Revision: ***REV***	4.0, 5.0, 6.0	
CPU: MIPS R4600 Processor Chip Revision: ***REV***	1.0,2.0	
CPU: MIPS R5000 Processor Chip Revision: ***REV***	1.0, 2.1	
CPU: MIPS R8000 Processor Chip Revision: ***REV***	1.1, 2.1, 2.2	
CPU: MIPS R10000 Processor Chip Revision: ***REV***	2.5, 2.6	
FPU: MIPS R2010 VLSI Floating Point Chip Revision: ***REV***	2.0	
FPU: MIPS R2010A/R3010 VLSI Floating Point Chip Revision: ***REV***	1.5, 2.0, 3.0, 4.0	
FPU: MIPS R4000 Floating Point Coprocessor Revision: ***REV***	0.0	
FPU: MIPS R4010 Floating Point Chip Revision: ***REV***	0.0	
FPU: MIPS R4600 Floating Point Coprocessor Revision: ***REV***	2.0	
FPU: MIPS R4610 Floating Point Chip Revision: ***REV***	0.0, 2.0	
FPU: MIPS R5000 Floating Point Coprocessor Revision: ***REV***	1.0	
FPU: MIPS R8010 Floating Point Chip Revision: ***REV***	0.1	
FPU: MIPS R10010 Floating Point Chip Revision: ***REV***	0.0	

Table 5-5 Cache

hinv Output	***S*** (size)	Comments
Data cache size: ***S*** Kbytes	8, 16, 32, 64	
Instruction cache size: ***S*** Kbytes	8, 16, 32, 64, 99	
Secondary data cache size: ***S*** Kbytes	64, 256	
Secondary data cache size: ***S*** Mbyte	1	
Secondary unified instruction/data cache size: ***S*** Kbytes [on Processor 0]	512	
Secondary unified instruction/data cache size: ***S*** Mbyte [on Processor 0]	1, 2, 4	

Table 5-6 Memory

hinv Output	***S*** (size)	Comments
Main memory size: S Mbytes	8, 12, 16, 20, 24, 28, 32, 40, 48, 56, 64, 72, 80, 88, 96, 104, 112, 128, 144, 160, 176, 192, 224, 256, 288, 320, 384, 2048, 4096	
Main memory size: S Mbytes, 1-way interleaved	32, 64, 128, 192, 256, 320, 512, 576, 768, 1280	
Main memory size: S Mbytes, 2-way interleaved	64, 128, 256, 384, 512, 640, 768, 1024, 1280, 2048	
Main memory size: S Mbytes, 4-way interleaved	256, 512, 768, 1024	
Main memory size: S Mbytes, 8-way interleaved	1024, 2048, 4096	

Table 5-7 SCSI Controllers

hinv Output	Where valid values of are:		Comments
	Y (controller)	***REV*** (Revision)	
Integral SCSI controller ***Y***: Version WD33C93	1,2		The SCSI controller used in the 4D Twin Tower, Single Tower, Personal IRIS and Indigo
Integral SCSI controller ***Y***: Version WD33C93A	1,2		A later version of the SCSI controller above. Was phased in on the Indigo product line. This controller was also used in the Crimson systems.
Integral SCSI controller ***Y***: Version WD33C93A, revision ***REV***	1,2	9	
Integral SCSI controller ***Y***: Version WD33C93B, revision ***REV***	0,1,2	C,D	A follow on version of the SCSI controllers listed above. Implemented on the Indigo^2 and Indy
Integral SCSI controller ***Y***: Version WD33C95A, [differential,] [single ended,] revision ***REV***	0,1,2,3,4,5,6,7,70, 71,90,91,95,96,97, 110,111,115,116, 117,130,131,135,	0,1,80,81	The SCSI controller used in the Challenge/Onyx systems. These controllers could be configured for either single ended or differential operation.
Integral SCSI controller ***Y***: Version SCIP/WD33C95A [differential]	2,3,4,5,6,7,72,73, 74,75,76,77,92,93, 94,112,113,114, 132,133,134,135, 136,137		The SCSI controller located on the IBUS (or mezzanine) card.
Integral SCSI controller ***Y***: Version ADAPTEC 7880	0,1		Adaptec SCSI controller chips built into the O2
Integral SCSI controller ***Y***: Version QL1040B	0 - 15		QLogic SCSI controller chips built into the OCTANE, Origin200/2000 and Onyx2 systems
Interphase 4210 VME-SCSI controller ***Y***: Firmware revision ***REV***	1,2...	01J,A05, A08,X87	A SCSI controller card OEM'd from Interphase. This card supported one SCSI bus and was the initial SCSI controller used in the 4D Twin Tower chassis.
GIO SCSI controller ***Y***: Version WD33C93B, revision ***REV***	1,2	D	An optional add in GIO32bis card that added a SCSI bus to the Indy. Not available for the Indigo.

Table 5-8 SCSI Devices

hinv Output	Where valid values of are:			Comments
	U (unit)	***C*** (controller)	***L*** (lun)	
CDROM: unit ***U*** on SCSI controller ***C***	1-7 or 1-15	1-4		A CDROM unit
Disk drive / removable media: unit ***U*** on SCSI controller ***C*** [floptical]		1-4		The 20 MB floptical drive
Disk drive / removable media: unit ***U*** on SCSI controller ***C***: 720K/1.44M floppy				A 3.5” floppy drive
Disk drive: unit ***U*** on SCSI controller ***C***				A typical disk drive
Disk drive: unit ***U*** on VME-SCSI controller ***C***				A disk drive connected to a VME SCSi controller
Disk drive: unit ***U***, lun z on SCSI controller ***C***				
Disk drive: unit ***U*** on SCSI controller ***C***: RAID				
Jukebox: unit ***U*** on SCSI controller ***C***				A tape drive jukebox
Jukebox: unit ***U***, lun 1 on SCSI controller ***C***		4,6,131, 134		
Printer: unit ***U*** on SCSI controller ***C***				A SCSI based printer
Processor: unit ***U*** on SCSI controller ***C***				A scanner connected to the SCSI bus
Scanner: unit ***U*** on SCSI controller ***C***				
Tape drive: unit ***U*** on VME-SCSI controller ***C***: 8mm(8500) cartridge				An 8mm Exabyte 8500 tape drive connected to a VME SCSI controller
Tape drive: unit ***U*** on SCSI controller ***C***: DAT				A 4mm DAT drive
Tape drive: unit ***U*** on SCSI controller ***C***: DLT				A DLT tape drive
Tape drive: unit ***U*** on SCSI controller ***C***: QIC 1000				A QIC1000 tape drive
Tape drive: unit ***U*** on SCSI controller ***C***: 8mm(8200) cartridge				An 8mm Exabyte 8200 tape drive

Table 5-8 SCSI Devices

hinv Output	Where valid values of are:			Comments
	U (unit)	***C*** (controller)	***L*** (lun)	
Tape drive: unit ***U*** on SCSI controller ***C***: 8mm(8500) cartridge				An 8mm Exabtye 8500 tape drive
Tape drive: unit ***U*** on SCSI controller ***C***: 8mm cartridge				An 8mm Exabyte tape drive (what's different about this one?)
Tape drive: unit ***U*** on SCSI controller ***C***: QIC 150				A QIC150 tape drive
Tape drive: unit ***U*** on SCSI controller ***C***: QIC 24				A QIC24 tape drive
Tape drive: unit ***U*** on SCSI controller ***C***: unknown				The system can't determine what kind of tape device this is.
Tape drive: unit ***U*** on SCSI controller ***C***: 9 track				A 9 track tape drive
Tape drive: unit ***U*** on SCSI controller ***C***: NTP				
WORM: unit ***U*** on SCSI controller ***C***				A WORM drive
RAID controller: unit ***U*** on SCSI controller ***C***				A RAID Controller
RAID lun: unit ***U***, lun ***L*** on SCSI controller ***C***	1- 4		0,1	
Unknown type 0: unit ***U*** on SCSI controller ***C***				The system can't figure out what kind of SCSI device this is.

Table 5-9 Ethernet

hinv Output	***U*** (unit)	***S*** (slot)	***V*** (version)	***IO*** (IO Board)	***MFG*** (manufacturer)	Comments
E-Plex Ethernet controller: ep0-7, slot ***S***, adapter 5, firmware ***V***		3	9412101300			IBUS Ethernet board for Onyx/Challenge
EFast FXP controller: fxp***U***	0,1,2,3					Fast VME Ethernet
ENP-10 Ethernet controller ***U***, firmware version ***V*** (***MFG***)	0		4		SGI	The original ethernet card shipped with the 4D systems
ENP-10 Ethernet controller: enp***U***, firmware version ***V*** (***MFG***)	0,1		0,4		CMC,SGI	
E++ controller: ***U***, version ***V***	ec1,ec2, ec3,ec4		1,2			An additional ethernet interface. Can be either a VME, GIO, EISA or PCI bus card.
Integral Ethernet controller: Version ***V***			0,3			
Integral Ethernet controller: et***U***, Ebus slot ***S***	0,1,2	2,3,4,5,9, 10,11,13, 15				The ethernet controller built into the Onyx/Challenge systems
Integral Ethernet: ec***U***, version ***V***	0,1,2,3		0,1			Ethernet controller built into the Personal IRIS, Indigo, Indigo^{2}, Indy and O2 systems
Integral Ethernet: et***U***, ***IO***	0,1			IO2, IO3		Ethernet controller built into the IO2 and IO3 boards. Used in 4D and Crimson systems
Integral Fast Ethernet: ef***U***, version ***V***	0		1			10/100 Base-T ethernet built into OCTANE and Origin200

Table 5-10 FDDI

hinv Output	***U*** (unit)	***S*** (slot)	***A*** (adapter)	***V*** (version)	***ATT*** (attach)	Comments
XPI FDDI controller: xpi***U***, firmware version ***V***, ***ATT*** [with bypass]	0,1,2,3			9310220901, 9310221105, 9402200310, 9406220038, 9407151532, 9408151911, 9410312218, 9411032038,	SAS,DAS	GIO FDDI board for Indigo[2]
XPI FDDI controller: xpi***U***, slot ***S***, adapter ***A***, firmware version ***V***, ***ATT***	0,1,2,3	3,5,11, 13,15	5,6,13,14	9411032000, 9412150700, 9412271100, 9409011200, 9409271400, 9410050000	SAS,DAS	IBUS FDDI board for Onyx/Challenge
FDDIXPress controller: ipg***U***, version ***V***	0,1,2			1		VME FDDI board

