



SiliconGraphics
Computer Systems

Indigo²™ Product Guide



1 High Bandwidth Bus Architecture -

High speed 64-bit memory bus between the CPU and main memory offers a peak of 400 MB/sec while the 64-bit system bus offers sustained 267 MB/sec

2 Upgradeable High Performance CPU -

Daughterboards for 100 MHz R4000 and 150 MHz R4400 CPUs enable an easy upgrade to higher performance

3 1 MB Secondary Cache -

Enables leading performance by providing the largest cache on a desktop workstation

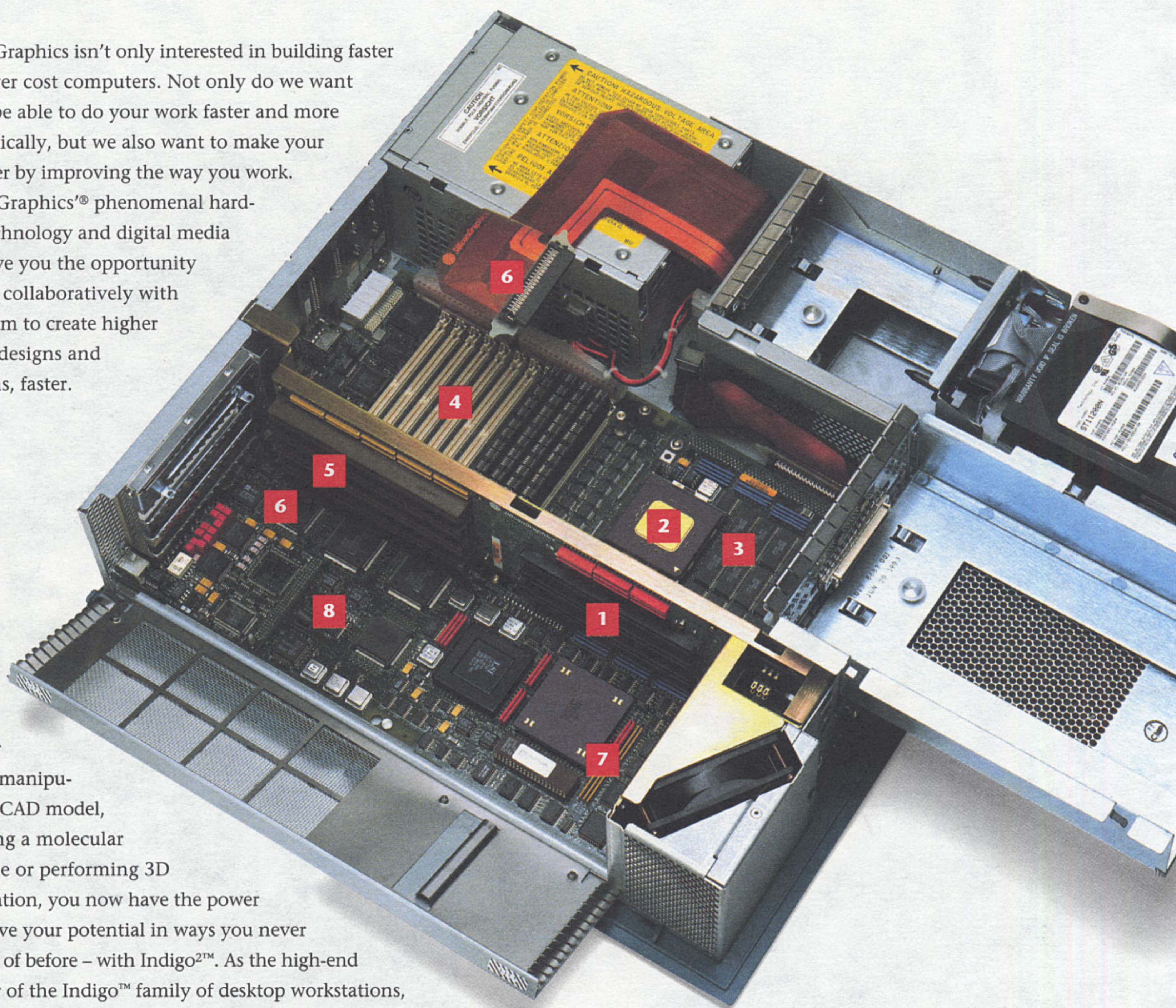
4 Huge Memory Expansion -

12 SIMM sockets allow for a maximum of 384 MB RAM

Silicon Graphics isn't only interested in building faster and lower cost computers. Not only do we want you to be able to do your work faster and more economically, but we also want to make your job easier by improving the way you work. Silicon Graphics'® phenomenal hardware technology and digital media tools give you the opportunity to work collaboratively with your team to create higher quality designs and solutions, faster.

So whether you are manipulating a CAD model, rendering a molecular molecule or performing 3D visualization, you now have the power to achieve your potential in ways you never thought of before – with Indigo²™. As the high-end member of the Indigo™ family of desktop workstations, Indigo² gives you the most advanced technology available for true collaborative work.

Indigo² delivers the fastest system throughput combining leading CPU and graphics architecture, for your intensive computing needs. You can choose from three types of graphics to suit your tasks with Indigo² XL, Indigo² XZ and Indigo² Extreme™. And of course unprecedented digital media tools are integrated to give you the most natural ways to communicate your work. Quite simply, the Indigo² is the world's fastest, most feature-rich graphics workstation on the desktop.

