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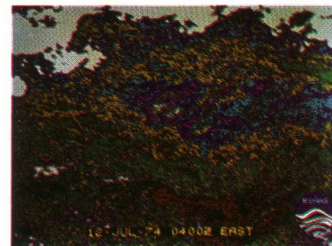
IKONAS

GRAPHICS SYSTEMS INC

1200 CARLTON AVE.
(919) 833-5401

RALEIGH NC 27606

IKONAS is a new supplier of custom configured high performance hardware for raster computer graphics. Each system is composed of multiple microprogrammed modules connected by a common 40 megabyte/second synchronous bus. Additional parallel busses may be included depending upon configuration.



2

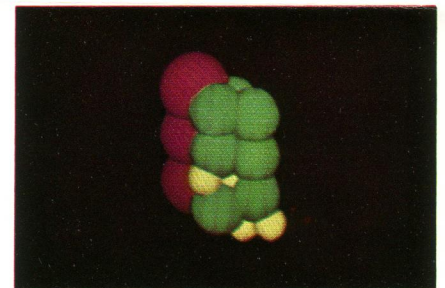


3

Available modules include a 32 bit microprogrammable bipolar processor, 16 X 16 bit matrix multiplier, frame buffer memory, and microprogrammed video interface. All microprogrammed modules may operate in parallel yielding outstanding performance--for example, 1 microsecond 3-D transformations using four multipliers in parallel.

For real-time animation output a 60 megabyte disk and run-length decoder module are available. Animation sequences of a minute or more may be displayed in real time (30 frames/second video).

IKONAS is dedicated to making flexible state-of-the-art raster graphics hardware available at reasonable cost.



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Photographs courtesy of:
Electrical Engineering Dept.,
N. C. State Univ. (1,3,4);
Dept. of Meteorology and Physical
Oceanography, Univ. of Miami (2);
Videotape by Computer Graphics
Research Group, Ohio State Univ.(5).

IKONAS GRAPHICS SYSTEMS INC

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IKONAS GRAPHICS SYSTEMS, INC. is a new supplier of custom configured high-performance hardware for raster computer graphics. System capabilities range from black/white 2-D vector display (in raster form) to dynamic real-time animation of complex 3-D color shaded scenes. IKONAS systems incorporate state-of-the-art concepts in computer architecture and implementation. Extensive use of microprogrammed controllers allows maximum flexibility and the exploitation of concurrently operating processes. The systems are conservatively designed using high-performance but thoroughly proven components.

All IKONAS raster graphics systems are configured around a common bus structure. The system bus supports a 40M byte/sec synchronous data transfer rate. It has a 32 bit data path and a 24 bit address path. Each card cage has a multilayer microstrip transmission line back plane. Cages are interconnected via flat cable which is impedance matched to the microstrip lines. A maximum of three cages of 9 cards each may be connected together. A standard set of high-performance bus transceivers is used on each card to insure a reliable, fast system.

IKONAS systems are essentially custom configured using a variety of standard modules which connect to the common bus structure. Among these modules are:

1. **PROCESSOR.** The 32 bit processor includes 16 internal general purpose registers and has a 200 nsec fetch/execute cycle time. The ALU is implemented using the AMD 2901 bipolar bit slice with full carry look ahead. The microprogram controller is implemented using the AMD 2911/29811 sequencer combination and is capable of addressing up to 4K words (64 bits each) of writeable control store. Fetch and execute cycles are overlapped to achieve the 200 nsec cycle time. An option is available which allows the processor to turn on any single bit in a data word (used for vector generation systems). For a complete description of the ALU and sequencer capabilities, refer to the AMD 2900 processor manual available from any Advanced Micro Devices, Inc. distributor.