Table 5-11 Other Networking

hinv Output	***U*** (unit)	***S*** (slot)	***A*** (adapter)	***V*** (version)	Comments
5080 Gateway card ***U***	0-3				The VME based 5080 board
ATM OC-3c unit ***U***: slot ***S***, adapter ***A***	0	5	6		VME based ATM board
ATM unit ***U***: slot ***S***, adapter ***A***, Multi-Mode Fiber, SONET STS-3c 155.52 Mbps	0,1	9,10,11, 12,13	5,6		VME based ATM board
Integral ISDN: Basic Rate Interface unit ***U***, revision ***V***	0	1.0		1.0	The built in ISDN interface on the Indy
X.25 controller ***U***	0,1				The VME based X.25 controller
VME Synchronous Communications board ***U***	0,1,2,3				
GIO Synchronous Communications board ***U***	0,1				A GIO32bis synchronous comm board
HIPPI adapter: hippi***U***, slot ***S*** adap ***A***, firmware version ***V***	0	3,5,13,15	2,5,6	000000, 170276, 1210308, 1432176, 15185228	IBUS HIPPI board
IRIS TokenRing controller fv***U***: 16 Mbit	0-3				VME TokenRing board
IRIS GIO TokenRing controller gtr***U***: 16 Mbit	0-3				GIO TokenRing board

Table 5-12 Video Devices

hinv Output	***U*** (unit)	***V*** (version)	***B*** (bus)	Comments
Cosmo Compression: unit ***U***, revision ***V***	0,1,2	0		The GIO32bis compression board, used with Indy Video
Galileo video (ev1): unit ***U***, revision ***V***. [Indycam connected.] [601 option connected.] [601 not connected]	0	2		The video board for the Indigo^2 that worked with the Extreme and XZ graphics board sets. The Galileo board supported component output and 601 style digital video output and input.
Indigo2 video (ev1): unit ***U***, revision ***V***. [Indycam connected.]	0	3		The video board for the Indigo^2 that worked with the Extreme and XZ graphics board sets. This board does not support component or 601 output and input.
Indigo2 video: unit ***U***, revision ***V***	0	3		
IndigoVideo board: unit ***U***, revision ***V***	0	2,3		The IndigoVideo board. Composite and S-Video inputs and outputs only. A custom board - not a GIO board that only fit the Starter graphics on the Indigo
Indy Video (ev1): unit ***U***, revision ***V***	0	0		The GIO32bis add-in board for the Indy
Indy Video: unit ***U***, revision ***V***	0	0		
Sirius video: unit ***U*** rev ***V*** at 0xf4	0	0		The Sirius video option board for the Onyx system
Sirius video: unit ***U*** revision ***V*** on bus ***B*** with [CPI] [DGI] [BOB] [SD1] [no] options	0	4	0	The Sirius video option to the Onyx system. Options are: CPI - DGI - BOB - Break Out Box SD1 -
Vino video: unit ***U***, revision ***V***, [IndyCam connected] [IndyCam not connected]	0	0,1		The 'Vino" is the chip in the Indy that processes video input. Indicates whether the IndyCam is connected or not. Vino = "Video In, Not Out"
AV: AV1 Card Version ***V***, [Camera not connected] [O2Cam type 1 version 0 connected]		1		The Audio/Video board for the O2, indicates whether the O2Cam is connected or not.
Video: unit ***U*** version ***V*** (sw:1) with AV1 Card version 1 and no Camera	0	1		
Video: MVP unit ***U*** version ***V***	0	1.2		

Table 5-13 Audio Devices

hinv Output	***U*** (unit)	***B*** (base)	***V*** (version)	***R*** (revision)	Comments
Iris Audio Processor, rev ***R***				1,2, 3,10	The audio subsystem in the Personal IRIS
Iris Audio Processor: version ***V*** revision ***R***			69, A2, A3	0, 6.9.6, 0.1.0, 1.1.0, 4.1.0	The audio subsystem for the Indigo, Indigo^2 and Indy
Iris Audio Processor: version RAD revision ***V***, number ***U***	1		12.0		The audio subsystem in the OCTANE
ViGRA 110 Audio ***U***, base ***B***, revision ***R***	0	0x1A000000		1	A VME add in card used in the Onyx and Challenge systems prior to the ASO options availability.

Table 5-14 Graphics

hinv Output	***P*** (pipe)	***S*** (slot)	***A*** (adapter)	Comments
CRM graphics installed				O2 graphics
GT Graphics option installed				Graphics found in 4D/XXGT systems
Genlock option installed				The Genlock option for the Personal IRIS
Graphics board: GR1.1 [Bit-plane], [Z-buffer] options installed				Personal IRIS graphics - original base level graphics - RE1 rendering engine, 8 bitplanes, 2 auxplanes, 2 widplanes, no Z-buffer planes. Bitplane option created 24 Bitplanes. Z-buffer option added 24 Z-buffer planes.
Graphics board: GR1.2 [Bit-plane] [Auxiliary planes] [Z-buffer] [Turbo] [Small monitor] option[s] installed				Personal IRIS graphics - RE2 rendering engine, 8 bitplanes, 2 auxplanes, 2 widplanes, no Z-buffer planes. Bitplane option created 24 Bitplanes. Z-buffer option added 24 Z-buffer planes.Turbo option added an additional graphics hardware acceleration.
Graphics board: GR2-Elan				The “Elan” version of the Express graphics family - 4 GEs, 1 RE, 24 Bitplanes, 4 auxplanes, 4 cidplanes, Z-buffer. This graphics set could be installed in an Indigo, a Personal IRIS, or a Crimson.
Graphics board: GR2-Unknown configuration				
Graphics board: GR2-XS [with Z-buffer]				The XS version of the Express graphics family - 1 GE, 1 RE, 8 Bitplanes, 4 auxplanes, 4 cidplanes, no Z-buffer. This graphics set could be installed in an Indigo, a Personal IRIS, or a Crimson.
Graphics board: GR2-XS24 [with Z-buffer]				The XS24 version of the Express graphics family - 1 GE, 1 RE, 24 Bitplanes, 4 auxplanes, 4 cidplanes, no Z-buffer. This graphics set could be installed in an Indigo, a Personal IRIS, or a Crimson.
Graphics board: GR2-XSM				The XSM version of the Express graphics family - 4GEs, 1 RE, 24 Bitplanes, 4 auxplanes, 4 cidplanes, no Z-buffer. This graphics set could be installed in an Indigo, a Personal IRIS, or a Crimson.

Table 5-14 Graphics

hinv Output	***P*** (pipe)	***S*** (slot)	***A*** (adapter)	Comments
Graphics board: GR2-XZ [missing Z]				The XZ version of the Express graphics family - 2GEs, 1 RE, 24 Bitplanes, 4 auxplanes, 4 cidplanes, Z-buffer. This graphics set could be installed in an Indigo, a Personal IRIS, or a Crimson.
Graphics board: GR3-Elan				The Indigo^2 version of the Elan graphics. Same specs as the GR2-Elan, but in the GIO64 board form factor. Two board set.
Graphics board: GR3-XZ				The Indigo^2 version of the XZ graphics. Same specs as the GR2-XZ, but in the GIO64 board form factor. Two board set.
Graphics board: GU1-Extreme				The Indigo^2 “Extreme” graphics - 8 GEs, 2 REs, 24 Bitplanes, 4 auxplanes, 4 cidplanes, Z-buffer. A 3 board GIO64 board set. Available only in the Indigo^2 chassis.
Graphics board: High Impact [/TRAM option card]				High IMPACT graphics for the Indigo^2 - 1 GE, 1 RE, 1 TRAM. TRAM option card increases TRAMs to 4
Graphics board: High-AA Impact [/TRAM option card]				High-AA IMPACT graphics for the Indigo^2 - 2 GE, 1 RE, 1 TRAM. TRAM option card increases TRAMs to 4
Graphics board: Indy 24-bit				Indy “Newport” graphics, 24 Bitplanes
Graphics board: Indy 8-bit				Indy “Newport” graphics, 8 Bitplanes
Graphics board: InfiniteReality				InfiniteReality graphics for the Onyx - 4 GEs, RM6
Graphics board: InfiniteReality2				InfiniteReality2 graphics for the Onyx - 4 GEs, RM7
Graphics board: LG1				Starter graphics for the Indigo. 8 Bitplanes, no Z-buffer. 1024x768 maximum resolution.
Graphics board: MG10 Impact				The MG10 version of IMPACT graphics for the Indigo^2 - 1 GE, 1 RE, no TRAM.
Graphics board: MXI				Maximum IMPACT graphics for the OCTANE. 2 GEs, 2 REs, 4 TRAMs
Graphics board: Maximum Impact				Maximum IMPACT graphics for the Indigo^2 - 2 GE, 2RE, 1 TRAM. TRAM option card increases TRAMs to 4

Table 5-14 Graphics

hinv Output	***P*** (pipe)	***S*** (slot)	***A*** (adapter)	Comments
Graphics board: Reality				Reality Engine for the Onyx2 - 2 GEs, RM8
Graphics board: SI [with texture option]				Solid IMPACT graphics for the OCTANE. 1 GEs, 1 REs, 4 TRAMs
Graphics board: XL				The Indigo^2 version of Newport graphics.
Indy Presenter adapter board [and display.]				Add in GIO card that allows the Indy Presenter to be connected
Multi-Channel Option board installed				The Multi-Channel option for Onyx
RealityEngine Graphics option installed				Reality Engine graphics for Onyx
RealityEngineII Graphics Pipe ***P*** at IO Slot ***S*** Physical Adapter ***A*** (Fchip rev 2)	0,1,2	3,9,11	A,2,5,6	Reality Engine II graphics for Onyx - 12 GEs, RM4 or RM5
VGX Graphics option installed				VGX graphics for 4D, and Crimson systems
VGXT Graphics option installed				VGXT graphics for 4D and Crimson systems
VTX Graphics Pipe ***P*** at IO Slot ***S*** Physical Adapter ***A*** (Fchip rev 2)	0	3,11	2	VTX graphics for Onyx systems - 6 GEs, RM4