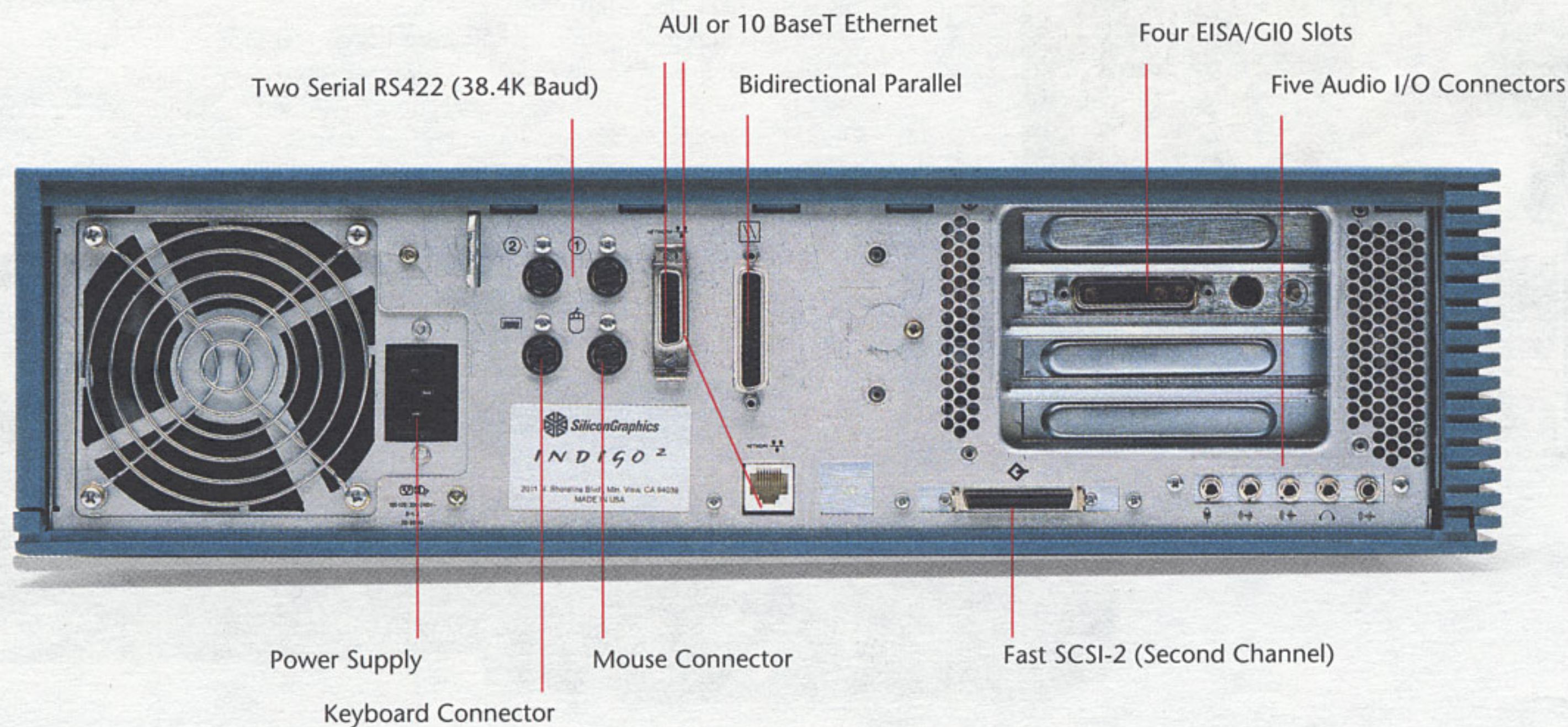


5 EISA Expandability -
Four EISA slots allow for a multitude of expansion capabilities with a 33MB/sec transfer rate

6 Two Fast SCSI-2 Channels -
Offer a total of 10 SCSI devices for storage and I/O expansion

7 Built-in Networking -
Ethernet supplied with every system including both AUI and 10 BaseT

8 Integrated Digital Media -
Up to six simultaneous input and output audio channels, plus an integrated video bus



A History of Exceptional Technology

The power of the Indigo² architecture represents a culmination of many technologies. At Silicon Graphics, we have been developing computer systems for the past ten years that easily crunch through large data sets. Our state of the art manufacturing capabilities provide revolutionary solutions at highly competitive prices.

In the past five years alone, we have created seven generations of the Geometry Engine[®]. The Geometry Engine processor now achieves 50 times the performance and occupies one-twentieth the space of the original graphics hardware. This gives you incredible performance for the price of a high-end PC. And finally, our integrated digital media technologies and user environment give you an interactive, highly productive way of working.

Extreme Computing

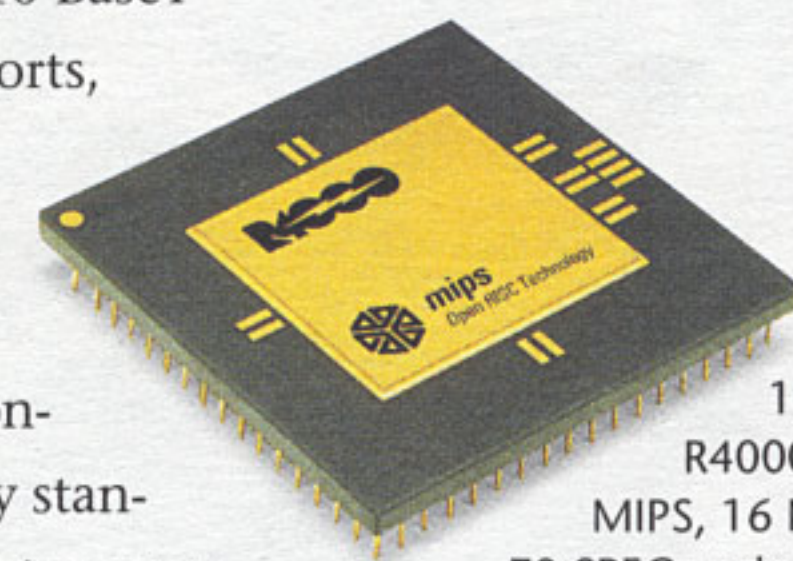
Leading desktop compute and graphics performance makes the Indigo² workstation the fastest application performer in the industry. Indigo² is the product of the third generation MIPS[®] RISC architecture built around the R4400[™] and R4000[®] processors running at 150 and 100 MHz, respectively. The CPU and memory bus achieve 400MB/sec and the system I/O bus achieves 267MB/sec throughput. Indigo² also has the largest cache on the desktop and a standard 64-bit data path which accelerates data at record breaking speeds.

If you need immediate results, this incredible architecture and compute power can be used to move large data sets around, or analyze and compute designs. This combination of tight integration and aggressive design gives you a major price/performance advantage

over other architectures. And finally, all this phenomenal power is not loud! Two variable speed fans make Indigo² one of the quietest systems available.