2. **STATIC MEMORIES.** 1K word (4K byte) and 4K word (16K byte) 100 nsec access memory modules are available for processor working memory, host I/O buffer, and microprogram memory (2 required for 64 bit microprogram word).
3. **DYNAMIC MEMORIES.** 16K word (64K byte) 300 nsec access dynamic memory modules are available for frame buffer storage, disk buffer, etc. Each memory module is controlled by its own microprogram sequencer allowing interleaved memory accessing techniques. For example, memory fetches may be sequentially initiated in four memory modules (100 nsec/initiation), then data can be sequentially taken from the four modules (100 nsec/transfer).
4. **MULTIPLIER-ACCUMULATORS (M-A).** The M-A modules include a TRW 16 X 16 bit signed multiplier, 74S181 type ALU/accumulator, two 256 X 16 bit input memories, and one 256 X 32 bit output memory. All timing, ALU control, etc., is contained in a microprogrammed sequencer. Firmware is provided for 4 element vector by 4 X 4 element matrix multiplication (for homogeneous 3-D transformation) and 4 element vector by 4 element vector multiplication (for use in multiple M-A configurations). Each M-A module runs under its own microprogram and, therefore, several modules may be run concurrently. User firmware development is straightforward for many applications since memory word addressing is done on a row/column basis. 512 words of PROM are normally provided with an optional 256 word RAM for microcode storage.
5. **VIDEO CONTROLLER AND INTERFACE.** A microprogrammed video controller and interface is available. Microprogram flexibility allows, for example, a 64K byte dynamic memory module to be output as a 256 X 256 element 8 bit image, a 256 X 512 element 4 bit image, a 512 X 512 element 2 bit image, or as two alternating (30 Hz) 512 X 512 element 1 bit images. Video output may be RGB from three 10 bit D/A converters or NTSC color encoded.
6. **COLOR LOOK-UP MEMORY.** A 1K X 24 bit color look-up memory (palette) is available.
7. **RUN-LENGTH DECODER.** The run-length decoder converts run-length encoded images to real-time video (for animation from host computer or system disk).
8. **SYSTEM DISK.** The system disk has 64M bytes of storage. The transfer rate for this nonremoveable disk is 8megabit/sec. The disk may be used for unencoded image storage (240 512 X 512 element 8 bit images, 330 msec access) or real-time animation using encoded images and a run-length decoder (1800 frames typical, 30 frames/sec).
9. **MICROPROGRAMMED HOST COMPUTER INTERFACE.**

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A typical small IKONAS system would include the 32 bit processor, 1K word writeable control store, 4K byte static memory, 64K byte dynamic memory, video controller with 1 bit output, and UNIBUS* interface (plus cooling and power supplies). This system would include software for displaying dynamic (1.2 μ sec/pixel drawing rate) 2-D vector images in a 512 X 512 raster format.

A large IKONAS system would typically be used for a shaded 3-D graphics animation system and would include the 32 bit processor, 4K word writeable control store, four 16K byte static memories, four 64K byte dynamic memories, video controller, color look-up memory, run-length decoder, 64M byte system disk, four multiplier-accumulator modules, high quality color display monitor, host interface, and rack with cooling and power supplies.

IKONAS GRAPHICS SYSTEMS, INC. is a recently formed corporation dedicated to delivering reasonable cost state-of-the-art hardware for raster computer graphics. The personnel involved in IKONAS have backgrounds in computer graphics research and development using well-integrated hardware/software systems. This background includes hardware development for graphics and imagery researchers at the University of Miami, Ohio State University, NASA-Langley, and North Carolina State University.

For more information about IKONAS GRAPHICS SYSTEMS products contact NICK ENGLAND or MARY WHITTON at SIGGRAPH'78 in Atlanta.

* "UNIBUS"--TM Digital Equipment Corporation

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IKONAS GRAPHICS SYSTEMS, INC. is a new supplier of high-performance hardware for raster computer graphics. IKONAS systems incorporate state-of-the-art concepts in computer architecture and implementation. Extensive use of microprogrammed controllers allows maximum flexibility and the exploitation of concurrently operating processes. The systems are conservatively designed using high-performance but thoroughly proven components.

The extremely flexible architecture of IKONAS graphics systems not only means that future expandability is insured, but also that each system is individually configured to meet a customer's needs. Our philosophy is to provide our customers with the hardware they want and need rather than forcing them to compromise.

IKONAS systems are custom configured from various standard modules attached to a common communication bus. The IKONAS bus is a 32 bit data, 24 bit address, 100 nsec synchronous bus design incorporating multi-layer transmission line techniques for high reliability. Standard modules include a 32 bit 200 nsec cycle processor, matrix multipliers for 3-D transformations, and a variety of memories for data, program and image storage.

Systems typically include a frame buffer memory for display of 512 X 512 images from 2 to 32 bits/pixel (or 1024 X 1024 images of 1 to 8 bits). These frame buffers are capable of a level of performance not often attained. For example, a 512 X 512 X 8 buffer is capable of simultaneously supporting video input, video output, and two host computers, each with 1.6 μ sec access.

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IKONAS processing elements are capable of providing a powerful tool to lighten a host computer's computational load. The 32 bit IKONAS processor can generate vectors (in raster format) at 1.2 μ sec per pixel for fast update of complex images. An IKONAS matrix multiplier can provide a 3-D transformation in under 4 μ sec. Four multipliers can be used in parallel to provide sub-microsecond transformations.