Table 5-15 Serial & Parallel Ports

hinv Output	***U*** (unit)	***S*** (slot)	***N*** (number of ports)	***V*** (version)	Comments
Integral EPC serial ports: ***N***			4,8,12,16		
Integral IO4 serial ports: ***N***			4		
On-board serial ports: ***N***			2		
On-board serial ports: ***N*** [per CPU board]			2		
On-board serial ports: ***N***			4		
IOC3 serial port: [tty1] [tty2]					Built in serial ports on the OCTANE
Central Data Serial controller ***U***, firmware version ***V***	0,1			1006, 1007,	The Central Data “CDSIO” serial port VME board
async serial controller: cdsio***U***, firmware version ***V***	0,1,2,3			1006, 1007, 20005, 20006	
Integral EPC parallel port: Ebus slot ***S***		2,3,4,5,7, 9,10,11, 13,15			The parallel port on the Onyx and Challenge systems
Integral IO4 parallel port: Ebus slot ***S***		3			
On-board bi-directional parallel port					The Indy parallel port
On-board parallel port					
On-board EPP/ECP parallel port					The O2’s parallel port
IOC3 parallel port: plp1					OCTANE built in parallel port

Table 5-16 ESDI

hinv Output	***C*** (controller)	***V*** (version)	***U*** (unit)	Comments
Interphase 3201 2-drive ESDI disk controller ***C***	0,1			The Interphase VME ESDI disk controller - 2 drives
Interphase 3201 2-drive ESDI disk controller ***C***: Firmware Revision ***V***	0,1	X0J		
Interphase 4201 4-drive ESDI disk controller ***C***	0,1			The Interphase VME ESDI disk controller - 4 drives
Interphase 4201 4-drive ESDI disk controller ***C***: Firmware Revision ***V***	0,1	040,04H,050		
ESDI Disk drive: unit ***U*** on Interphase controller ***C***	0,1		0,1,2,3	How actual ESDI drives show up in the hinv output

Table 5-17 IPI

hinv Output	***U*** (unit)	***V*** (version)	***C*** (controller)	Comments
Xylogics 7800 16-drive IPI disk controller ***U***: Firmware version ***V***	0,1	2.2.4,2.2.9		This is a VME based IPI controller
IPI Disk drive: unit ***U*** on Xylogics controller ***C***	0-15		0,1	How the IPI drive is reported in hinv

Table 5-18 SMD

hinv Output	***U*** (unit)	***V*** (version)	***C*** (controller)	Comments
Xylogics 754 4-drive SMD disk controller ***C***			0, 1	The VME based SMD disk controller card
Xylogics 754 4-drive SMD disk controller ***C***: Firmware version ***V***		2.7.0	0, 1	
SMD Disk drive: unit ***U*** on Xylogics controller ***C***	0-3		0, 1	How the SMD disks are reported by hinv

Table 5-19 1/2 Tape Controller

hinv Output	***C*** (controller)	***V*** (version)	Comments
Xylogics 1/2 inch tape controller ***C*** ctlr type: 772 firmware: ***V***	0,1	2.7,2.8	The VME based tape controller board

Table 5-20 Bus Adapters

hinv Output	***A*** (adapter)	***M*** (adapter mapping)	***V*** (version)	Comments
EISA bus: adapter ***A***	0			This is a dead give away that the system is an Indigo^{2}
VME bus: adapter ***A***	0, 1, 13, 21, 36, 37, 45, 47, 61			The VME bus. Seen on the Personal IRIS, Onyx and Challenge systems.
VME bus: adapter ***A*** mapped to adapter ***M***	0	13, 21, 45, 61		Seen on the Onyx and Challenge systems.

Table 5-21 I/O Boards

hinv Output	***S*** (slot)	***IO*** (IO board)	***V*** (version)	Comments
I/O board, Ebus slot ***S***: IO4 revision ***V***	2,3,4,5,7,9, 10,11,13,15		1	
I/O board, slot ***S***: ***IO*** [revision ***V***]	E,F	IO2,IO3, IO3B	2	

Table 5-22 PCI Devices

hinv Output	***B*** (bus)	***S*** (slot)	***F*** (function)	Comments
Bit3 PCI Bridge Card: Bus ***B***, Slot ***S***	0,1,2	0-7		Bit3 card that links to the PCI expansion chassis
PCI controller, slot: ***S***, Texas Instruments E++ Ethernet Controller		0-7		Texas Instruments Ethernet card
Unknown Type PCI: Bus ***B***, Slot ***S***, Function ***F***, Vendor ID 0x***VID***, Device ID 0x***DID*** No driver	0,1,2	0-7	?	This indicates that the system has found a PCI device, but does not have a driver for the specific Vendor ID (***VID***) and Device ID (***DID***).

Table 5-23 Miscellaneous

hinv Output	***C*** (controller)	***U*** (unit)	***V*** (version)	Comments
EPC external interrupts				External Interrupts on the Onyx and Challenge systems
IOC3 external interrupts: 1				OCTANE external interrupt connections
IEEE-488 bus controller ***C***	0			A VME based IEE-488 controller board made by National Instruments
Light Video unit ***U*** Rev ***V***		0	2	
CC synchronization join counter				
Processor: unit ***U*** on SCSI controller ***C***	0,1	2, 3, 4, 5, 6, 7		
IRIS Channel Adapter board ***U***		0		
IndyComp: unit ***U***, revision ***V***		0	1:3	
FLASH PROM version			1.0,2.3, 4.0	The O2 uses Flash Prom for the system prom. This prom image may be upgraded by software rather than replacing the actual prom chip.
Vice: [DX] [TRE]				The VICE image processing chip on the O2. The DX is the earlier version, the TRE the later version.

Not just another empty page.

Chapter 6

The IRIX Operating System

The operating system SIlicon Graphics systems use, IRIX, has undergone major changes during its lifetime. Changes to the operating system have ranged from the subtle changes in appearance of the desktop display and changes to some underlying kernel interfaces to changes in windowing systems and major kernels capabilities. Knowing which version of IRIX a system is using, or which versions of IRIX support particular platforms is an important piece of information. The purpose of this chapter is to provide some information in this regard.

6.1 What Causes The Release of a New Operating System?

While this seems like a question with an obvious answer, it makes sense to lump these reasons into a small number of categories then look at each category individually. Trying to understand the whole landscape of IRIX releases without subdividing it in some way is a truly daunting task. Hopefully this approach will make understanding the IRIX releases easier.

A new version of the operating system is released when the following occurs:

- **New System -** a new system (chassis) has been introduced. This usually drives creation of a new processor board and, possibly, new features in the system's architecture.
- **New CPU -** a new processor (here meaning the microprocessor chip) has been introduced
- **New Graphics -** a new graphics subsystem has been introduced
- **New Capabilities -** some significant new software feature has been introduced. Examples would be new windowing system, kernel base, or filesystem support.

In the history of IRIX, the introduction of new features or systems has tended to create a version of the operating system that works on a specific new platform or is different from what is used on other, usually older, systems. The final category of operating system changes addresses this issue.

- **A Merge Release -** a release where the differences created by the situations above are merged into a common base operating system release. This is often also a release where bugs or patches are incorporated into the release. As often happens, new features are added to a release that creates a new base operating system release. This makes it rare to have an operating system version that is purely a merge type of release.

The remainder of this chapter will look at each category and point out the major milestones for each of these.

6.2 New Systems

Each new system chassis that is introduced needs a version of the operating system that is customized to its unique features - CPU type, memory architecture, graphics subsystem and I/O subsystem to name the obvious ones. It is important to know which version of IRIX was the first to support a particular platform. It is also important to know which version of IRIX did not include support for a particular platform. Table 6-1 shows these major milestones.)

Table 6-1 IRIX New System Milestones

<table>
<tr><th>System/Chassis</th><th>First Version of IRIX that supported this</th><th>First Version of IRIX that DIDN'T support this</th></tr>
<tr><td>4D/60</td><td>IRIX 3.0</td><td>IRIX 5.2</td></tr>
<tr><td>4D/100 Series</td><td>IRIX 3.1</td><td rowspan="7">IRIX 6.2</td></tr>
<tr><td>4D/200 Series</td><td>IRIX 3.2</td></tr>
<tr><td>4D/300 Series</td><td>IRIX 3.3</td></tr>
<tr><td>4D/400 Series</td><td>IRIX 3.3.2 + 3.3.3L</td></tr>
<tr><td>Personal IRIS (R2000)</td><td>IRIX 3.1</td></tr>
<tr><td>Personal IRIS (R3000)</td><td>IRIX 3.3.2 + 1.0 4D/35</td></tr>
<tr><td>Crimson</td><td>IRIX 4.0.3</td><td>Still supported</td></tr>
<tr><td>Indigo (R3000)</td><td>IRIX 4.0</td><td>IRIX 6.2</td></tr>
<tr><td>Indigo (R4000)</td><td>IRIX 4.0.5E</td><td rowspan="10">Still supported</td></tr>
<tr><td>Onyx/Challenge</td><td>IRIX 5.0</td></tr>
<tr><td>Indigo2</td><td>IRIX 4.0.5H</td></tr>
<tr><td>Challenge M</td><td>IRIX 4.0.5H a360</td></tr>
<tr><td>Indy</td><td>IRIX 5.1 (Indy)</td></tr>
<tr><td>Challenge S</td><td>IRIX 5.2 for Indy R4600 PC & Challenge S</td></tr>
<tr><td>O2</td><td>IRIX 6.3MR</td></tr>
<tr><td>Origin200, Origin2000, Onyx2</td><td>IRIX 6.4 for Origin200, Origin2000, Onyx2</td></tr>
<tr><td>OCTANE</td><td>IRIX 6.4 for Origin, Onyx2 & OCTANE</td></tr>
</table>

6.3 New CPU

A new microprocessor type typically requires changes to the kernel to accommodate the new features of the processor and its register and memory layout. Table 6-2 shows these milestones.

