GRAPHICS AND IMAGE PROCESSING SUBSYSTEM
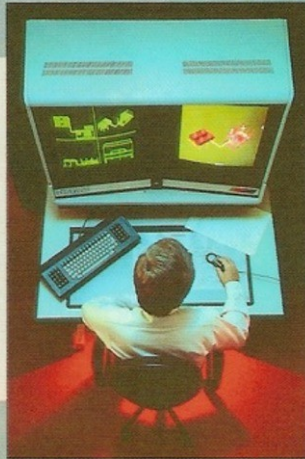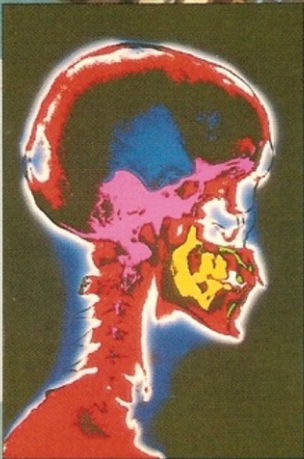
Vision Master

RADSTONE
R VISION TECHNOLOGY

F·E·A·T·U·R·E·S

- VMEbus interface, fully compatible with IEEE 1014-1987

- Proprietary pixel processor capable of peak burst execution speeds of over 160 MIPS

- Standard video memory of 4 Mbytes

- Extension memory expandable with additional memory boards up to 256 Mbytes maximum per VisionMaster set

- Standard display of 256 different colors and/or grey shades out of a palette of 16.7 million

- The full range of 16.7 million colors available using three VisionMaster's in parallel

- Fully programmable video format for input and output. Possible video formats include PAL, SECAM, NTSC and D2MAC

- Programmable displays up to 2048 x 1024 pixels interlaced or non-interlaced

- Capable of generating a complete broadcast quality synchronization signal

- Built-in video frame grabber with programmable digitizer operating at up to 30 Msamples/sec

- Can be locked to an external synchronization signal, for stable frame grabbing

- Hardware zoom at 2, 4, 8 and 16 times in both X and Y directions

- Two on-board cursor chips capable of providing 1 x 3-color or 2 x 1-color cursors

- Built-in functions include line drawing, area filling, Gouraud shading, edge detection, filtering, anti-aliasing, affine transformations, erosion, dilation, contouring, thresholding, profiling and many more

- MICrocode ASsembler (MICAS) for development of custom firmware functions

O·V·E·R·V·I·E·W

Until recently, image processing and graphics have been viewed as divergent technologies despite the many advantages to be gained by combining the two disciplines (shorter development time, better user interfaces, higher levels of realism, improved functionality etc.).

Radstone Vision Technology now provides the means to easily and cost effectively exploit these advantages. VisionMaster is the result of a major development program and provides a processing resource which is tightly-coupled both to pixel-orientated operations, as demanded in imaging applications and also to the coded mathematical models used in graphics based applications.

VisionMaster is an advanced state of the art graphics and image processing sub-system, designed to perform in the most demanding of applications. The basic VisionMaster consists of a 3 board VMEbus set, able to process and display images at resolutions up to 2048 x 1024 pixels, in 256 colors. Using a proprietary pixel processor, VisionMaster offers a performance level unsurpassed by other board-level products, reaching a peak of over 160 MIPS.