We've also given Indigo² unrivaled expandability. So you can choose your configuration. Four industry standard EISA slots or two EISA slots and two high-performance GIO slots are at your disposal. An assortment of industry standard I/O, such as AU1 and 10 BaseT Ethernet, as well as two serial ports, a parallel port and five audio connections make Indigo² comfortable as a stand-alone system or in a networked environment. Compliance with industry standards gives Indigo² the ability to integrate into a multivendor environment. And Indigo² can read and write Mac and PC files.

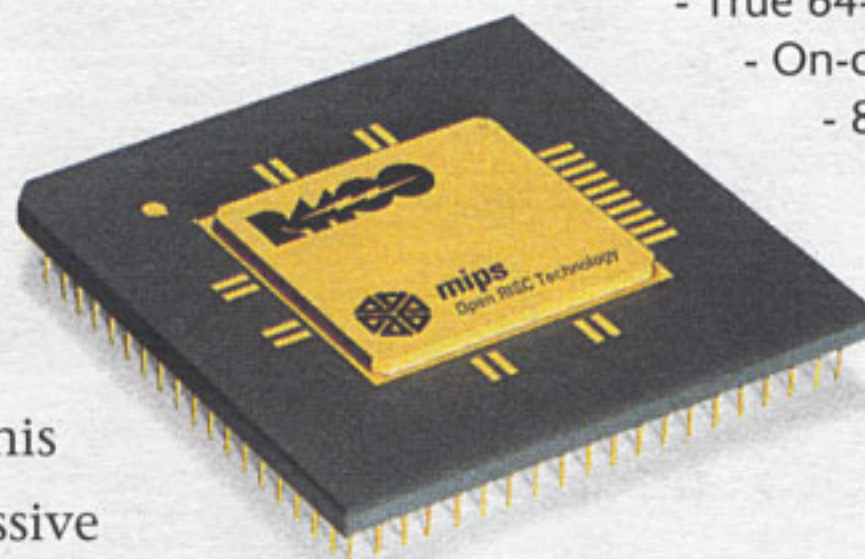
Flexible disk and peripheral configuration is facilitated by two independent Fast SCSI-2 controllers. These binary compatible systems also have three internal Fast SCSI-2 bays for disks, DAT, floppy drives and CD-ROM. So you can protect your investment and expand your Indigo² as your needs grow.



100 MHz
R4000 offers 85
MIPS, 16 MFlops,
70 SPECmarks

Both R4000 and R4400 use:

- True 64-bit architecture
- On-chip TLB for fast virtual-to-physical address translation
- 8-stage superpipeline architecture
- large integrated caches



150 MHz R4400 offers
136 MIPS, 24 MFlops,
100 SPECmarks

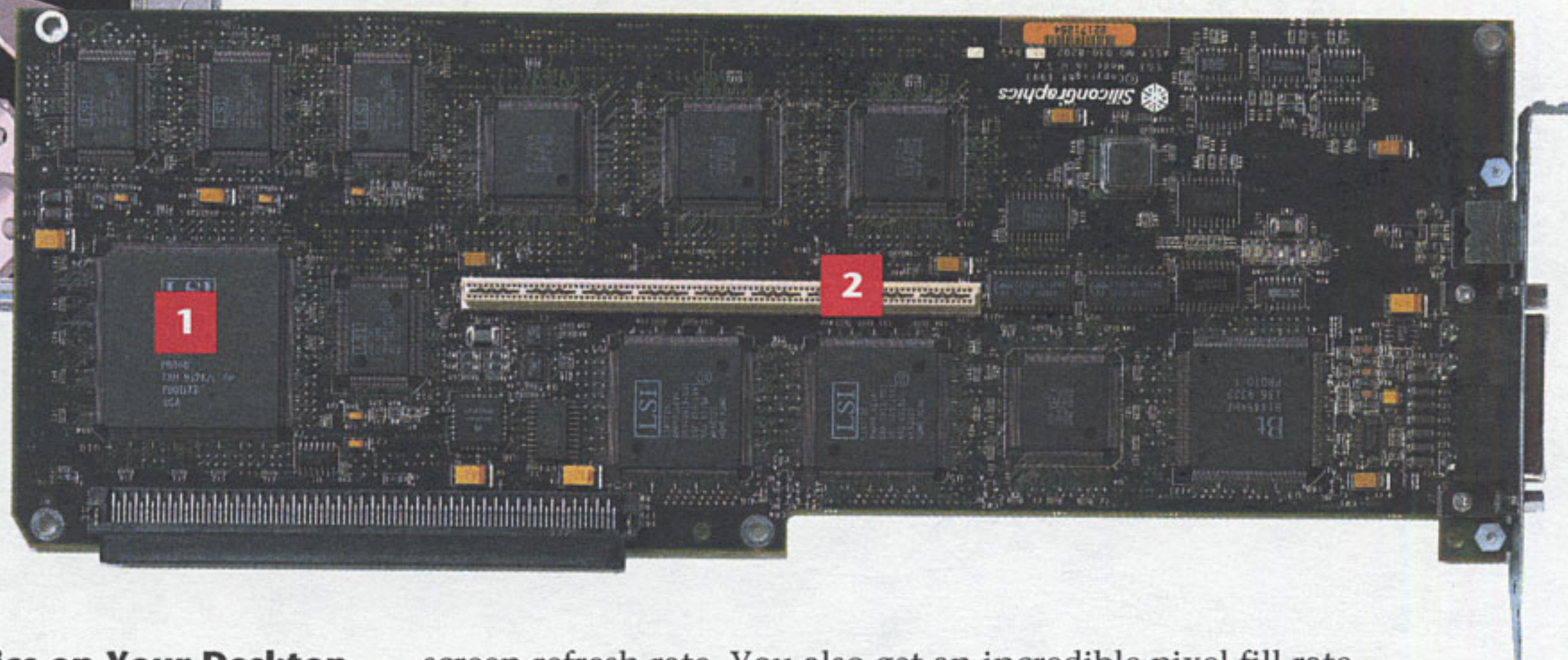


1 CPU Accelerated XL Graphics - REX3

Raster Engine ASIC converts geometric data processed by the CPU into pixel and line data that it then writes into the framebuffer. As CPU power increases, so does graphics performance.

2 Live Video I/O Slot -

A port for video expansion using Indigo² Video and Galileo Video options.



A Family of Extraordinary Graphics on Your Desktop

Indigo² is available with a family of graphics subsystem offerings to suit your requirements - XL, XZ or Extreme graphics.