Table 6-2 IRIX New CPU Milestones

CPU Type	On:	First Version of IRIX that supported it	First IRIX release that didn't support it:
R2300	4D/60	IRIX 3.0	IRIX 5.3
R2000	4D/100,200	IRIX 3.0	IRIX 6.2
	Personal IRIS	IRIX 3.1	
R3000	4D/300	IRIX 3.3	
	Personal IRIS	IRIX 3.3.2 + 1.0 4D/35	
	Indigo	IRIX 4.0	
R4000	Crimson	IRIX 4.0.3	Still supported
	Indigo	IRIX 4.0.5E	
	Indigo2	IRIX 4.0.5H	
R4000PC	Indy	IRIX 5.1 (Indy)	
R4000SC	Indy	IRIX 5.1 (Indy)	
R4400	Onyx/Challenge	IRIX 5.0	
	Indigo2	IRIX 4.0.5H	
	Indy	IRIX 5.1 (Indy)	
R4600PC	Indy	IRIX 5.2 for Indy R4600 PC & Challenge S	
R4600SC	Indy	IRIX 5.2 for Indy R4600SC/XZ & Presenter	
	Challenge S	IRIX 5.2 for Indy R4600/XZ & Presenter	
	Indigo2	IRIX 5.2	
R5000	Indy	IRIX 5.3 Indy R5000	
	O2	IRIX 6.3MR	
R8000	Onyx/Challenge	IRIX 6.0	
	Indigo2	IRIX 6.0.1	
R10000	Onyx/Challenge	IRIX 6.2	
	Indigo2	IRIX 6.2 for Indigo2 IMPACT 10000	
	O2	IRIX 6.3 for O2 including R10000	
	Onyx2/Origin200/ Origin2000	IRIX 6.4 for Origin200, Origin2000, Onyx2	
	OCTANE	IRIX 6.4 for Origin, Onyx2 & OCTANE	

6.4 New Graphics

A new graphics subsystem also tends to require changes to the kernel and basic parts of the operating system due to different memory, access and capability constraints. The first release of IRIX that supported each graphics type (specific to a particular chassis) is shown in Table 6-3. This table also shows the first version of IRIX that *did not* support this graphics type.

Table 6-3 IRIX New Graphics Milestones

Graphics Subsystem	On:	First Version of IRIX that supported this	First Version of IRIX that **Did Not** support this:
4D B, G	4D/60, 70	IRIX 3.0	IRIX 6.2
GT	4D/70, 80, 85, 100, 200	IRIX 3.1	IRIX 6.2
GTX	4D/60, 70, 80, 85, 100. 200	IRIX 3.3.2 + 1.0 4D/35	IRIX 6.2 (Crimson GTX only)
SkyWriter	4D/200, 300	IRIX 4.0	IRIX 6.2
G	Personal IRIS	IRIX 3.1	
Turbo	Personal IRIS	IRIX 3.2	
VGX	4D/100, 200, 300	IRIX 3.3	
VGXT	4D/100, 200, 300	IRIX 4.0	
VTX	Onyx	IRIX 5.0	Still supported
Entry	Indigo	IRIX 4.0	
XS, XS24, Elan	Personal IRIS & Indigo	IRIX 4.0.2	
XS, XZ, Extreme	Indigo2	IRIX 4.0.5H	
Extreme	Crimson	IRIX 4.0.5H	
Extreme	Onyx	IRIX 5.2 for Onyx Extreme	
XL	Indigo2	IRIX 5.1 (non-Indy)	
XL	Indy	IRIX 5.1 (Indy)	
XZ	Indy	IRIX 5.2 for Indy R4600SC/XZ & Presenter	
Reality Engine	Crimson	IRIX 4.0.5D	
Reality EngineII	Onyx	IRIX 5.0	
Infinite Reality	Onyx	IRIX 6.2	
High IMPACT	Indigo2	IRIX 5.3 Indigo2 IMPACT	
	OCTANE	IRIX 6.4 for Origin, Onyx2 & OCTANE	

Table 6-3 IRIX New Graphics Milestones

Graphics Subsystem	On:	First Version of IRIX that supported this	First Version of IRIX that **Did Not** support this:
Solid IMPACT	Indigo2	IRIX 5.3 Indigo2 All IMPACT	Still supported
	OCTANE	IRIX 6.4 for Origin, Onyx2 & OCTANE	
Maximum IMPACT	Indigo2	IRIX 5.3 Indigo2 All IMPACT	
	OCTANE	IRIX 6.4 for Origin, Onyx2 & OCTANE	
O2 Graphics	O2	IRIX 6.3MR	

6.5 New Capabilities

Major changes in an operating systems lifetime occur when some significant part of the operating system is replaced or changed. In the case of IRIX, there have been changes to the fundamental windowing system used, the filesystem supported, and the inherent bit size of the operating system. Table 6-4 shows these major milestones.

Table 6-4 IRIX New Capabilities Milestones

New Capability	First Version of IRIX that supported this
NeWS Windowing System	IRIX 3.1
X-Windows	IRIX 4.0
EFS	Prior to IRIX 3.0
XFS (32 bit OS)	IRIX 5.3 XFS
XFS (64 bit OS)	IRIX 6.0.1 XFS
64-bit Operating System	IRIX 6.0
Trusted IRIX	IRIX 4.0.1T
4D/30,35 Audio	IRIX 3.3.2 + 1.1 4D/35

6.6 Merge Releases

The merge releases pull together features and capabilities of releases created to fill a specific need - a new CPU, system, etc. These releases are often the releases where bugs in the operating system are fixed. These releases are typically those that are “pushed” out to all users under support to create a single release that supports most, if not all, the currently available systems.

Table 6-5 IRIX Merge Releases

Release	
IRIX 4.0.1	Replaced the IRIX 3.3 and IRIX 4.0 releases. Incorporated support for all the early 4D systems, the Personal IRIS and the R3000 Indigo
IRIX 5.2	Replaced the following releases for specific platforms - 4.0.1, 4.0.5A, 4.0.5C, 4.0.5F, 4.0.5G, 4.0.5H a360, 4.0.5IOP and 4.0.5J. Merged the support of all the early 4D systems, Personal IRIS, R3K & R4K Indigo, Indigo2, Indy, Onyx and Challenge systems.
IRIX 5.3	Incorporated support for all the above systems and made significant performance enhancements across the board.
IRIX 6.2	Incorporated support for all platforms with R3000 CPU’s with the exception of Crimson GTX. This included the R8000 based Power Onyx, Power Challenge, Power Indigo2 and the R10000 based Onyx, Challenge and Indigo2.

Chapter 7

Software Tools

There are a wealth of software tools that will assist in determining information about the software or hardware configuration of the system, that can be used for controlling the system. These tools can be very helpful when trying to determine what you're working with. This list is by no means exhaustive, but does provide a good overview of some of the most commonly used tools.

The tools have been divided into the following general categories:

- System Hardware Tools
- System Software Tools
- User Information Tools
- Terminal Tools
- Peripheral Tools
- Networking Tools
- Mail Tools
- Miscellaneous Tools

The tools mentioned here either have manual ("man") pages, or are compilable source code with some sort of readme file. Unless mentioned otherwise, typing "**`man commandname`**" will show manual page for that command.

The contents of the man pages for these tools will not be repeated here - just a general description of the command and what it can be used for. Where a particular set of command options provides useful information, that will be noted along with the expected results.

The following three pages show a list of the commands included in this chapter as well as some related information:

- Beware! - commands that are dangerous to use without being really sure what you're doing
- Description - a "one-liner" description of the command
- Page - what page they can be found on in this chapter
- Location - where the command can actually be found in the directory structure
- Related Commands - commands that might be of use, or perform similar or complementary functions

System Hardware Tools

Command	Beware!	Description	Page	Location	Related Commands
gfxinfo		show graphics subsystem information	7-5	/usr/gfx	
hinv		show system hardware configuration	7-5	/bin	
nvram	**!!**	show the values of Non-volatile RAM variables	7-6	/sbin	
sysinfo		show the system's unique identifier	7-6	/sbin	

System Software Tools

Command	Beware!	Description	Page	Location	Related Commands
chkconfig		show state of configuration flags	7-6	/sbin	
crontab		table of chronological events	7-6	/bin	
date		show or set system day and time	7-6	/sbin	
df		show amount of free disk blocks	7-6	/sbin	
du		show disk usage	7-7	/bin	
gr_osview		graphical version of osview	7-7	/usr/sbin	osview
gr_top		graphical version of top	7-8	/usr/sbin	top
hostname		show the name of the system	7-7	/usr/bsd	
idbg		kernel debugger print utility	7-7	/var/sysgen/ boot	
last		list last logins of users or devices	7-7	/usr/bsd	
mkboottape		build, list or extract a boot tape	7-7	/usr/sbin	
osview		show the activity of the operating system	7-7	/usr/sbin	gr_osview
printenv		show the settings of the environmental settings	7-7	/bin	
ps		show process status	7-8	/bin	
swap	**!!**	add, delete or monitor system swap areas	7-8	/sbin	
syserr/sysmon		show system error info	7-8	/usr/sbin	
systune	**!!**	display/set tunable kernel parameters	7-8	/usr/sbin	
top		show processes using largest percentage of CPU	7-8	/usr/sbin	gr_top
uname		show the current OS version	7-9	/bin	
versions		list software installed by inst	7-9	/usr/sbin	inst
whereis		locate source, binary or man pages for a program	7-9	/usr/bsd	
which		locate a program including aliases	7-9	/usr/bsd	
xlsfonts		list the fonts available to X server	7-9	/usr/bin/X11	
xdpyinfo		X display configuration info	7-9	/usr/bin/X11	
xwininfo		X window information	7-9	/usr/bin/X11	

User Information Tools

Command	Beware!	Description	Page	Location	Related Commands
id		show current user and group ID's	7-10	/bin	
who		show current system users	7-10	/bin	
whoami		show current user ID name	7-10	/bin	

Terminal Tools

Command	Beware!	Description	Page	Location	Related Commands
stty		set tty characteristics	7-10	/bin	
terminfo		terminal capabilities database	7-10	/usr/lib	
tput		initialize terminal or query terminfo database	7-10	/bin	
tty		get name of the terminal	7-10	/bin	

!! - When logged in as root, these commands could cause system damage. Not for casual use!!