In addition, IKONAS can provide several types of run-length encoded animated image display systems. These animation systems can provide several minutes of real time complex displays from an integral 64 Mbyte disk drive at a price comparable with that of a typical disk system alone!

IKONAS is dedicated to providing the most appropriate equipment for a particular customer. To do so, we can provide our standard products, modifications to the standard products, or a custom design from the ground up if need be. We have the background in computer graphics hardware and software to understand your problems and to provide equipment to solve those problems with state-of-the-art hardware and firmware at a reasonable cost.

The enclosed literature details some of our standard products and typical pricing. Please write or call for a quote on a system meeting your particular requirements.

IKONAS Graphic Systems, Inc. is a new supplier of custom configured high-performance hardware for raster computer graphics. System capabilities range from black/white 2-D vector display (in raster form) to dynamic real-time animation of complex 3-D color shaded scenes. IKONAS Systems incorporate state-of-the-art concepts in computer architecture and implementation. Extensive use of microprogrammed controllers allow maximum flexibility and the exploitation of concurrently operating processes. The systems are conservatively designed using high-performance but thoroughly proven components.

All IKONAS raster graphics systems are configured around a common bus structure. This 100 nsec 32 bit data, 24 bit address bus is implemented using controlled impedance transmission line techniques for maximum reliability.

IKONAS Systems are essentially custom configured using a variety of standard modules which connect to the common bus structure.

Among these modules are:

1. A 200 nsec cycle (overlapped fetch/execute) micro-programmable 32 bit processor with 16 internal registers. The processor includes 1K to 4K 64 bit words of writeable control store.
2. 4Kbyte and 16Kbyte 100 nsec static memories (for processor working memory, etc.).
3. 64Kbyte 300 nsec access dynamic memory (for frame buffer storage, etc.).
4. 16 bit x 16 bit 200 nsec microprogrammed multiplier-accumulator with two 256 x 16 input cache memories and one 256 x 32 output cache (for 2-D and 3-D transformations, cubic polynomial evaluation, etc.).
5. Microprogrammed video controller and interface. Microprogram flexibility allows, for example, a 64Kbyte dynamic memory module to be output as a 256 x 256 8 bit image, 256 x 512 4 bit image, 512 x 512 2 bit image, or as two alternating (30 Hz) 512 x 512 1 bit images. Video output may be RGB from three 10 bit D/A convertors or NTSC color encoded.
6. 1K x 24 bit color look-up memory.
7. Run-length decoder for converting run-length encoded images to real-time video. (for animation from host computer or system disk).

8. 64 mbyte system disk. 8 megabit/sec transfers from non-removeable disk. Used for unencoded image storage (240 512 x 512 8 bit images, 330 msec access) or real-time animation using encoded images and run-length decoder (1800 frames typical, 30 frames/second).
9. Microprogrammed host computer interface

A typical small IKONAS System would include the 32 bit processor, 1K word writeable control store, 4Kbyte static memory, 64Kbyte dynamic memory, video controller with 1 bit output, and UNIBUS interface (plus cooling and power supplies). This system would include software for displaying dynamic (1.2 msec/pixel drawing rate) 2-D vector images in a 512 x 512 raster format.

A large IKONAS System would typically be used for a shaded 3-D graphics animation system and would include processor, 4K word writeable control store, four 16Kbyte static memories, four 64Kbyte dynamic memories, video controller, color look-up memory, run length decoder, 64Mbyte disk, four multiplier-accumulator modules, high quality color display monitor, and rack with cooling and power supplies.

IKONAS Graphics Systems is a recently formed corporation dedicated to delivering reasonable cost state-of-the-art hardware for raster computer graphics. The personnel involved in IKONAS have backgrounds in computer graphics research and development using well-integrated hardware/software systems. This background has included hardware development for graphics and imagery researchers at the University of Miami, Ohio State University, NASA-Langley, and North Carolina State University.