XL Graphics

XL graphics is the entry price point into the Indigo² product family, giving you the fastest X and 2D graphics architecture on the market. But XL also supports 3D through a software Z buffer and host-based geometry calculations. Image processing, entry CAD and general science problems are solved fast. Indigo² comes standard with built-in 24-bit color, crisp, 1280 x 1024 high-resolution frame buffer, and an ergonomically comfortable 76Hz

screen refresh rate. You also get an incredible pixel fill rate of up to 437 million pixels per second and an industry leading 1.4 million X11 lines per second!

XZ Graphics

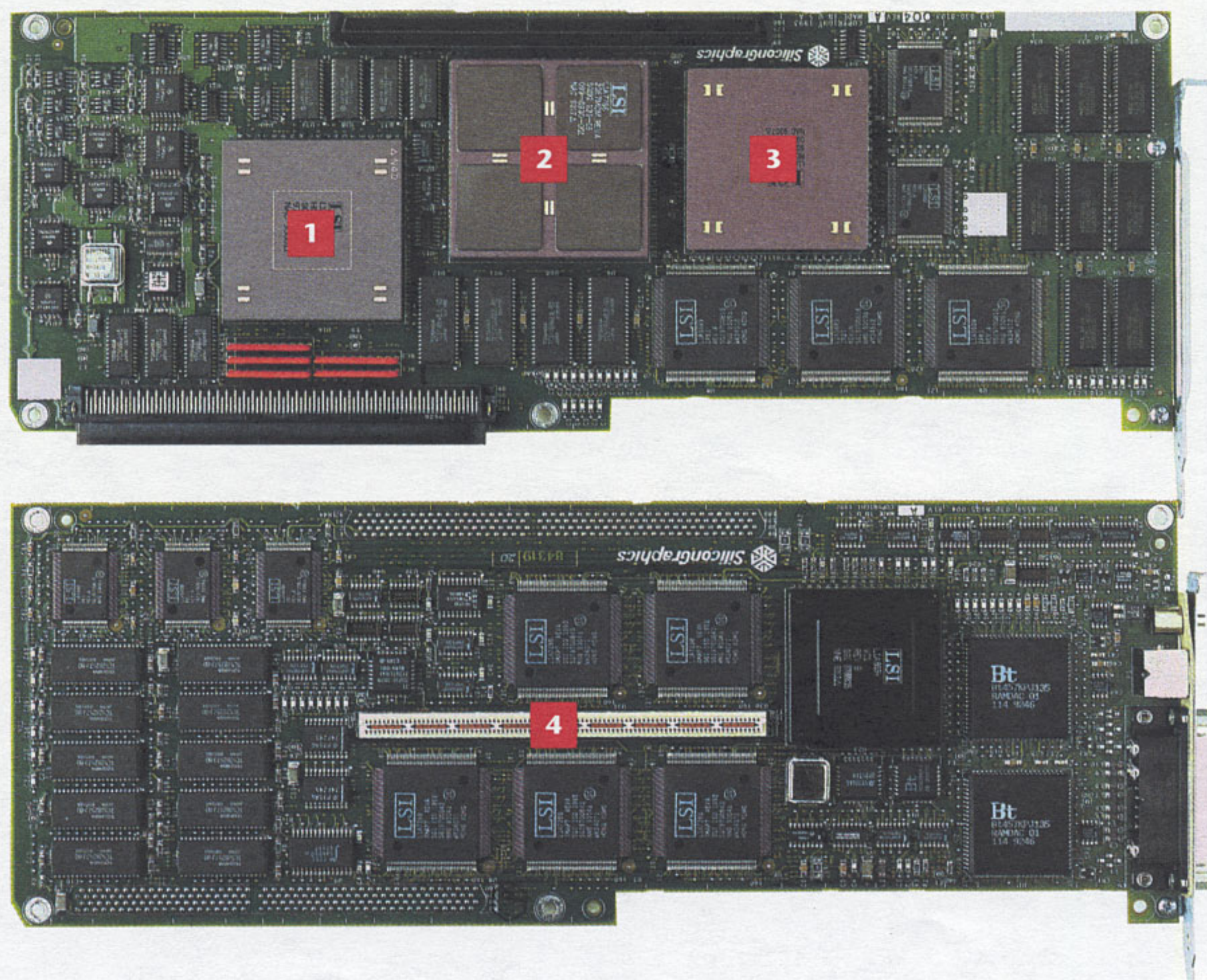
When 2D computing isn't enough, XZ graphics is the answer to your more intensive needs. XZ has two geometry engines in a patented geometry pipeline architecture delivering 64 Mflops of graphics compute performance. The Geometry Engine design delivers 250K 3D triangles per second for strong visualization, architecture and MCAD performance. Professional engineers and scientists can use XZ for working on real-world design and technical challenges.

1 Command Engine -
The HQ2 is an 80,000 gate device that delegates graphics primitives to the Geometry Engine Processors.

2 Two Geometry Engine Multi-Chip Module - Provide 64 MFlops through an effective multi-chip module design integrating two GE7 Geometry Engines for a total of 160,000 custom gates.