Peripheral Tools

Command	Beware!	Description	Page	Location	Related Commands
bru		backup and restore utility	7-11	/usr/sbin	
cpio		copy file and archives in and out	7-11	/bin	
inquire		show result of a SCSI device inquiry	7-11	~4Dgifts	scsicontrol, scsiha
dvhtool	**!!**	show disk volume header information	7-11	/sbin	
eject		eject removable media	7-11	/usr/sbin	
findblk		find file system block	7-11	/sbin	
fsck		check file system	7-12	/sbin	
fuser		identify a process using a file or file structure	7-12	/sbin	
fx	**!!**	disk formatter/exerciser	7-12	/bin	
ioconfig		configure I/O devices	7-12	-	
lpsched		start up the line printer scheduler	7-12	/usr/lib	
lpshut		shut down the line printer scheduler	7-12	/usr/lib	
lpstat		prints line printer scheduler	7-12	/bin	
mediad		removable media daemon	7-13	/usr/etc	
mkfs	**!!**	make a file system	7-13	/sbin	
mkfp		make a floppy disk partition	7-13	/bin	
mount		mount or unmount a file system	7-13	/sbin	showmount, umount
mt		magnetic tape program	7-13	/mt	
ncheck		generate a path name from an I-node number	7-14	/sbin	
prtvtoc		show disk volume header information	7-14	/usr/sbin	
quota		display disk usage limits	7-14		
scsicontrol		probe and control SCSI devices	7-14	/usr/sbin	inquire, scsiha
scsiha		probe and control SCSI buses	7-14	/usr/sbin	scsicontrol, inquire
umount		mount or unmount a file system	7-13	/sbin	showmount, mount
xfs_check		check XFS filesystem consistency	7-15	/usr/sbin	
xfs_repair		repair an XFS filesystem	7-15	/usr/sbin	
xselinput		show X device input events	7-15	~4Dgifts	
xlist		list all the X input devices	7-15	~4Dgifts	

Networking Tools

Command	Beware!	Description	Page	Location	Related Commands
exportfs		export and unexport directories to NFS clients	7-15	/usr/etc	
ifconfig		configure network parameters	7-15	/usr/etc	
netstat		show network status	7-15	/usr/etc	
ping		send an ECHO_REQUEST to a network machine	7-16	/usr/etc	
rup		show host status of host machine	7-16	/bin	
ruptime		show host status of local machines	7-16	/usr/bsd	
showmount		show remotely mounted file systems	7-16	/usr/sbin	mount, umount
timedc		timed control program	7-16	/usr/etc	
traceroute		print the route packets take to a network host	7-16	/usr/etc	
uustat		UUCP status and job control	7-16		
ypwhich		show the NIS server of map master hostname	7-17	/bin	

Mail Tools

Command	Beware!	Description	Page	Location	Related Commands
mailq		print contents of the mail queue	7-17	/usr/bsd	
sendmail		send network mail	7-17	/usr/lib	

!! - When logged in as root, these commands could cause system damage. Not for casual use!!

Miscellaneous Tools

Command	Beware!	Description	Page	Location	Related Commands
apropos		locate commands by keyword lookup	7-17	/bin	man
autoconfig	**!!**	configure a kernel	7-17	/etc	lboot
clri	**!!**	clear i-node	7-17	/sbin	
distcp		copy or compare software distributions	7-18	/usr/sbin	
endsession		terminate a login session	7-18	/usr/bin/X11	
ftp		Internet file transfer program	7-18	/usr/bsd	
gclear		clear the graphics screen	7-18	/usr/sbin	
halt	**!!**	halt the system	7-18	/etc	reboot, shutdown,
init		process control initialization	7-19	/etc	init
inst		software installation tool	7-19	/usr/sbin	distcp
kill		terminate a process by default	7-19	/bin	killall
killall		kill a named process	7-19	/sbin	kill
lboot	**!!**	configure a bootable kernel	7-19	/usr/sbin	autoconfig
MAKEDEV		create device special files	7-19	/dev	
makewhatis		make manual page database	7-19	/usr/lib	
man		print entries from on-line reference manuals	7-19	/bin	apropos
network		network initialization and shutdown script	7-20	/etc/init.d	
nice		run a command at a low priority	7-20	/bin	renice, npri
npri		modify the scheduling or priority of a process	7-20	/usr/sbin	nice, renice
od		octal dump	7-20	/bin	
powerdown		stop all processes and halt the system	7-20		halt, reboot, shutdown.
rcp		remote file copy	7-20	/usr/bsd	
rdist		remote file distribution program	7-20	/usr/bsd	
reboot	**!!**	reboot the system	7-20	/etc	halt, shutdown
renice		alter the priority of a running process	7-21	/usr/sbin	nice, npri
setmon		set the current and default video output format	7-21	/usr/gfx	
single		switch the system to single user mode	7-21	/etc	init
shutdown	**!!**	shut the system down, change system state	7-21	/etc	halt, reboot
startgfx, stopgfx		start or stop the window system	7-21	/usr/gfx	
su		switch to root or another user	7-21	/bin	single
sync		update the super block	7-21	/bin	
talk		talk to another user	7-21	/usr/bsd	
telinit		process control initialization	7-22	/sbin	init
wakeupat		request the system power back on at a future time	7-22	/usr/sbin	powerdown
whatis		describe what a command is	7-22	/bin	
winterm		a terminal emulator window	7-22	/usr/sbin	wsh, xwsh, xterm
wsh		create a window shell	7-22	/bin	xwsh, xterm, winterm
xconsole		monitor system console messages	7-22	/usr/bin/X11	
xterm		terminal emulator for X	7-22	/usr/bin/X11	wsh, xwsh, winterm
xwsh		creates and specifies a window shell	7-22	/usr/sbin	wsh, winterm, xterm

!! - When logged in as root, these commands could cause system damage. Not for casual use!!

7.1 System Hardware Tools

gfxinfo - show graphics subsystem information

This tool will help determine the kind of graphics subsystem that is installed in the system. It will provide information about the type and revision of the graphics board, the number of bit planes used and some other aspects of the graphics subsystem.

hinv - show system hardware configuration

The most familiar tool is '**hinv**'. This shows the **h**ardware **inv**entory for the system. This inventory includes:

- the CPU type and clock speed
- the CPU and FPU type and revision
- the number of serial ports
- the presence of a parallel port
- sizes of the various memory caches
- amount of main memory
- any bus adapters that are present **-** VME, or EISA
- the number and type of SCSI controllers and devices
- the type of graphics subsystem installed

The '-c' and '-t' options allow displays of the inventory for specific classes or types. A sample hinv result (from an Indigo^2 Extreme) is shown below:

```
1 150 MHZ IP22 Processor
FPU: MIPS R4010 Floating Point Chip Revision: 0.0
CPU: MIPS R4400 Processor Chip Revision: 5.0
On-board serial ports: 2
On-board bi-directional parallel port
Data cache size: 16 Kbytes
Instruction cache size: 16 Kbytes
Secondary unified instruction/data cache size: 1 Mbyte
Main memory size: 64 Mbytes
EISA bus: adapter 0
Iris Audio Processor: version A2 revision 0.1.0
Integral Ethernet: ec0, version 1
CDROM: unit 7 on SCSI controller 1
Tape drive: unit 6 on SCSI controller 1: QIC 150
Disk drive: unit 4 on SCSI controller 1
Integral SCSI controller 1: Version WD33C93B, revision D
Disk drive: unit 3 on SCSI controller 0
Tape drive: unit 2 on SCSI controller 0: DAT
Disk drive: unit 1 on SCSI controller 0
Integral SCSI controller 0: Version WD33C93B, revision D
Graphics board: GU1-Extreme
```

nvram - show the values of Non-volatile RAM variables

This tool allows you to see and set the values in the non-volatile RAM. Many important variables are kept in the nvram that determine how the system operates.

sysinfo - show the system's unique identifier

`sysinfo` prints the value of the unique system identifier. Many software companies use some sort of licensing scheme based on this value.

7.2 System Software Tools

chkconfig - show state of configuration flags

`chkconfig` shows the state of certain configurable flags for the system. For example, it will show whether or not networking is turned on. This tool can be used to turn on or off these configurable flags. Typing "**`chkconfig`**" will list all of the configurable options and their state. You must be root to modify any of these flags.

crontab - table of chronological events to be performed

`crontab` is a table of events that are scheduled to occur at a preset time and frequency. This could include tape backups, file updates, etc. To determine what events are in the queue for a specific user use **`crontab -l`**.

date - show or set system day and time

This tool allows the user to check or set the systems day and time.

df - show the amount of free blocks on the disk

This tool shows the file systems that are currently mounted as well as how disk space is used. In particular, it shows the number of (disk) blocks on each mounted partition, the number of blocks currently used, and the number of blocks available. Keep in mind that disk blocks are 512 bytes. By using the **`-k`** option the tool will report all the above in terms of Kbytes instead of blocks.

du - show disk usage

This tools shows the amount of disk space for the current (and all underlying) directories. It is done in a bottom-up fashion, so the total space in the directory will be the last number listed. As with df, the numbers reported are in disk blocks unless the **-k** option is used.

hostname - show the name of the system

hostname shows the name of the system you are currently logged into.

idbg - kernel debugger print utility

A useful tool for getting more information about what is going on in the kernel.

last - list last logins of users or devices

last shows a listing of the logins (most recent first) for a particular user or device. It also shows the time the login occurred and its length.

mkboottape - build, list or extract a boot tape

mkboottape is used to make a bootable tape for system recovery. To list the contents of a boot tape use **mkboottape -l**.

osview & gr_osview - show the activity of the operating system

These two tools can show any number of different aspects of the operation of the system. The **osview** tool works purely in text, while the **gr_osview** tool opens up a window and shows various aspects of the system in real time.