IKONAS

Graphics Processing Power

- High Speed Architecture for Rapid Image Update and Communication with Host Computer
- 3-D Transformation Hardware
- Real Time Vector Generation Hardware

Image Processing Power

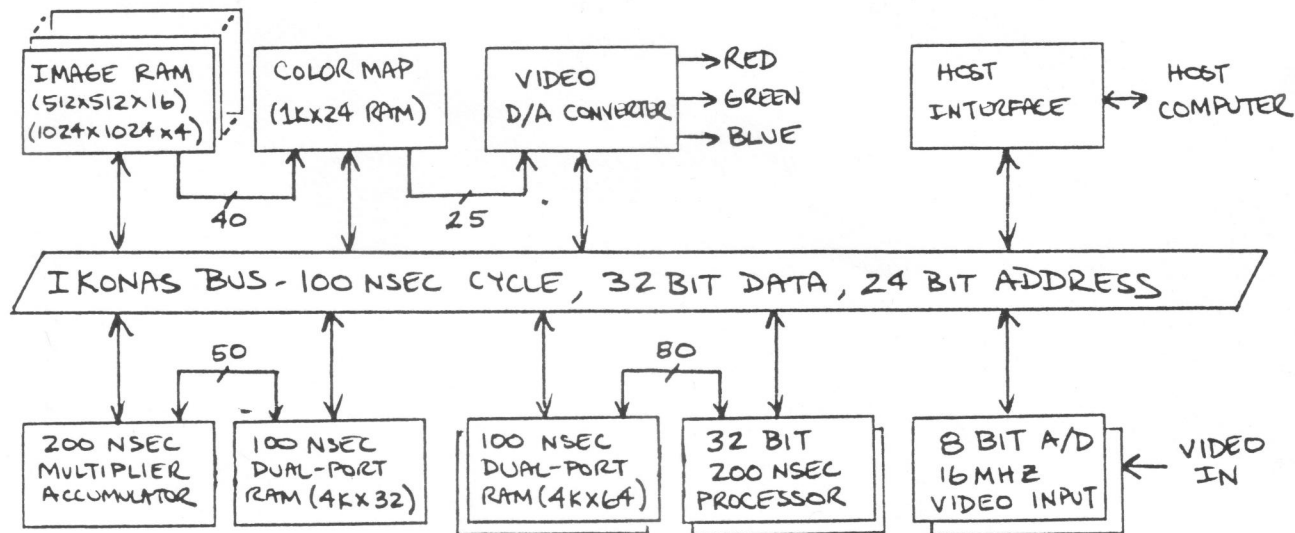
- 32 Bit Processor for Unparalleled Precision
- Firmware Controlled Hardware Multiplier
- Fast, Flexible Look-Up Memory for Gamma Correction and Pseudo-Color

Display Flexibility

- Variable Frame and Line Rates
- Pan, Scroll, and Zoom
- Various Display Formats Possible without Hardware Changes
- Full Window and Viewport Control

Customized Systems

- Modular System Elements
- Easy Expansion and Reconfiguration
- Modules can be Tailored to meet Specific Requirements



Typical System Block Diagram

PROCESSOR

The IKONAS processor is fully user programmable. A fast, 32 bit wide architecture gives unparalleled precision for graphics and image processing applications. The IKONAS processor speeds image computation by executing many repetitive, time consuming calculations from microcode programs. Graphics and image processing performance is further enhanced by allowing the host computer direct access to the image memory as well as to any other memory on the IKONAS bus (color look-up table, microcode store, etc.).

IMAGE MEMORY

IKONAS Image Memory is bit plane organized. Each module can be addressed as 1024x512x1, 512x512x2, or, for multi-pixel access, as 16Kx32. Pan, and scroll in pixel increments are standard as is zoom to any integer ratio 1:1 to 256:1. Modular nature of the units allow memory to be easily expanded from 512x512x2 up to 512x512x32 or 1024x1024x16.

FAST HARDWARE MULTIPLIER

The multiplier accumulator module facilitates the rapid execution of many graphics and image processing tasks which require multiply then add or subtract cycles, e.g. matrix multiplication (3-D point transformation), vector dot and cross product (shade calculations), and weighted averaging (anti-aliasing). Four modules operating in parallel allow sub-microsecond 3-D point transformation.

VIDEO INPUT

Video signals may be written into the image memory in real time. The high speed bus architecture of the IKONAS system allows simultaneous 10 Mbyte/sec video input, 10 Mbyte/sec video output, and 2 Mbyte/sec host data transfer.

ANIMATION

Computer graphics animation is a fast developing field with applications in physical system modeling, display of time varying data, and cartooning. IKONAS systems support computer animation using color-map or run-length encoding techniques with a variety of color look-up tables and run-length decoders. Image Memory serves as a run-length animation buffer for encoded images as well as frame buffer for unencoded images. The Mass Image Storage module can hold up to 60 seconds of moderately complex animation for real-time playback or can be used to store unencoded images.