VisionMaster is unique in combining high performance graphics capabilities with extremely fast image processing functions. Using the built-in frame grabber, it can act as an image/graphics processing engine, overlaying and combining real world images with sophisticated graphical displays. With a fully programmable video output, VisionMaster can be used for applications as diverse as simulation, medical imaging, CAD and electronic pre-press. The product is equally applicable to television or studio use since it also provides a broadcast quality input/output capability.
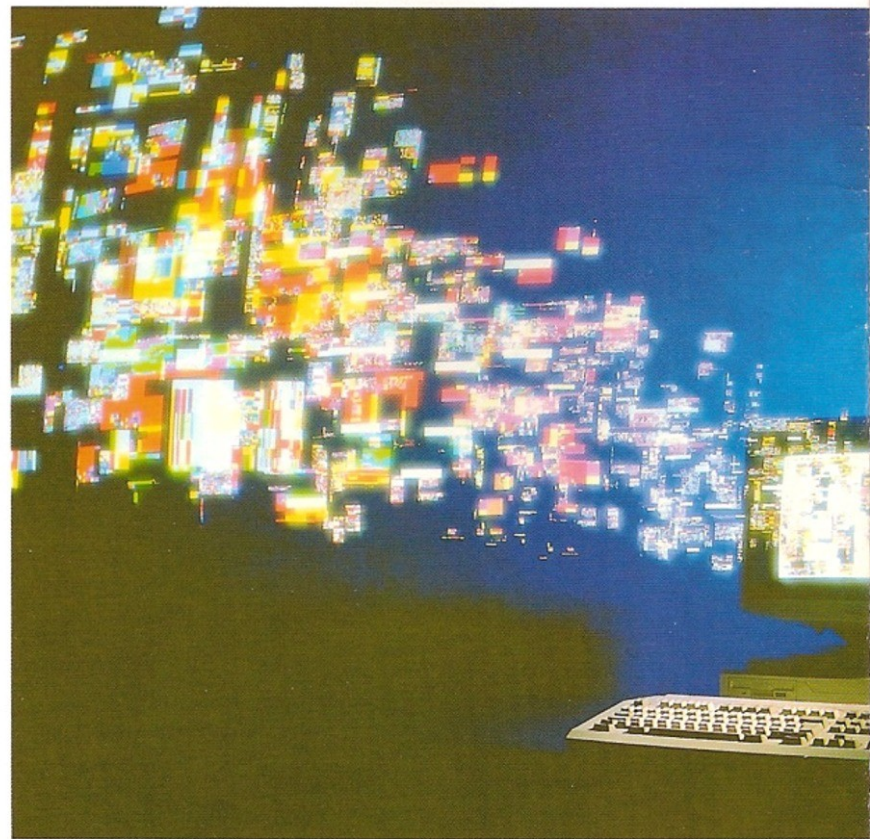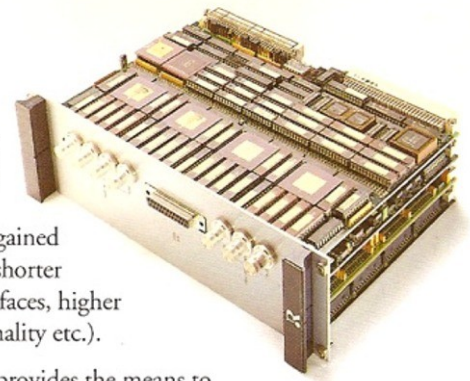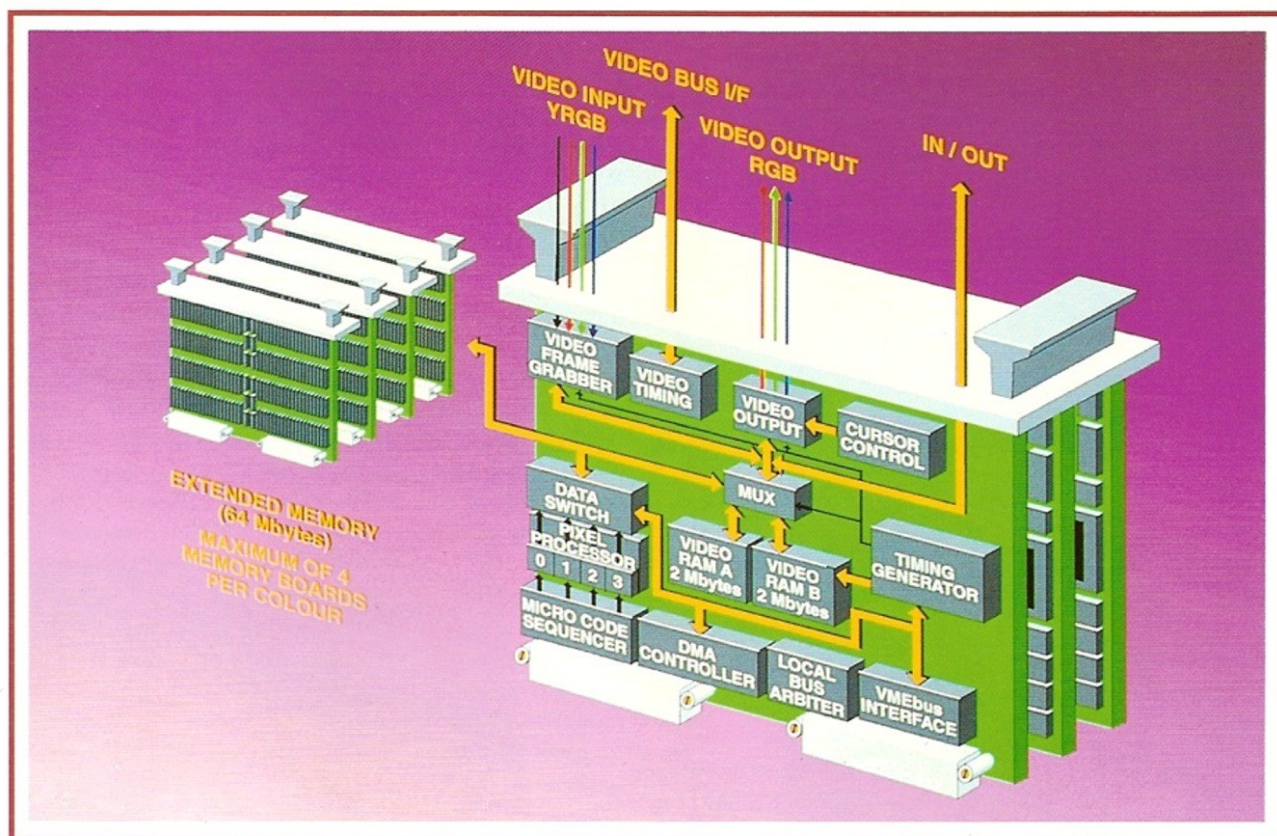
The basic 3 board set can be expanded in two ways;