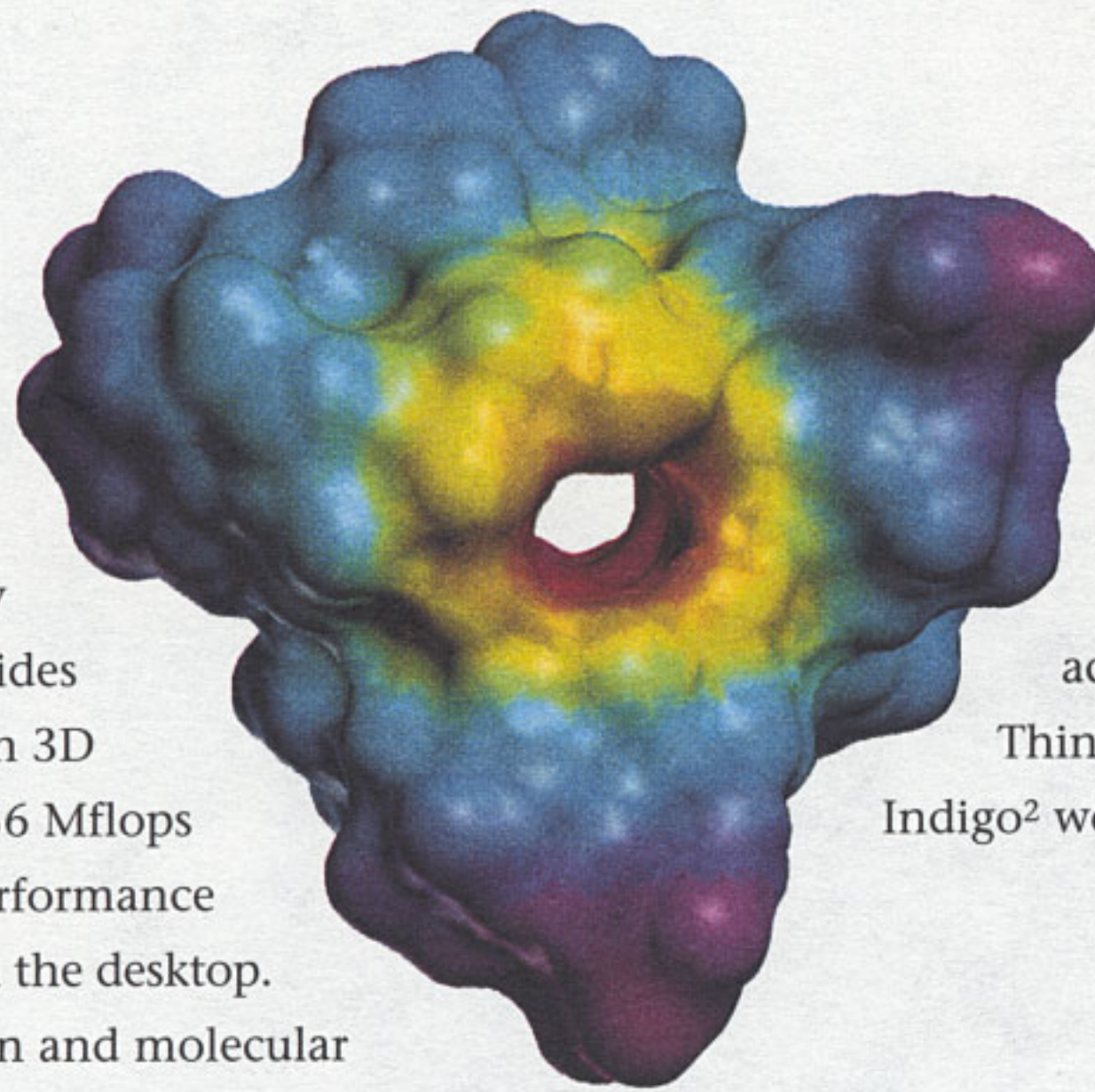
3 Integrated Raster Engine - The RE3 Raster Engine holds 100,000 custom gates and runs at 50 MHz

4 Live Video I/O Slot -
A port for video expansion using Indigo² Video and Galileo Video options.



Extreme Graphics

Extreme Graphics offers the world's fastest graphics on the desktop. Using eight Geometry Engines, Indigo² Extreme provides 630K triangles and 1.25 million 3D vectors per second from the 256 Mflops of dedicated, floating-point performance—for the fastest 3D graphics on the desktop. Complicated MCAD, animation and molecular modeling projects come alive with the help of 31



custom VLSI gate arrays with over 1.2 million gates.

A new level of performance is achieved with Indigo².