Some aspects of the system that can be tracked are: memory usage, CPU load, swap space, I/O activity, etc.

printenv - show the settings of environmental variables

printenv shows the current settings for the systems environmental variables. Many of these variables are set by the system at boot or login time, but this tool also shows those variables set by the user in .cshrc or .login files. Two frequently used incantations of printenv are:

printenv PATH - this shows the current search path the system is using

printenv TERM - this shows the terminal type currently being used

ps - show process status

This tool shows all the processes that are currently running. It has several options that allow you to configure the way it presents the data. It's helpful in finding if some is still running when it shouldn't be. Some useful "**ps**" incantations:

ps -eaf | grep *process* - see if a particular *process* is running

ps -eaf | sort +n1 - list all the processes running by owner

ps -eal | sort +n4 - list all the processes running by process ID number

swap - add, delete or monitor system swap areas

swap is used to change or monitor the systems swap area(s). To show the current status of the swap area use **swap -l**.

syserr/sysmon - show system error information

Both of these utilities are part of the Desktop and can be found in the toolchest's SYSTEM menu.

syserr shows the critical system errors that have occurred. **Sysmon** shows all the errors the system has logged and their priorities. For an alternative way of checking system messages the command **tail -f /usr/adm/SYSLOG** or **tail -40 /usr/adm/SYSLOG**.

systune - display and set tunable kernel parameters

systune will display the kernel's tunable parameters. It will also allow some of these parameters to be modified in either an interactive or non-interactive mode. For these changes to take effect the kernel must be rebooted.

top and gr_top - show processes using largest percentage of CPU

These two tools accomplish the same end. They show the processes on the system that are using up the most CPU resources. The process at the top of the list is using the most resources. This can be very helpful in determining why a system is bogged down.

gr_top is opens its own window on the screen for running rather than running in the current window.

uname - show the current OS version

uname identifies the current IRIX Operating System that is on the machine. **uname -a** is typically used to show the version of IRIX that is running, as well as the system name and the type of CPU. The **-R** option shows additional release information.

versions - list software installed by “inst”

The **versions** tool can tell you what software has been installed by the ‘**inst**’ installation tool. It can also be used for removing software from the system that has been installed buy ‘**inst**’.

whereis - locate source, binary or manual page for a program

whereis will show where the source, executable or man page for a particular program. It is especially useful when the current PATH variable does not include the directory where the program exists.

which - locate a program including aliases

which is similar to **whereis** with the exception that it will show any aliases for that program that have been defined. This is only available in csh.

xlsfonts - list the fonts available to X Server

xlsfonts shows the fonts available on your system.

xdpyinfo - X display configuration information

This tool provides information about the X server. The number of displays and their possible configurations (8 bit / pixel, 24 bit / pixel, etc.) are included in this listing.

xwininfo - X window information

xwininfo provides information about an X-based window. The information can include window location, height, width, color depth, border width, colormap id, and corner locations to name a few. After typing **xwininfo**, the mouse is clicked on the window for which information is desired.

7.3 User Information Tools

id - show current user and group ID’s

This tool shows both the user ID and group ID by name and number.

who - show current system users

who identifies who is currently logged into the system, what port (either real or virtual) they’re logged in on and what time that login started.

whoami - show current user ID

whoami is similar to **ID**, but shows only what your current user ID name is.

7.4 Terminal Tools

stty - set tty characteristics

This tool shows or sets the characteristics of the current terminal (either real or virtual). The terminal can be configured to respond to certain protocols or keystrokes. Often a basic terminal set up is provided in a .login or .cshrc file.

terminfo - terminal capabilities database

This is a database of capabilities for specific terminal (and printer) types. The database describes the way the terminal will react to certain keystrokes and function keys. The name for the terminal in use is found in the TERM environmental variable.

tput - initialize terminal or query terminfo database

This tool can be used for a number of different terminal control functions. It can initialize the terminal, show the settings for specific terminal capabilities, or can be used to set shell variables for setting bold or other terminal characteristics.

tty - get name of the terminal

This tool shows the name of the tty device that is currently being used.

7.5 Peripheral Tools

bru - backup and restore utility

This tool reads, writes and lists data on tapes using the bru format. To show a list of files contained on a cpio formatted tape, use **`bru -vt`**.

cpio - Copy file archives in and out

Cpio is most often used to transfer files onto and off of magnetic tape. It can also be used to transfer groups of files between disk drives and/or file systems. To show a list of files contained on a cpio formatted tape, use **`cpio -ivt`**.

inquire - show result of a SCSI device inquiry

This program will echo the results of an inquiry to a particular SCSI device (as specified on the command line). It can be useful in determining the exact manufacturer and model number of the device on the SCSI bus.

This program is provided in the /usr/people/4Dgifts directory. It does not have a man page. Consult the README file in the directory for specifics on using this utility.

dvhtool - show disk volume header information

`dvhtool` shows the information contained in a disks volume header. This tool can also be used to modify this information, but fx is the preferred tool for modifying any disk parameters.

> ***Caution!!!***
>
> *Since this utility can change a hard disks configuration, it is NOT RECOMMENDED for casual use. Read the "dvhtool" man page prior to using this utility.*

eject - eject removable media

`eject` does exactly what it sounds like. If no argument is given, it will try and eject the first device it finds in either fsd.tab or in the hardware inventory table. If the media is a mounted file system, eject will try and unmount it prior to ejecting it.

findblk - find filesystem block

Finds the filesystem claimants for the block specified.

fsck - check file system

This utility checks the integrity of a file system. It will automatically be run when IRIX boots if the system detects some problem with the file system. It can be invoked on separate file systems to resolve some file system problems.

fuser - identify a process using a file or file structure

`fuser` will show any process that is currently using the specified file or file structure. Since all IRIX devices are files, this allows a listing of all processes using that device.

fx - disk formatter/exerciser

This is a very useful, but potentially dangerous, tool. It allows the disk to be repartitioned, formatted and exercised. It uses a hierarchical command structure where many commands may be invoked by using one or two letters.

> ***Caution!!!***
>
> *Since this utility can erase data from a hard disk, it is NOT RECOMMENDED for casual use. Read the "fx" man page prior to using this utility.*

ioconfig - configure I/O devices

This tool, available in IRIX 6.4 and later, allows control of various I/O devices.

lpsched - start up the line printer scheduler

This tool is used to start up the scheduling process for a connected printer.

lpshut - shut down the line printer scheduler

This shuts down the printers scheduling process.

lpstat - prints line printer spooler status

This tool prints LP status information. Use '**`lpstat -t`**' to get all printer spooling information.

mediad - removable media daemon

Mediad monitors removable media on the system. When a piece of removable media is inserted into a drive mediad automatically determines the type of file system that is on the media and mounts the file system appropriately. This works for floppy drives and cdroms.

To disable mediad's automatic mounting, use **'mediad -q**'.

mkfs - make a file system

mkfs takes a disk partition and makes it usable as an IRIX file system. This file system may then be mounted to the system.

> **Caution!!!**
>
> *Since this utility can erase data from a hard disk, it is NOT RECOMMENDED for casual use. Read the "mkfs" man page prior to using this utility.*

mkfp - make a floppy disk partition

mkfp will write an FAT (MS-DOS) or HFS (Macintosh) type file system onto a floppy disk. The utility will format 5 different types of FAT file systems - 360Kbytes (5.25" disk), 720 Kbytes (3.5" disk), 1.2Mbytes (5.25" disk), 1.44Mbytes (3.5" disk), or 20 Mbytes (floptical). Two HFS formats are supported - 1.44Mbytes and 20Mbytes - both on 3.5" media.

mount/umount - mount or unmount a file system

mount can take an existing file system (most typically on a disk drive) and mount it onto a defined mount point. **umount** does the reverse. Either command may be used to mount a single file system, group of file systems, or those file systems related to a particular host. **mount** uses the file /etc/fstab for some operations.

The **mount** command without any options will show all mounted file systems.

mt - magnetic tape program

mt can be used for a number of things. It can control and get status of a magnetic tape device (QIC, DAT, 1/2", etc.). Useful incantations of **mt** include:

mt -t /dev/mt/tps0d2 stat - get the status of tape device 2 on SCSI bus 0.

mt -t /dev/tape rew - rewind the default /dev/tape device

ncheck - generate a path name from an I-node number

ncheck will accept an I-node number and, optionally, a file system and generate a path name for each I-node given.

prtvtoc - show disk volume header information

This tool prints the disk volume header information for a specific disk. You must be root to run this tool.

An example printout for a root disk is shown below.

```
Printing label for root disk
* /dev/rdsk/dks0d1s0 (bootfile "/unix")
* 512 bytes/sector
* 54 sectors/track
* 15 tracks/cylinder
* 2 spare blocks/cylinder
* 1631 cylinders
* 4 cylinders occupied by header
* 1627 accessible cylinders
*
* No space unallocated to partitions
Partition Type  Fs  Start: sec (cyl)  Size: sec (cyl)  Mount Directory
 0         efs  yes      3232  ( 4)      32320 ( 40)  /
 1         raw          35552 ( 44)      81608( 101)
 6         efs  yes    117160( 145)    1200688(1486)  /usr
 7         efs           3232  ( 4)    1314616(1627)
 8      volhdr  0              ( 0)       3232  ( 4)
10      volume  0              ( 0)    1317848(1631)
```

quota - display disk usage and limits

quota displays the amount of disk space used and the limits for usage for each user.

scsicontrol - probe and control SCSI devices

This tool is a replacement for the **inquire** tool that was available previously only as a gift. As of 6.2 this tool is part of the IRIX release.

scsiha - probe and control SCSI buses

Similar in concept to scsicontrol, this tool allows control of SCSI buses rather than specific devices on a bus.

xfs_check - check XFS filesystem for consistency

Checks to see that the XFS filesystem is intact.

xfs_repair - repair an XFS filesystem

Repairs, to the best of its ability, an XFS filesystem.

xselinput - show X device input events

This program will provide information about X events coming into the system from X devices.

This program is provided in the /usr/people/4Dgifts directory. It does not have a man page. Consult the README file in the directory for specifics on using this utility.

xlist - list all the X input devices

This program lists all the X devices that the system has attached.

This program is provided in the /usr/people/4Dgifts directory. It does not have a man page. Consult the README file in the directory for specifics on using this utility.