- Additional memory boards can be added to increase the extended image memory, for either very large images (up to 16,000 x 16,000 pixels) or sequences of smaller images (eg. 30 seconds of PAL).

- Multiple VisionMaster sets can be combined in parallel to produce a 24 bit or 32 bit image.

An extensive library of routines is available in firmware and as C libraries. These, coupled with software drivers for, amongst others, SUN Microsystems workstations, PC's and OS-9 systems, make system integration a straightforward task.

GRAPHICS PROCESSING

VisionMaster is an exceptionally powerful graphics sub-system capable of the most complex graphical operations. The on-board firmware and complementary C libraries contain a very wide range of functions including line drawing, area filling, Gouraud shading, anti-aliasing and affine transformations.

IMAGE PROCESSING

VisionMaster is also a sophisticated image processing engine with a performance level approaching that of dedicated pipeline processors. It has all the advantages of a general purpose processor, combined with the speed of a dedicated image processor. A comprehensive range of imaging routines are contained both in firmware and as C libraries and include functions such as thresholding, erosion, dilation, edge detection, contouring and profiling.

GRAPHICS BENCHMARKS

Vector Draw	4 Mpixels/sec
Block Fill	160 Mpixels/sec
Block Copy	26 Mpixels/sec
Texture Mapping	2.5 - 97 Mpixels/sec
Gouraud Shading	20 - 160 Mpixels/sec
Anti-aliasing	10 Mpixels/sec
Affine transforms	3.2 - 85.3 Mpixels/sec

IMAGE PROCESSING BENCHMARKS

9 point convolution	5.3 Mpixels/sec
25 point symm'l. convolution	4.4 Mpixels/sec
Walking mean (64x64)	1.7 Mpixels/sec
Edge detection	5.6 Mpixels/sec
Binary Erosion	8.4 Mpixels/sec
Correlation	14.0 Mpixels/sec
Histogramming	26.0 Mpixels/sec

MICROCODE ASSEMBLER (MICAS)

The range of firmware functions provided is extensive and will satisfy the requirements of the vast majority of users. In specialist circumstances however, users may wish to generate a new function and add it to the existing firmware set. The MICrocode ASsembler (MICAS) permits the user to design new functions which will directly program and control the pixel processor.

A simulation package is also provided which allows the user to simulate operation of the new function and examine the internal workings of the pixel processor in detail. Results of the simulated function are displayed in a window which represents a portion of the video memory. Images in this window may be edited, stored and retrieved to/from disk, enabling patterns to be prepared for testing image processing and graphics routines.

The user interface to the simulator is menu driven, providing facilities for editing the video memory and pixel processor registers, and allowing the routine under test to be stepped through in either single or multiple steps. There are options for updating the video RAM and source displays at each step or at specified intervals, thus aiding faster simulation of complex functions.

Both packages run on Sun Microsystems workstations and enable the generation of new functions without the need to have access to a VisionMaster unit. Implementation in the firmware-based function set is then simply a matter of programming a set of EPROM's using code generated by MICAS.