FLEXIBILITY, EXPANDABILITY

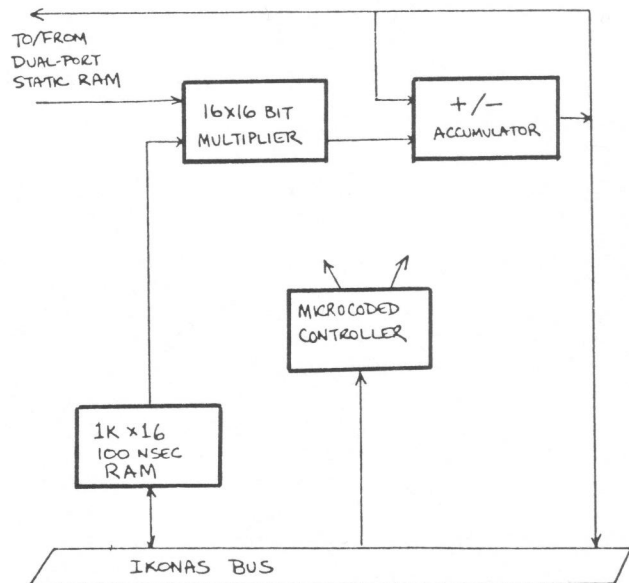
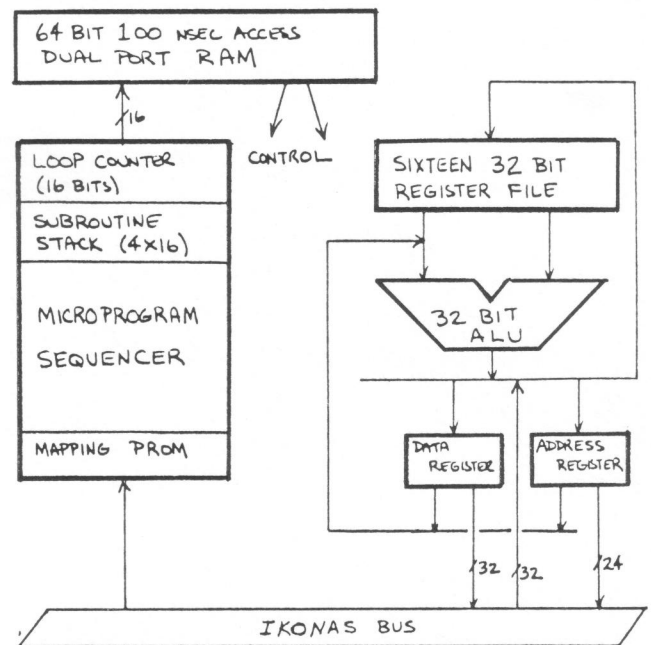
IKONAS systems are entirely modular, being configured from various modules attached to a common communication bus. Systems are easily expanded. One cage holds 20 cards; multiple cage configurations are possible. A user can begin with a simple frame buffer and add processor, image input, and hardware multiplier modules later.

CUSTOMIZED SYSTEMS

Modular design of components means that systems are configured to meet a customer's particular needs. Extensive use of microprogrammed controllers in the modules means that custom modifications are easily performed in many cases. A wide variety of options is available. IKONAS is particularly interested in providing state-of-the-art hardware for research and special purpose graphics and image processing systems.

PROCESSOR

- 32 bit bipolar microprogrammable processor; 200 nsec cycle; 16 internal registers.
- 64 bit wide microcode words stored in standard 100 nsec static memory.
- Architecture allows simultaneous execution of ALU functions and program control; execution speeds enhanced by hardware loop counter and subroutine stack.
- Microcode store easily expanded to 32K of 64 bit words.
- IKASM™, microcode cross assembler, written in standard FORTRAN.



MULTIPLIER/ACCUMULATOR

- 200 nsec 16x16 bit multiply and 35 bit add/subtract accumulate.
- 1024x16 on card buffer memory useful for storing elements of transformation arrays or filter coefficients.
- Operation controlled by on card firmware.
- Data paths available for recursive filtering.
- Direct port to standard 100 nsec 32 bit static memories.

VIDEO INPUT

- RS-170 compatible.
- 8 bits/sample; 16 MHz maximum sample rate.
- Full window and viewpoint control (independent of output window and viewport).

RUN-LENGTH DECODERS/ANIMATION

- Shade Look-Up Decoder uses 1024x24 color look-up table. 10 bit color code selects one of over 1000 colors without changing map entries.
- Color/Intensity Decoder uses 8 bits of encoded color to address color map. Displayed shade is determined by multiplying 8 bit red, green, and blue output of map by encoded intensity value.
- Direct Shade Decoder for codes which contain 8 bits each of red, green, and blue, as well as run-length. Requires no look-up table.