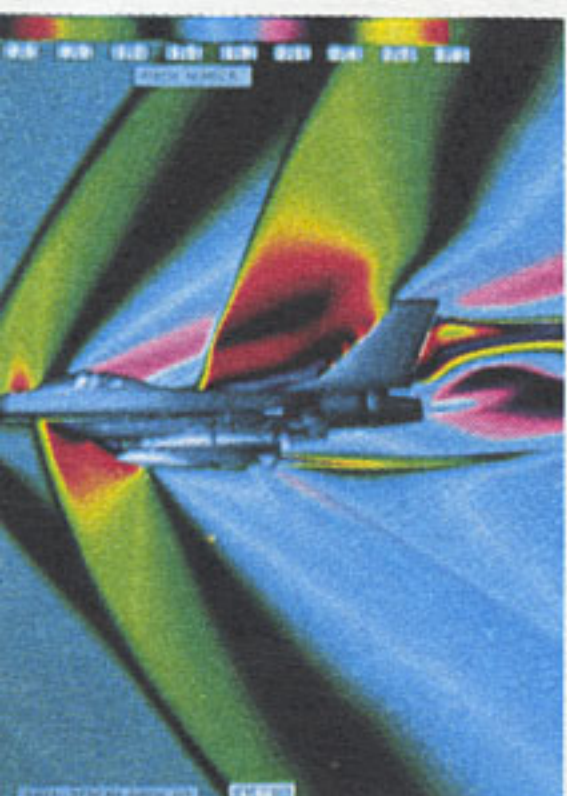
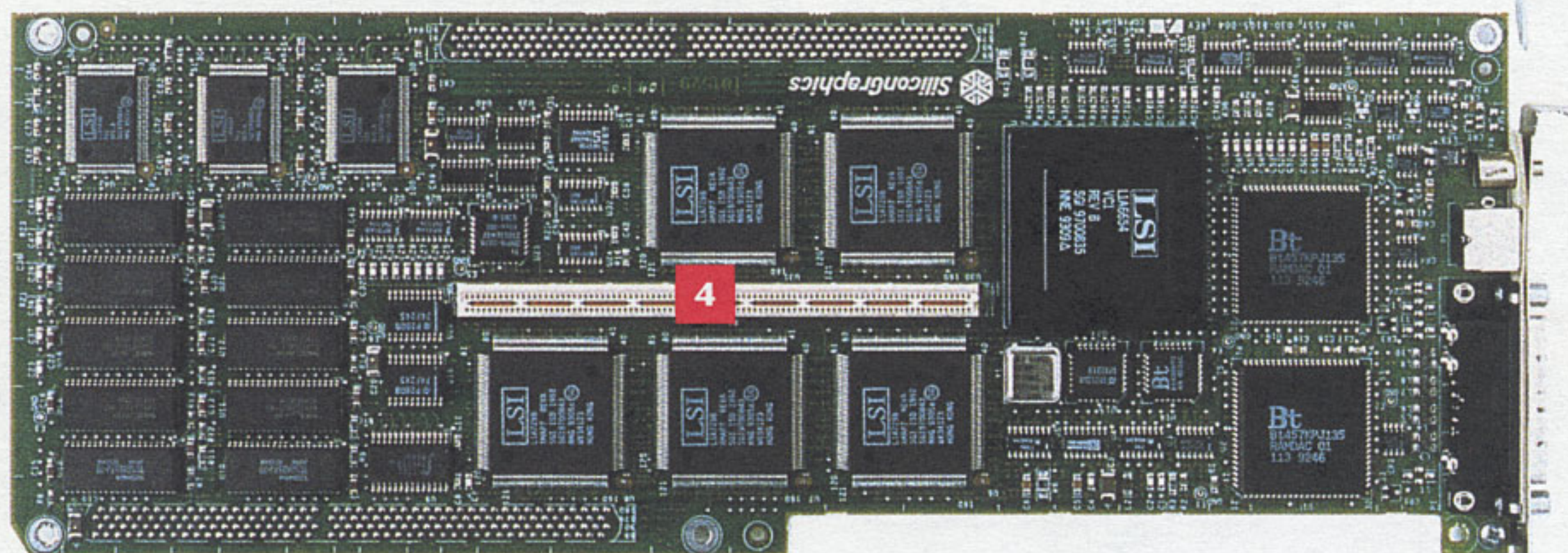
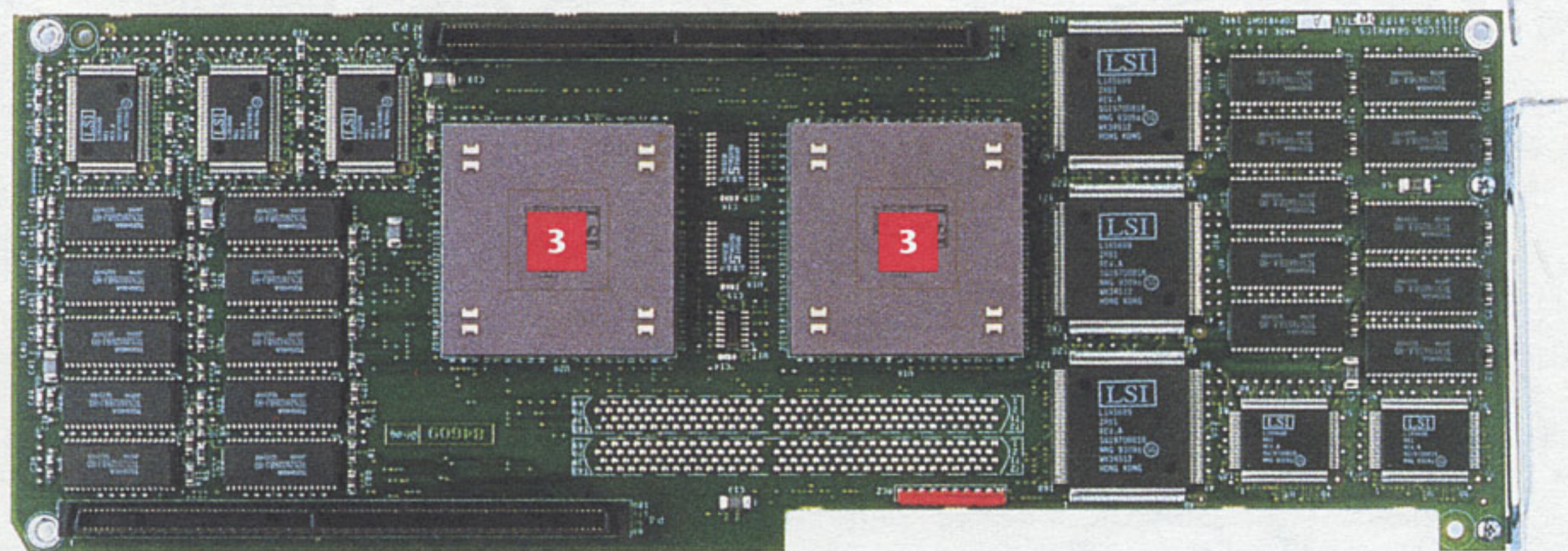
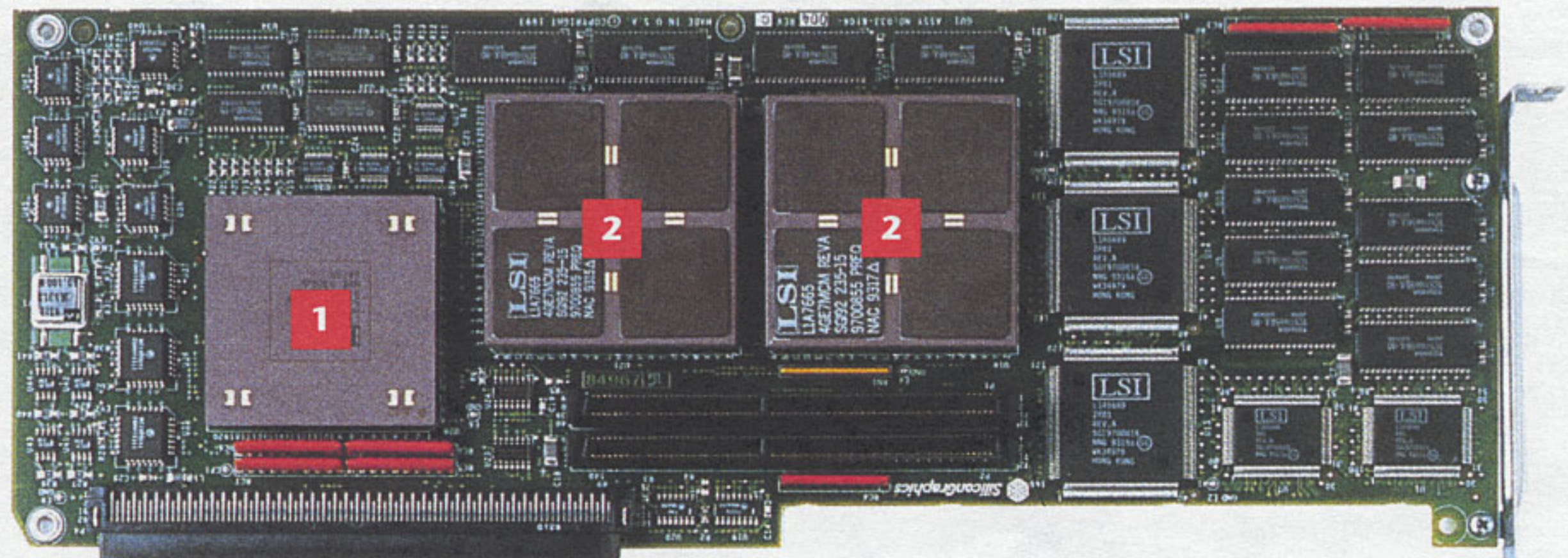
Things happen faster, more convincingly. Indigo² works at the speed you work.