VISIONMASTER DEVELOPMENT ENVIRONMENTS

VisionMaster applications can be developed on a variety of standard engineering platforms. Support for non-VME host systems such as PC-AT's and Sun workstations can be provided using bus-to-bus adaptors.

For development on VME-based systems, Radstone offers a complete range of hardware and software, including support for operating systems such as UNIX V.4, OS-9 and VxWorks. These can be used by OEM's and system integrators both as development platforms and as building blocks for producing added value solutions.
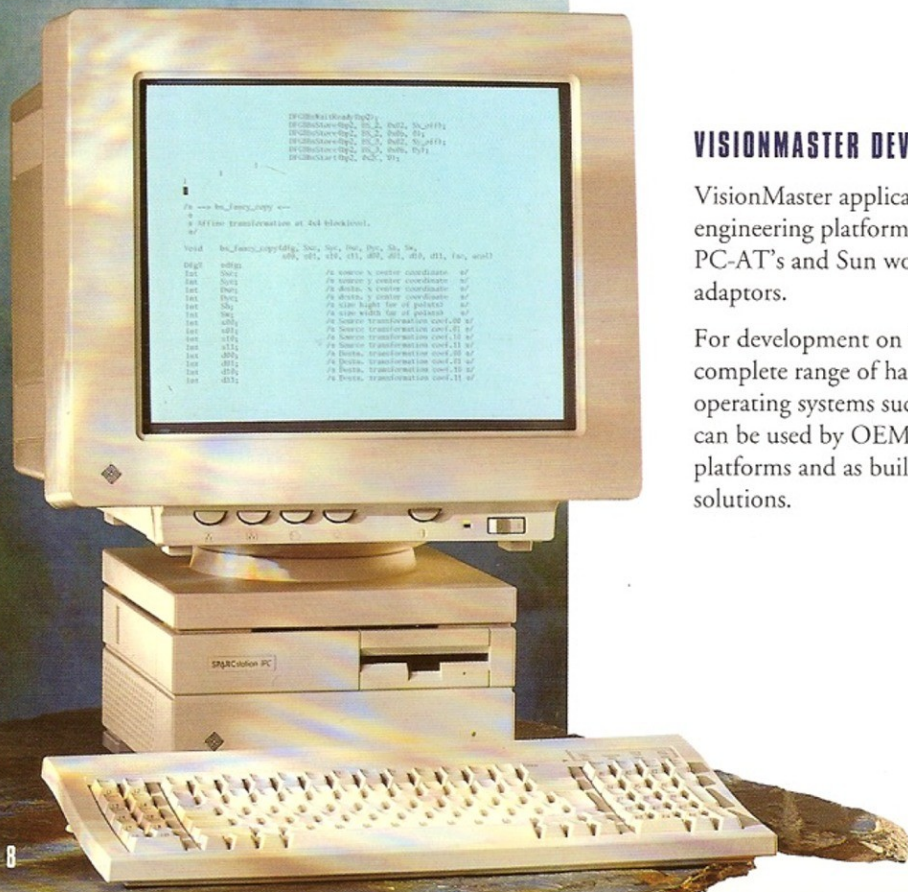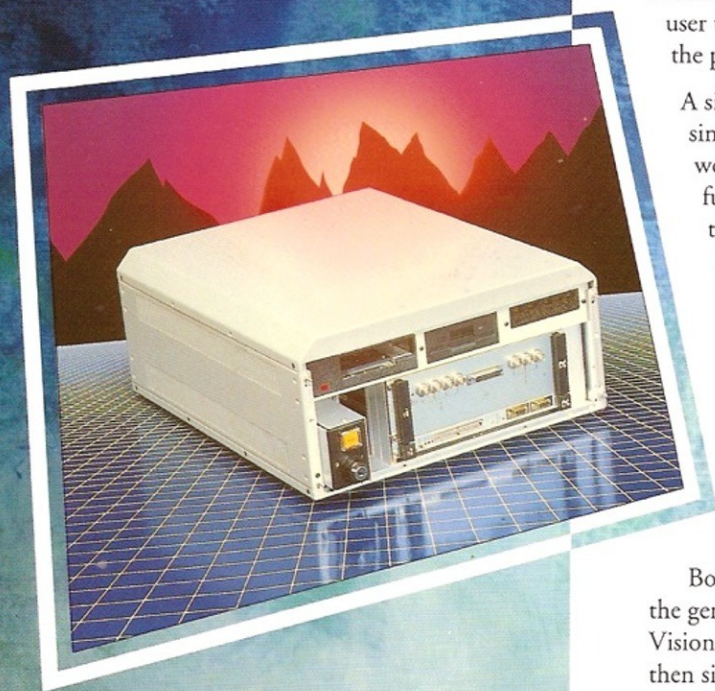
TYPICAL APPLICATION AREAS