VIDEO OUTPUT

- Flexible system configuration and video output control. Memory can be displayed as 512x512x16 or 1024x1024x4 without hardware changes.
- Full window and viewpoint control; software controllable frame rate, line rate, and resolution.
- Flexible color map addressing and filling.
- Bit plane organization allow easy implementation of overlays and easy memory expansion.

LOOK-UP TABLES

- Standard 1024x24 Look-Up table allows full 8 bits resolution of red, green, and blue.
- Special look-up configurations (including hardware intensity multiplication) available.

STANDARD MODULES

PROCESSOR ELEMENTS

BMP 32	Bipolar Microprocessor 32 bit microprogrammable 200 nsec bipolar microprocessor with 16 internal registers, full carry look-ahead, and optional hardware multiply.
MPS 16	Microprogram Sequencer Capable of addressing up to 64K words of 64 bit wide microprogram memory.
MA 1024	Multiplier-Accumulator 16x16 bit 200 nsec multiplier with 35 bit add/subtract accumulator. 1024x16 bit memory on card. Microprogram controlled by on card firmware for graphics transformations and filtering.

MEMORY

DR 16B	Dynamic RAM Multi-format memory accessed as 512x512x2, 1024x512x1, or 16Kx32. Used for frame buffer, run-length memory, or general purpose memory. 300 nsec access.
ROM 16 ROM 32 ROM 64	Read Only Memory 16K, 32K, or 64Kx16 bit memory for function look-up and/or firmware storage. Sine and cosine functions standard. 100 nsec access.
SR1 SR 4 SR 8	Static RAM 1K, 4K, or 8Kx32 bit high speed, dual port memory used for display list or microcode memory. 100 nsec access.

MASS IMAGE STORAGE

KD 64	Disk and Controller 64 Mbytes of storage for encoded real-time animation or encoded image storage. 1 Mbyte/sec transfer rate.
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VIDEO INPUT

VI 8	Video Input Module (2 Cards) Real-time storage of video signals. 16 MHz sample rate; 8 bits resolution/sample. Full windowing and viewport control.
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VIDEO OUTPUT

FB/HC	Frame Buffer Controller Controls video refresh and generates all system timing. Microprogram controlled to allow flexible display formats up to 1024x1024x16 (or 512x512x32). Full window and viewport control.
RLI 8	Run-Length Decoder (Intensity Control) Used for color shade-intensity run-length coded animation (with LU 24).
RLS 10	Run-Length Decoder (Shade Look-Up) Used for shade look-up run length-coded animation (with LU 24).
RLU 24	Run-length Decoder (Unencoded Shade) Used for 24 bit/pixel run-length coded animation.
LU 24	Color Look-Up Table 1024x24 bit memory used for color look-up (color map) operation in frame buffer system or in run-length coded animation. 10MHz throughput.
LU 24/HS	Color Look-Up Table/High Speed 40 MHz version of the LU 24.
LUI 24	Color Look-Up Table (Intensity Control) LU 24 with separate 8 bit intensity multiplication of red, green, and blue.
VO 30	Gamma Correction and Video Output Module Three 8 bit video outputs with gamma correction. RS-170. 10 MHz throughput.
VO 24/HS	Video Output Module/High Speed Three 8 bit video outputs with 40 MHz throughput. RS-170 or RS-343A.

INTERFACES

Fast DMA or memory mapped interfaces for popular minicomputers are available.

MISCELLANEOUS

CB 20	Card Cage and Power Supply Holds up to 20 cards. 5 volts @ 200 amps; +12 volts; @ 30 amps; -5 volts @ 12 amps; + 15 volts @ 3 amps power supplies and fan cooling are included. Multiple cage configurations are possible. 19"x22.75"x28" slide mounted.
RK 6	Rack 70 inches of rack mounting space.

IKONAS GRAPHICS SYSTEMS, INC. is a supplier of high performance hardware for raster computer graphics and image display. IKONAS systems incorporate state-of-the-art concepts in computer architecture and implementation. Extensive use of microprogrammed controllers allows maximum flexibility and the exploitation of concurrently operating processes. The systems are conservatively designed using high performance but thoroughly proven components.

The extremely flexible architecture of IKONAS graphics systems means that not only is future expandability assured, but also that each system is individually configured to meet a customer's needs. In order to provide the most appropriate equipment for a particular customer IKONAS can supply standard products, modifications to standard products, or complete custom design. Our philosophy is to provide our customers with the hardware they want and need rather than forcing them to compromise. IKONAS strives to meet the graphics requirements of advanced, high-technology research groups.