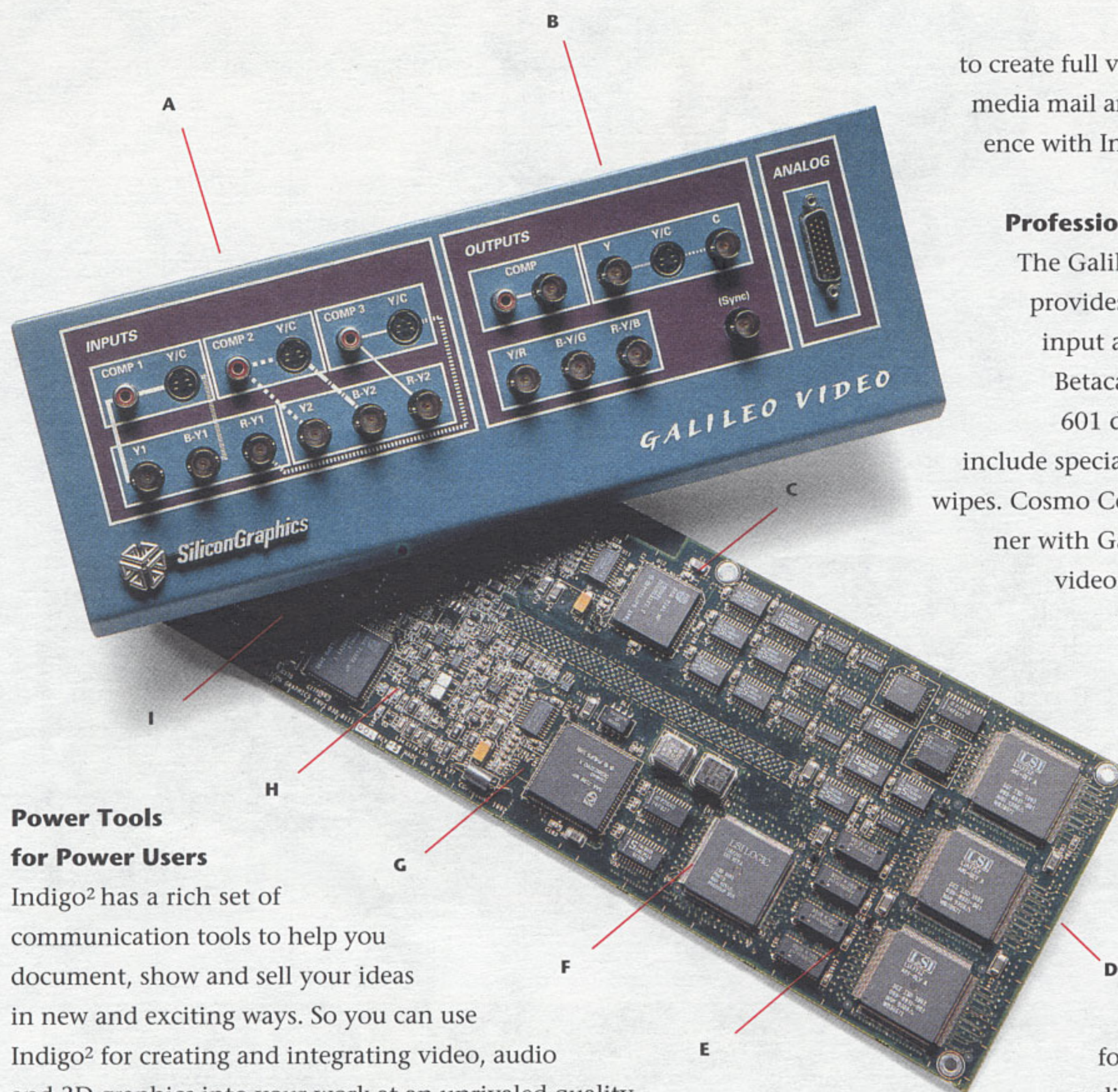
1 Command Engine - The HQ2 is an 80,000 gate device that delegates graphics primitives to the Geometry Engine Processors.

2 Eight Geometry Engines - Provide 256 MFlops through an effective multi-chip module design.

3 Dual Integrated Raster Engines - Two RE3 Raster Engines hold 200,000 custom gates running at 50 MHz

4 Live Video I/O Slot - A port for video expansion using Indigo² Video and Galileo Video options.





Power Tools for Power Users

Indigo² has a rich set of communication tools to help you document, show and sell your ideas in new and exciting ways. So you can use Indigo² for creating and integrating video, audio and 3D graphics into your work at an unrivaled quality.

Every Indigo² comes standard with high-quality audio and is video ready with its own dedicated video bus and a variety of video boards. You get complete DAT-quality sound with five audio connections, a microphone and a speaker. Up to six simultaneous input and output channels come standard with 16-bit sampling and stereo outputs.

Indigo² coupled with Indigo Magic™, the new user environment, gives you new, productive methods of work-group collaboration. Imagine the value of being able to send your 3D model to video tape for viewing at a presentation. The Indigo² Video™ option allows you to print to tape and input video. Now you have the opportunity

to create full video presentations, send media mail and have a desktop conference with Indigo² Video as the platform.

Professional Video Solutions

The Galileo Video™ option board provides broadcast quality video input and output such as NTSC, Betacam, PAL, YUV and D1 CCIR 601 digital video. You can also include special effects such as fades and wipes. Cosmo Compress™, designed to partner with Galileo, gives you real-time video compression and decompression for intense video manipulation with compression ratios from 2:1 to 100:1.