VisionMaster is ideally suited to a wide range of application areas, particularly where a combination of imaging and graphics functionality is required. However, it is equally well-suited to applications which require high performance capabilities in one or other of the technologies. Example application areas include;

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CAD	Simulation
Medical Imaging	Printing pre-press
RADAR/SONAR displays	Animation
Geophysical/Mapping	Remote sensing
Industrial Inspection	Broadcast

and many, many more.

LOW-COST FLIGHT SIMULATOR

A single VisionMaster with one or two memory boards can be used as the basis of a low-cost flight simulator. An area pixel map of, say, 8192 x 8192, stored in memory and combined with height information, can be mapped at extremely high speed to supply the scene background. A set of photo realistic images of objects seen at various angles combined with VisionMaster's high speed affine transformation capabilities, produces an alternative to classical Gouraud shaded solutions for moving foreground objects. Realistic scenes can be generated without resorting to true color using a single VisionMaster, but three units combined would provide a photorealistic full color simulation, if required.

CARTOGRAPHIC SATELLITE IMAGE CONVERTER

The process of converting a satellite image to a cartographic representation needs high speed image processing to reveal details, very fast interactive graphics for enhancement and information overlays and large amounts of memory to handle the very high resolution images involved. A single VisionMaster with additional memory extension boards can deal with satellite images up to 16,000 x 16,000 pixels and software zooming, panning and filtering can be done interactively at multiple frames per second. Because VisionMaster supports specialized functions such as "bilinear filtered affine transformations" it can easily be used to remap a geometrically distorted image (such as would result from the curvature of the Earth's surface) at high speeds.
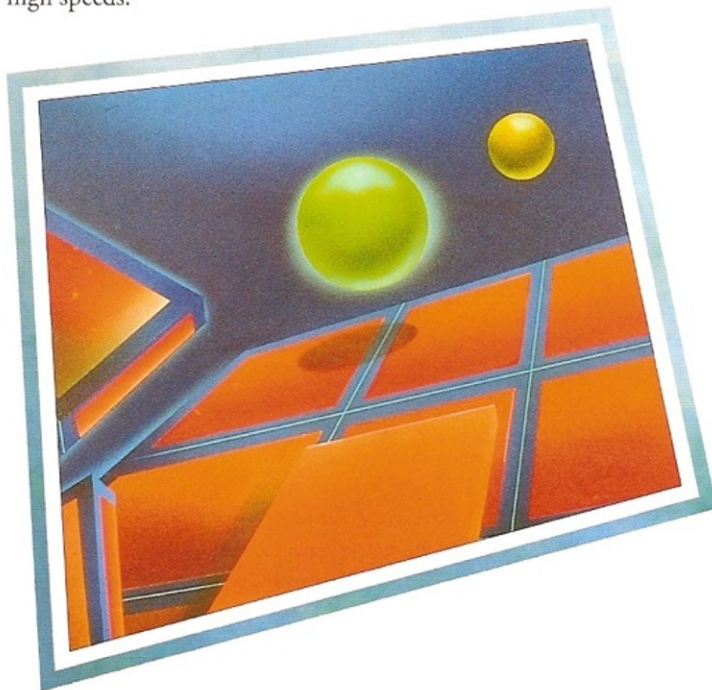
ANIMATION TIME SEQUENCE EDITOR