7.6 Networking Tools

exportfs - Export and unexport directories to NFS clients

`exportfs` makes a local directory (or file) available for mounting over the network by NFS clients. A list of exported directories is kept in /etc/exports.

ifconfig - configure network parameters

`ifconfig` is used to configure network interface parameters. Each network interface has a name ("enp0" for example). Ifconfig can be used to turn on or off each of these network interfaces by name. An example is **`ifconfig enp0 down`**. This shuts down the network interface enp0.

netstat - show network status

`netstat` shows the status of the network connections on the machine. In particular, **`netstat -i`** will show the status of the various network interfaces. **`netstat -C`** shows several formats in a full screen, dynamic fashion. **`netstat -ia`** shows the MAC address of a network device.

ping - send an ECHO_REQUEST to a network machine

`ping` is used to see if you can communicate with a remote machine. This is done by sending an ECHO_REQUEST to a the machine. Ping will continue to send these requests until you stop the process (Control-C).

rup - show host status of local machines

`rup` shows a listing of all local machines with their name, how long they've been up and what their load average is.

ruptime - show host status of local machines

`ruptime` shows the status of local machines.

showmount - show remotely mounted file systems

`showmount` shows all the clients that have remotely mounted a filesystem from a particular host (the local host if no argument given).

timedc - timed control program

`timedc` is used to control the timed daemon. It can be used to determine the time difference between two systems, find the system on the network being used as a time master, or help debug problems with the timed daemon.

traceroute - prints the route packets take to a network host

A useful tool if networking routing issues seem to be a problem. Allows you to follow a packet as it proceeds from one network machine to another and (hopefully) to the proper destination.

uustat - UUCP status and job control

`uustat` will show the status of uucp commands or the status of uucp connections.

ypwhich - show the NIS server or map master hostname

ypwhich shows which Network Information Service (NIS) server supplies the NIS services to an NIS client, or which server is the master for a map. If no hostname is supplied as an argument, it supplies the hostname of the NIS server for the local machine.

7.7 Mail Tools

mailq - print contents of the mail queue

mailq prints the contents of the mail queue. It is actually the sendmail program invoked with the argument '**-bp**'.

sendmail - send network mail

sendmail is the facility used by mail programs to send mail over the network.

7.8 Miscellaneous Tools

The following is a list of commands for doing common operations on SGI systems. Some might be considered tools, while others are the commands necessary to bring a system up, shut it down, or change it into some different operational state.

apropos - locate commands by keyword lookup

apropos uses the whatis database to find commands associated with keywords.

autoconfig - configure a kernel

autoconfig is used to invoke lboot and other commands to generate a UNIX kernel. **autoconfig** automatically places the newly generated kernel in place for the next reboot.

clri - clear i-node

clri writes nulls on the inode table entry for the given i-number.

distcp - copy or compare software distributions

distcp copies or compares software distributions. Software distributions are software releases for one or more software products that are prepared by Silicon Graphics and installed by inst.

endsession - terminate a login session

endsession terminates a login session initiated by xdm.

ftp - Internet file transfer program

ftp is the user interface to the Internet standard File Transfer Protocol. The program allows a user to transfer files to and from a remote network site.

gclear - clear the graphics screen

gclear clears every visible bit of every pixel on the entire IRIS graphics screen.

halt - halt the system

halt causes the system to be shut down. The -p option can cause the power to be turned off once the system is down on those system that support this feature. **halt** calls the shutdown command. Key differences between **halt**, **powerdown**, **reboot** and **shutdown** are shown below:

Table 7-1 System shutdown commands

Command	Confirmation Option?	Grace Period Option?	Init State Choice?	Power Down Option?	Restart System?	Confirmation if remote?
halt	no	no	no (state 0)	yes	no	yes
powerdown	yes	yes	no	yes (default)	no	
reboot	no	no	no (state 6)	no	no	yes
shutdown	yes	yes	yes (state 0)	yes	no	no

init - process control initialization

init is used to change the operating level of the system. It can be used to bring the system from a multiuser state into a single user state.

inst - software installation tool

The **inst** tool installs software from a source where the software is in the “**inst**” format. This can be from a CD-ROM, tape, local disk or remote disk. An “**-a**” argument will enable the automatic mode where little interaction is required.

kill - terminate a process by default

kill sends a signal to the processes either by process ID or process group ID.

killall - kill named processes

killall sends a signal to a set of processes specified either by name, process group, or process ID. **killall** is similar to **kill** except the process can be specified by name.

lboot - configure a bootable kernel

lboot creates a bootable kernel based on the information in the master directory. By default, the resulting kernel is placed in the file unix.new. **Lboot** does not replace the new kernel for the currently used kernel. Since **lboot** forces the system to check for all installed hardware, using the verbose flag, **lboot -v**, can be used to see whether a board or device responds to a probe. Also see **autoconfig**.

MAKEDEV - create device special files

MAKEDEV creates specified device files in the current directory. This is most often invoked in the /dev directory to make (or remake) all or some of the systems devices. For example, ‘**MAKEDEV tape**’ will create all the tape device special files.

makewhatis - make manual page database

makewhatis finds all the man pages and compiles a database that is used by **man**, **apropos** and **whatis**.

man - print entries from on-line reference manuals

Man is used to print the manual page for the given command.

network - network initialization and shutdown script

network (**/etc/init.d/network [start | stop]**) is used to either start or stop the network devices attached to the system. Issuing a '**network stop**', then a '**network start**' will cause the system to recognize any changes in network configuration and reinitialize the networking hardware.

nice - run a command at a low priority

nice executes a command with a lower CPU scheduling priority.

npri - modify the scheduling or priority of a process

Allows root to adjust the scheduling or priority of a process.

od - octal dump

Somewhat of a misnomer, **od** displays a file in one of several different formats, including octal, character, hexadecimal and decimal.

powerdown - stop all processes and halt the system

powerdown brings the system to a state where nothing is running so the power can be turned off. By default, the user is asked questions that control how much warning the other users are given. This can be overriden by a command line argument. **Powerdown** invokes shutdown. This command is useful for shutting down a system after it completes some long running command. For a comparison of **halt**, **powerdown**, **reboot** and **shutdown** see Table 7-1.

rcp - remote file copy

rcp copies one or more files from a source machine to a destination machine.

rdist - remote file distribution program

rdist is a program to maintain identical copies of files over multiple hosts.

reboot - reboot the system

reboot halts the system and then restarts it. To bring a system down before shutting off the power use either halt or shutdown. For the differences between **halt**, **powerdown**, **reboot** and **shutdown** see Table 7-1.

renice - alter the priority of running processes

renice alters the scheduling priority of one or more running processes.

setmon - set the current and default video output format

setmon changes the video output format to the one specified on the command line. It is also used to define the default video format for the system.

single - switch the system to single user mode

single switches the system to single user mode and turns gettys off. This can be performed while in IRIX or in the command mode of the prom monitor.

shutdown - shut the system down, change system state

shutdown brings the system to a new system state (by default, the PROM monitor). For differences between halt, powerdown, reboot and shutdown consult Table 7-1.

startgfx, stopgfx - start stop the window system

startgfx turns the windowsystem configuration flag on, and executes the X Display Manager, xdm. **stopgfx** turns the windowsystem configuration flag off, and terminates the X Display Manager.

su - switch to root or another user

Su is used to switch from the current login to another user login. Without an argument su assumes you want to switch to the root login. Use of the "**-**" argument defines that the environment of new login will be used. Otherwise the current environment will be used for the new login.

sync - update the super block

sync is used to update the information on the disks super block. It flushes all previously unwritten system buffers out to disk, thus assuring that all file modifications up to that point will be saved.

talk - talk to another user

talk is a visual communication program which copies lines from your terminal to that of another user.

telinit - process control initialization

telinit is used to change the operating level of the system. It can be used to bring the system from a multiuser state into a single user state.

wakeupat - request the system power back on at a future time

wakeupat allows you to specify a time at which the system will power on by itself.

whatis - describe what a command is

whatis uses the whatis database to show the header line from a particular commands man page.

winterm - a terminal emulator window

winterm is a shell script that runs an application in a shell window. It is used by workspace and toolchest when launching applications with teletype-style user interfaces. The value of winterm is that it will start a **wsh**, **xwsh** or **xterm** terminal emulator by specifying the $WINTERM variable. Winterm is specific to SGI machines.

wsh - creates a window shell

wsh is the predecessor to Xwsh. It is a terminal emulation program that runs a shell (or other UNIX command) within its own window on the screen. **wsh** is specific to SGI machines. It takes advantage of the SGI graphics hardware.

xconsole - monitor system console messages

xconsole displays messages which are usually sent to /dev/console.

xterm - terminal emulator for X

The **xterm** program is a terminal emulator for the X Window System. Useful for running programs specifically written for a pure X environment.

xwsh - creates and specifies a window shell

xwsh is a terminal emulation program that runs a shell (or other UNIX command) within its own window on the screen. **xwsh** is specific to SGI machines. It takes advantage of the SGI graphics hardware.

Glossary

1000
See IRIS 1000

2000
See IRIS 2000

3000
See IRIS 3000

4D
See IRIS 4D

6U
width of 6 unit wide VME bus board

9U
width of 9 unit wide VME bus board

AL
Audio Library

ASD
Advanced System Division - home of VGX, Reality Engine, Onyx and CHALLENGE products

ATM
Asynchronous Transfer Mode

BVO
Broadcast Video Option

Blackjack
Internal name for IP20; Indigo R4000

BlueLight
PI with a 15” 1024x768 display

CCIR-601
Component digital video format; aka D1, aka 4:2:2

CD-ROM
Compact Disk - Read Only Memory

CG2
Genlock and Composite Video Option (9U) ASD machines only

CG3
Genlock and Composite Video Option (6U) ASD and ESD machines

CISC
Complex Instruction Set Computer

Clover1
IRIS 4D / G; pre GT graphics

Clover2
IRIS 4D / GT 4D / GTX graphics

Crimson
SGI’s first R4000 system from ASD

Cypress
Internal name for IRIX 4.0 project

D1
Component digital video format

D2
Composite digital video format

DAT
Digital Audio Tape

DID
Display ID, determines pixels display mode

DMA
Direct Memory Access

DSP
Digital Signal Processing

Da Vinci
PI 24-bitplane graphics without Z-buffer

Diehard
The code name for the Single Tower chassis

Diehard2

The code name for the Crimson chassis

EEPROM

Electrically Erasable PROM

EFS

Extent File System; the native IRIX file system

EISA

Extended Industry Standard Architecture

EMI

Electro-Magnetic Interference

EMR

Electro-Magnetic Radiation

EOE

Execution Only Environment

EPROM

Erasable PROM

EPSF

Encapsulated PostScript

ESD

Electro-Static Discharge, also Entry Systems Division (the birthplace of the Personal IRIS)

Eclipse

internal name for the PI

Elan

4 GE version of the Express graphics system

EntryGraphics

Internal name for Starter Graphics

EverestMP

R4000 / R4400 system

Express

high-performance graphics system for Indigo and 4D / 35 which became known as XS, XS24, XZ, Elan and Extreme.