So you see, Indigo² can be an incredibly valuable collaborative communications tool or easily transform itself for professional audio and video production.

- A Real-time video inputs
- B Real-time video outputs
- C Independent square and rectangular pixel decoders
- D Scan conversion for nearly full screen output
Anti-flicker filters
Zoom and pan
- E Four frame buffers
- F Fully linear key generator
Alpha blender
- G High quality encoder
- H Dedicated component analog circuitry
- I Two real-time digital video channels



A Desktop Environment to Suit You

Most user interfaces are too rigid, requiring you to adapt to their way of working instead of adapting to yours. The Indigo Magic user environment changes all that by giving you a unique way of collaborating with your design team.

Indigo Magic is a new generation desktop user environment that combines an intuitive desktop management system with powerful digital media tools in one user interface. In fact, we call it a 'Media User Interface', because Indigo Magic simplifies system and network access and facilitates collaborative computing through unique digital media tools.

The Indigo Magic iconic interface lets you organize your desktop environment to suit the way you work, increasing your communication and productivity. Now you have a click and point method of organizing your desktop and accessing resources.

With the Indigo Magic Desk Manager you can create multiple, iconic desktops each having all the applications, files and tools you'll need to work on specific projects. System administration and management is a breeze. Now you can set up your printer and user accounts and connect to a network all with the click of an icon.

Indigo Magic is 'network aware', so that you can work in your networked world. You can simply find and use all the resources on your network.

Collaborative Communication Tools

Indigo Magic user environment includes all of the digital media tools you need to capture, create and communicate your ideas in ways that are more vivid and compelling than ever imagined. With bundled applications and integrated media tools you can make the unique environment of interactive 3D graphics, audio and video a part of all of your work.

Imagine sharing your engineering designs in new ways. Now you don't have to cram a dozen people into your office to show your newest model. You can print your 3D model to video and add special effects, graphics or audio overlays and send it to your co-workers. With Indigo Magic you have the power to make your ideas come alive.

Indigo² is, quite simply, the world's fastest, most feature rich desktop workstation on the market. It is the ultimate power tool for power users. It gives you a new way of working, increasing your productivity and the quality of your work. That kind of phenomenal, desktop computing puts Indigo² in a class all its own.

Processing

CPU/FPU	R4000	R4400
MHz	100 MHz	150 MHz
Primary Cache	16KB	32KB
Secondary Cache	1MB	1MB
Memory Storage I/O	32MB to 384MB	
	2	3 1/2" Bays
	1	5 1/4" Half-height Bay
	2	Serial RS422 (38.4 k baud)
	1	Bidirectional Parallel
	5	Audio I/O Connectors
	1	Ethernet (AUI or 10BaseT)
	2	GIO-64 Slots
	4	EISA Slots (total of 4 slots)
SCSI	2	Fast SCSI - 2 channels

Graphics

Advanced Features	Alpha blending
	Accumulation buffer
	Anti-aliased RGB lines and points
	Full-scene anti-aliasing
	Texture Mapping
	Fog
	Lighting features
	Spot lighting
	Eight light sources
	Two-sided lighting
	Ambient, diffused, and specular
	Arbitrary clipping planes
	Depth cueing
	Soft shadow and depth of field
	Sub-pixel positioning
	Stenciling
	Stereo graphics
	Pan and zoom
	Sphere rendering
	X11 pixel operations
Color Maps	2 (4096 colors each)
	XL 1 (4096 colors each)
IRIS GL™ Display Modes	RGB double buffer
	RGB single buffer
	Color index double buffer
	Color index single buffer
	Stereo viewer connector

Audio/Video

Input	Mono/Stereo microphone (mono electret condensor microphone ships standard)
	Line-level stereo analog
	Serial Digital Stereo (IEC958)
Output	Stereo Headphone output/Mono (combined stereo) internal speaker
	Line-level stereo analog
	Serial Digital Stereo (IEC958)
Sampling Rates	48, 44.1, 32 KHz, and many lower rates
	Input and Output rates are independent
Converters	Combined DAC and ADC
	16-bit, delta-sigma, 64x-oversampling
	Two Stereo Audio Codecs,
Connectors	All 1/8 inch (3.5 mm) stereo jack
Video	Video slot on graphics board
	Independent video bus
	Genlock

Performance

	XL/R4000	XZ	Extreme
3D Lines	490K	640K	1.2M
3D Lines GouraudZ, Depth Cued	98K	275K	1.0M
Tmesh, Flat NO-Z,	100K	250K	630K
Tmesh, GouraudZ, Lit	26K	113K	415K
Quads, FlatZ	19K	84K	210K
Quads, GouraudZ, Lit	13K	43K	155K
Characters	288K	240K	250K
Screen Clear	3.0ms	9.0ms	4.5ms
Rectangle Fill Rate (screen-aligned)	437M pix/sec	40M pix/sec	78M pix/sec
	R4000/100	R4400/150	
MHz	100	150	
MIPS	85	136*	
MFLOPS	16	24*	
SPEC 89	70	100*	
SPEC 92 INT	59	85*	
SPEC 92 FP	61	93*	

*Estimated

Physical Environment

System	5 inches H x 18.5 inches W x 18.5 inches D 40 lbs.
19-inch Monitor	18.7 inches H x 18.9 inches W x 19.9 inches D 71.6 lbs.
Power Requirements	Voltage and Frequency 100-240 VAC
Heat Dissipation	1000 BTU/hour
Ambient Temperature	+ 13 to + 35 degrees C operating - 10 to + 65 degrees C non-operating
Relative Humidity	10% to 80% operating no condensation 10% to 95% non-operating no condensation
Altitude	10,000 feet operating 40,000 feet non-operating
Vibration	0.02 inches, 5-19 Hz 0.35 G, 19-500 Hz

Regulatory Agency Approvals

Electromagnetic	FCC Class A
Emission	Canada DOC. Class A CISPR 22 Class A Germany VDE Class A VCCI Class 1
Product Safety	UL 1950 CSA 22.2 No. 950, IEC 950 EN 60-950 Class 1 SELV
Ergonomic/Health	Germany ZH618

For more information please call

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