IKONAS personnel have the background in computer graphics and image processing hardware and software to understand your problems and to provide equipment to solve those problems with state-of-the-art hardware and firmware at a reasonable cost.

IKONAS GRAPHICS SYSTEMS INC

403 GLENWOOD AVE — RALEIGH NC 27603 — 919/833-5401

IKONAS

NEW

RDS-3000 Graphics Processor and Raster Display System

Display Flexibility

Software selectable 512² or 1024² display format
Variable pixel rate—5 to 40 MHz
Variable frame rate—200 to 2000 lines/frame
Real-time video input—frame grabber
Pan and scroll in pixel increments; zoom in integer ratios
Window and viewport control

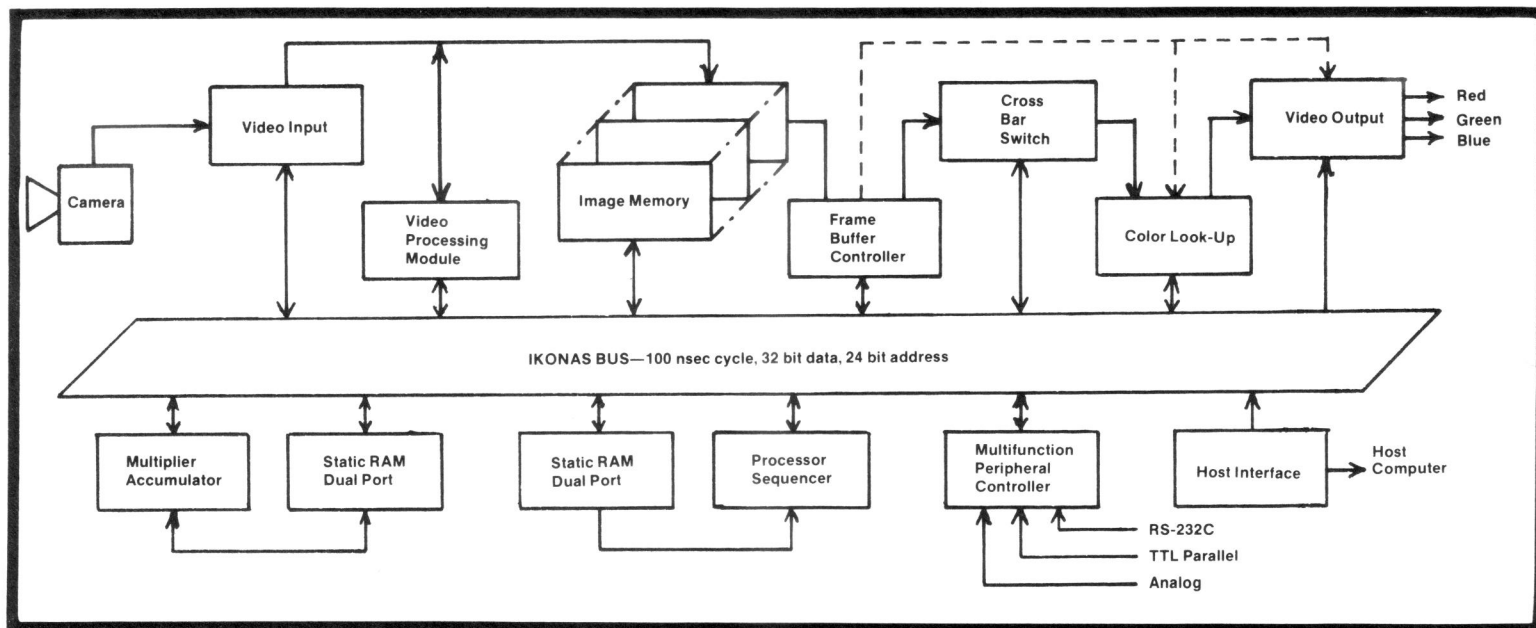
Processing Power

32 bit 200 nsec bipolar microprocessor
3-D transformation hardware including division
NEW video rate processor

System Expandability

Modular system elements
Easy expansion and reconfiguration
Modules tailored to your specific requirements

**THE GRAPHICS SYSTEM
FOR THE 80's**



TYPICAL SYSTEM BLOCK DIAGRAM

PROCESSOR

- 32 bit bipolar microprogrammable processor; 200 nsec cycle
- 64 bit wide microcode words stored in standard 100 nsec static memory
- Architecture allows simultaneous execution of ALU functions and program control; execution speeds enhanced by hardware loop counter and subroutine stack
- Microcode store easily expanded to 32K of 64 bit words (RAM or ROM)

The IKONAS processor is fully user programmable. A fast, 32 bit wide architecture gives unparalleled precision for graphics and image processing applications. The IKONAS processor speeds image computation by executing many repetitive, time consuming calculations from microcode programs. Graphics performance is further enhanced by allowing the host computer direct access to the image memory as well as to any other memory on the IKONAS bus (color look-up, microcode store, etc.).