Extreme
8 GE version of Express graphics system

FAQ
Frequently Asked Question; or summary of answers to FAQ’s

FDDI
Fiber Distributed Data Interconnect

Fullhouse
Indigo 2; SGI machine with EISA bus.

GE
Geometry Engine

GIO
Graphics I/O Bus

GL
Graphics Library

Guinness
Former internal name for Indy

HZ
Hertz; cycles per second

Hollywood
Internal name for Indigo system

IDB
Image Database; as in inst idb tags

IDO
IRIX Development Option

IEC
The International Electrotechnical Commission (Swiss Name)

IHV
Independent Hardware Vendor

IL
ImageVision Library

IM
IRIS InterfaceMaker; Name for SGI’s Motif port

INITTAB

Initialize Network interfaces, ttys, and bring-up.

IO1

Input/Output Board

IO2

Input/Output Board

IO3

Input/Output Board

IO4

Input/Output Board

IP

Internet Protocol

IP

Iris Processor

IP

Instruction Processor

IP10

20MHz PI processor (4D/25)

IP12

The processor board for the Magnum 4D30 (30MHz) and 4D35 (~37MHz) and the Indigo (30MHz)

IP13

2x33MHz R3000A multiprocessor for 4D/300 series

IP15

2x40MHz R3000A multiprocessor for 4D/400 series

IP17

50MHz R4000 processor board for Crimson (4D/510)

IP19

Everest multiprocessor board

IP20

50MHz R4000 processor board for Indigo, aka Blackjack

IP22

Indigo^2 processor board

IP24

Guinness (Indy) Processor Board

IP26

Power Indigo^2 (R8000 based Indigo^2)

IP27

Origin2000 and Onyx2 processor

IP28

Indigo^2 R10K processor

IP29

Origin200 processor

IP30

OCTANE processor

IP32

O2 processor

IP4

12MHz R2000A processor board for 4D / 70 (Clover)

IP4.5

16.7MHz R2000A processor board for 4D / 80

IP5

2x16.7MHz R3000[A] multiprocessor board (4D / 120)

IP6

12.5MHz R3000 PI processor (4D / 20)

IP7

2x25MHz R3000A multiprocessor for 4D / 200 series

IP9

25MHz R3000A processor for 4D / 210

IRIS

Integrated Raster Imaging System: a generic name for Silicon Graphics workstations

IRIS 1000

Marketing name for the first Silicon Graphics line of graphics terminals and workstations; Motorola 68010 based

IRIS 2000

Marketing name for the second generation of workstations; chief enhancement was a new graphics subsystem; successor to the IRIS 1000 product line

IRIS 3000

Marketing name for the last line of workstations that used the Motorola 68000 series processors (specifically the 68020); the successor to the IRIS 2000 product line

IRIS 4D

Marketing name for the line of systems that first used the MIPS RISC processor; the successor to the IRIS 3000 product line

IRIX

IRIS Unix; SGI's version of ATT System V Unix

ISDN

Integrated Services Digital Network; It Still Does Nothing

ISM

Inst Selectable Module; any installable software package

ISV

Independent Software Vendor

Indigo

IRIS Indigo workstation (also, that family of workstations)

Indy

SGI's low-end Indigo-family machine

Inst

Our IRIX software installation program

JPEG

An image compression standard; Joint Photographic Experts Group

Juniper

3000 Product Internal Code Name

kb

Kilo byte

LE

Little Endian

Lego

Internal name for Origin2000 and Onyx2 systems

LG1
see bluelight

lg1
Starter graphics hardware name, appears in code

Lonestar
Internal name for IP17 (Crimson) project

MCO
Multi-Channel Option, the VS2

MG1
board name for Grinch

MII
Panasonic version of Betacam; aka M2

MIPS
Million Instructions Per Second

Moosehead
Internal name for O2

MP
Multi-processor system

MPEG
An movie compression standard; Motion Picture Experts Group

Magnum
System that used an IP12 processor in a modified PI chassis

Mirage
Venice graphics on Everest

NFS
Network file system

NIS
Network Information Service; Same as YP

Newport
graphics hardware for Guinness

Newpress
Indigo with 1 Newport head and 1 Express head

Ng1
Newport Graphics hardware, appears in code

OEM
Original Equipment Manufacturer

PCI
Peripheral Component Interconnect, a high speed bus

pel
See Pixel

PIO
Physical (raw) Input and / or Output

pixel
picture element

PS
PostScript page description language from Adobe

Predator
First rack mounted chassis for 4D series of workstations

R10K, R10000
MIPS R10000 processor

R3K
MIPS R3000 processor

R4K
MIPS R4000 processor, also applies to R4400 and R4600 processors

R5K
MIPS R5000 processor

R8K, R8000
MIPS R8000 processor

RE
RealityEngine

RE1
Raster Engine 1; graphics chip in GR1.1 PI

RE2
Raster Engine 2; graphics chip in GR1.2 PI

RGB
Red Green and Blue color model

RealityEngine
Venice graphics hardware

RISC
Reduced Instruction Set Computer

S-VHS
Super VHS; A consumer/industrial quality video tape format

S-Video
a 2-component video format; used by many Hi-8 and S-VHS decks

sec
Second

SGI
Silicon Graphics, Inc.; the mug and T-shirt company

SGI
Soka Gokai International

SIGGRAPH
ACM Special Interest Group for Computer Graphics

SMD
Storage Module Device

SNA
System Network Architecture

SONET
Synchronous Optical NETwork; Bellcore’s optical transmission interface.

Speedo
Internal name for Origin200

Speedracer
Internal name for OCTANE

STREAMS
AT&T modular device driver interface

SV1
Internal designation for IndigoVideo product

SVID

System V Interface Description

SVR4

System 5 Unix Release 4 from USL

SW

Software

Shamrock

Clover1

Sherwood

IRIX 5.0 based on ATT SVR4 from USL

SkyWriter

Dual-headed 10-span VGXT or RealityEngine

Span

Vertical columns of pixels i.e., “10-span VGX”

Stapuft

Development name for VGX graphics

Starter

Lowest cost 1024x768 graphics system for Indigo, aka Entry Graphics

svideo

IDB designation for IndigoVideo software

T5

Next generation processor project, as far as we know;

TAC

Technical Assistance Center. Obsoleted by CSE

TCP

Transmission Control Protocol

TFLU

Totally Front Loadable Unit, refers to the second generation of Personal IRIS chassis where the main system disk (a 5 1/4” full height unit) was removable from the front of the unit be simply removing a plastic cover.

TFP

Twin peaks floating point

Terminator

The second generation rack chassis for the 4D series. First shipment with the Onyx and Challenge line

Top Hat

The part of the chassis skins that sit on the top of the system. Colors of the top hats often indicated the type of graphics subsystem installed.

Twin Peaks

High-performance floating point version of R4000

Ultra

8 GE version of the Express graphics system, a.k.a Extreme

V-LAN

Video-LAN; a product of Videomedia for controlling video device

VAD

Value Added Dealer

VAR

Value Added Reseller

VC

VideoCreator

VFR

VideoFramer

VFS

Virtual File System; SUN's file system switch architecture, used by SVR4

VGX

1990 highest end graphics machine

ViewKit

C++ Application Framework for building Motif Applications

VINO

Video in, no out; video chip for Guinness

VL

Video library

VL

VideoLab

VLI
Another name for VideoLab

VME
VersaModule Eurocard; 32-bit bus SGI machines use

VO1
VideoLab

VO2
Next generation VideoLab

VS1
VideoSplitter

VS2
VideoSplitter2

VTR
Video Tape Recorder

Venice
1992 highest end graphics machine

W4D
Part of Marketing code name for workstation OS

WORM
Write Once, Read Mostly

X
The X window system

XS
1 GE Express with 8-bit graphics

XS24
1 GE Express with 24-bit graphics

XS24Z
1 GE Express with 24-bit graphics and hardware z-buffer

XZ
2 GE Express

Xsgi
The Silicon Graphics X Server

YC

Luminance-Chrominance; a color system

YP

Yellow Pages; A distributed name service now called NIS

YUV

A color encoding scheme Y is perceived brightness, U and V are color difference signals

Appendix

Reference Information

EISA Bus Specification

The EISA bus specification (version 3.12) is available from the following source:

BCPR Services, Inc.
P.O. Box 11137
Spring, Texas 77391-1137

(713) 251-4770
(713) 251-4832 (FAX)

GIO Bus Specification

The GIO Bus Specification is available through the Silicon Graphics Developer Program. A signed non-disclosure agreement is required since this is a proprietary bus. Contact the Developer Program in any of the following ways:

Telephone:	(415) 933-3033 (International) (800) 770-3033 (U.S.)
Email:	devprogram@sgi.com
Web:	http://www.sgi.com/Support/DevProg

PCI Bus Specification

The PCI Bus Specification is handled through the PCI Special Interest Group (SIG). It is available from the following source:

PCI Special Interest Group
P.O. Box 14070
Portland, Oregon 97214

(800) 433-5177 (U.S.)
(503) 797-4207 (International)
(503) 234-6762 (FAX)

PCI Developer Guide

This document is available through the Silicon Graphics Developer Program. It is available either in printed form or an online (HTTP) version for members of the Developer Program. Use the contacts listed in "GIO Bus Specification" to obtain this document.

Device Driver Programming Guide

The Device Driver Programming Guide is the key document when writing a device driver for the IRIX Operating System. It has seen a number of revisions over the years to keep it up to date with the hardware supported by SGI systems and the changes in the operating systems. Contact the local Silicon Graphics sales office to purchase a printed version of this document. The marketing code for this document is "M4-DVDR-*n*", where "*n*" is the revision of the document.

This document is also available in an online version. This online (insight) version is included with the IDO software option. The document is usually found in the "dvdr.books" image.

SGI Digital Video Specification

The SGI Digital Video Specification is available from the Silicon Graphics Developer Program. This documents the digital video interfaces found on the Indy and Indigo2 video products. Use the contacts listed in "GIO Bus Specification" to obtain this document.

Online SGI Technical Publications

There are a number of documents available from SGI's web site. The Technical Publications library is a good source for Owner's Manuals, software manuals and hardware option manuals. This resource can be found here:

http://www.sgi.com/techpubs

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