Many steps in the production of an animated movie can be computerized effectively with the use of VisionMaster. An interactive time sequence editor is capable of combining several background overlays, shifting at different speeds, with numerous objects and "characters" stored in a range of movements and positions. The high speed pixel processor and large memory arrays make VisionMaster ideal for such applications. Time sequences can be prepared on a high resolution screen and then filtered down to maximal quality broadcast standard format and written to a studio recorder.
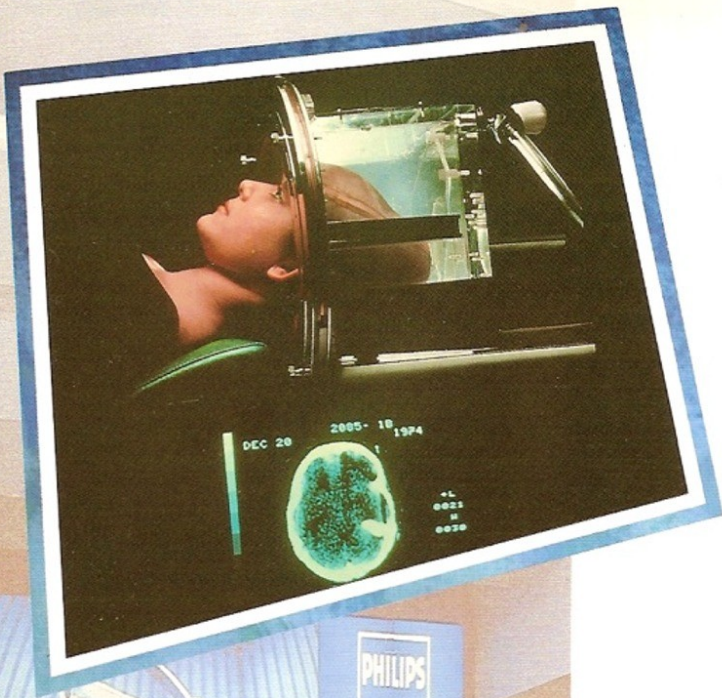
PROCESSING AND OUTPUT OF DIGITIZED X-RAY IMAGES

The analysis of X-ray images can be greatly enhanced using VisionMaster's powerful image processing capabilities. A typical image will have 10 to 14 bit resolution, which provides sufficient depth to enable hidden information to be revealed using the board's contrast enhancement capabilities. VisionMaster will also handle interactive zooming, real time switching between several images, stereoscopic viewing and presentation of 3-dimensional information by replaying stored sequences of moving images. The performance characteristics of VisionMaster are such that it can even handle a combination of stereoscopic and motion methods which can produce results superior even to some of the latest 3D visualization techniques.

VIDEO GRAPHICS INTERFACE TO VIDEOWALL DISPLAYS

Because of it's high level of programmability, VisionMaster can be used as an intelligent interface unit between standard computer systems and videowalls. It has the ability to handle analog video as well as high and medium resolution digital images and can split pictures of any size into smaller images for display on the videowall's 2-dimensional array of monitors.

In addition to this, VisionMaster can provide a wide range of effects such as scaling, rotation, warping etc. and can also store images for future comparison or review. Being a digital solution, VisionMaster avoids the inherent quality losses associated with analog to analog conversion methods and can operate independently of the size of the videowall, thereby allowing easy expansion.

GRAPHICAL INTERFACE FOR FLIGHT CONTROL RADAR SYSTEMS

VisionMaster's ability to handle bit-map manipulations very quickly makes it ideally suited to flight control radar systems, which can be effectively implemented by combining several display elements at very high speed.

VisionMaster's large memory array can be used to store background information (ie. airfield and surrounding area) and overlay grids (to give additional information such as distance, position, forbidden areas etc.) which can be interactively manipulated through pan, scroll and zoom functions. Data coming from the radar system is processed to provide magnitude and direction information and used to position decals (also stored in memory) in the composite image.

The unit can also produce a simulation of a conventional radar display, including sweep and phosphor persistence. This results in an image which can more easily be interpreted by the flight controller.

VISIONMASTER SPECIFICATION

Bus Interfaces	Standard VMEbus conforming to IEEE 1014-1987 Private bus from pixel processor to video and extended memory
Address Space	VMEbus: 2kbyte area, jumper selectable on any 2kbyte boundary within the VME short supervisory address space
VMEbus Access	Slave A16:D16 (ACRTC, DMAC and pixel processor) Slave A16:D8(0) (user registers) Master A32:D16 (DMAC)
VMEbus Interrupts	1 IRQ on level 1 to 7 4 vectored interrupts for Pixel Processor, VSync, ACRTC and DMAC
Video Memory	4 Mbytes, accessible via the pixel processor and ACRTC
Extended Memory	Up to 256Mbytes per color (ie. per VisionMaster board set)
Maximum Display Size	2048 x 1024, interlaced or non-interlaced
Video Format	Line and raster frequencies user programmable
Pixel Depth	8 bit, expandable to 32 bit
Color Selection	256 colors from a palette of 16.7 million colors, at 8 bit pixel depth 16.7 million colors displayable at 24 bit pixel depth
Video Outputs	1 to 128MHz pixel frequency, RS-343 compatible, 0.7 Vpp video R, G and B on 75 ohm load, 0.3 Vpp composite sync. on G. Available through 3 BNC connectors on front panel
Video Inputs	Maximum sample rate 30 Msamples/sec, 8 bit resolution, RS-343 compatible, 75 ohm inputs through 4 BNC connectors on front panel. User programmable as RGB + composite sync., Y + composite sync., RGB + sync. on green, R, G or B and grey scale Sensitivity: 2.0 Volts for full scale/8-bit or 1.0 Volt for full scale/7-bit
Special Functions	On-board proprietary pixel processor consisting of 4 x 16-bit bit-slice processors On-board sync. generator, capable of producing a broadcast quality composite sync., including serration and equalization pulses Two hardware cursors, user programmable as cross hair and/or as 64 x 64 bit maps Hardware zoom in both X and Y directions of 2, 4, 8 & 16 times User programmable display window Inter-board bus on front panel for multiple board synchronization in RGB and CMYK applications 8 Gamma correction tables for correction of camera input video, 1 user programmable
Power Requirements	+5 Volt: 14.5A typical, 18A max. +12 Volt: 35mA typical, 50mA max. -12 Volt: 100mA typical, 125mA max.
Operating Temperature	0 to +50 degrees Celsius
Storage Temperature	-25 to +75 degrees Celsius (non-operating)
Relative Humidity	0 to 90%, non condensing
Mechanical Form Factor	6U, conforming to the VMEbus double height board basic dimensions. Requires 3 VMEbus slots plus 1 slot per extension memory board
Dimensions	190 x 260 x 60mm, including connectors, handles, etc.
Weight	2.0kg net

VISIONMASTER OPTIONS INFORMATION

- VisionMaster board set

- 8MB extension memory board
- 16MB extension memory board
- 32MB extension memory board
- 64MB extension memory board

- C libraries for OS-9
- C libraries for Unix System V Release 4
- C libraries for SunOS
- C libraries for PC-DOS
- C libraries for VxWorks

- Microcode Assembler (MICAS) for Sun host
- X - Windows

Further information about currently available VisionMaster options can be obtained from Radstone sales offices and Representatives.
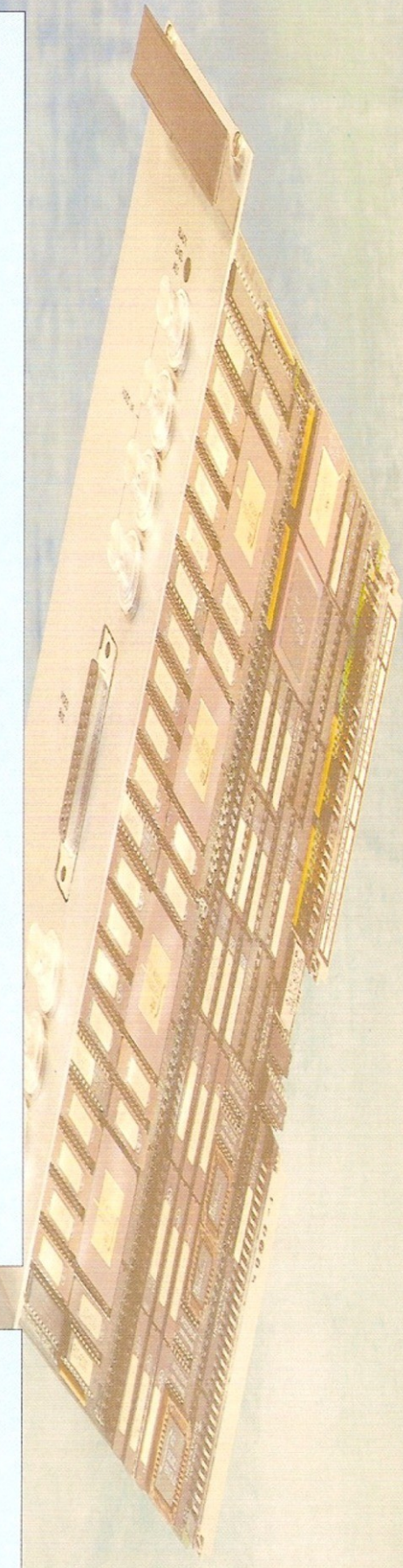
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