MULTIPLIER/ACCUMULATOR

- 200 nsec 16 x 16 bit multiply and 35 bit add/subtract accumulate
- 1024 x 16 on-card buffer memory useful for storing elements of transformation arrays or filter coefficients
- Operation controlled by on-card firmware
- Direct port to standard 100 nsec 32 bit static memories
- Optional division circuitry

The Multiplier/Accumulator facilitates the rapid execution of many graphics and image processing tasks which require multiply then add or subtract cycles, e.g. matrix multiplication (3-D point transformation), vector dot and cross product (shade calculations), and weighted averaging (anti-aliasing). Four modules operating in parallel allow sub-microsecond 3-D point transformation. Perspective division is possible with the division option.

ANIMATION

Computer graphics animation is a fast developing field with applications in physical system modeling, display of time varying phenomena, and cartooning. IKONAS systems support computer animation using color map or run-length encoding techniques with a variety of color look up tables and run length decoders. Image Memory can serve as a run-length animation buffer for encoded images as well as frame buffer for unencoded images. The Mass Image Storage module can hold up to 60 seconds of moderately complex animation for real-time playback or can be used to store unencoded images.

VIDEO PROCESSING MODULE

- 16 x 16 bit hardware multiplier
- High Precision 16 bit ALU
- 10 MHz processing rate

Image addition, subtraction, multiplication, scaling and look-up type operations can be performed by the VPM in one frame time. Filtering with a 3 x 3 coefficient matrix can be performed in less than one third second. Any DR 64B, the video input module, or an internal coefficient memory may be used as an input to the VPM. The unit is controlled by registers set via the IKONAS Bus from the internal processor or the host computer.

VIDEO INPUT

- RS-170 compatible
- 8 bits/sample; 16 MHz maximum sample rate
- Full window and viewport control (independent of output window and viewport)

Video signals may be written into the Image Memory and displayed in real time (1/30 sec.). The high speed bus architecture of the IKONAS system allows simultaneous 10 Mbyte/sec video input, 10 Mbyte/sec video output, and 2 Mbyte/sec host data transfer.

SOFTWARE

Microcode Cross Assembler, IKASM, is written in standard Fortran for installation on host computer and is supplied with the processor, BPS 32.

Graphics primitives including vector drawing, character generation, conic generation, area fill, 2-D and 3-D transformations are available in microcode.

FLEXIBILITY/EXPANDABILITY

IKONAS systems are entirely modular being configured from various modules attached to a common communication bus. Systems are easily expanded. A user can begin with a simple frame buffer and add processing elements and video input at a later time. One chassis holds 12 boards; multiple chassis configurations are possible. Maximum Image Memory size is 512² x 64 or 1024² x 32. Larger memories and other special modules available on a custom basis.

STANDARD RDS-3000 MODULES

PROCESSING MODULES

BPS 32	Bipolar Processor and Sequencer Microprogrammable 32 bit 200 nsec bipolar microprocessor with 16 internal registers, full carry look ahead, and optional hardware multiplier. Microprogram sequencer capable of addressing up to 64K words of 64 bit wide microprogram memory (RAM and/or ROM). Horizontal microcoding for maximum parallel operation.
MA 1024 MA 1024/D	Multiplier Accumulator 16 x 16 200 nsec multiplier with 35 bit add/subtract accumulate. 1024 x 16 memory on card for coefficient storage. Ported to both the IKONAS Bus and to Static RAM processor working memory. Microprogram controlled by on card firmware for graphics transformations and filtering operations. Option: MA 1024/D Multiplier Accumulator with Perspective Division. Additional circuitry allows perspective division for 3-D transformations.
CGM	Character Generator Microprocessor based hardware character generator allows 7 x 9 or 10 x 14 standard or larger user defined characters and symbols to be drawn into the frame buffer at a rate of approximately 8 microseconds per 7 x 9 character. The module is used in conjunction with an SR 4 Memory for font storage.
VPM	Video Processing Module VPM adds a variety of image processing capabilities to the system. Image addition, subtraction, multiplication, scaling and look-up type corrections can be performed in one frame time. High precision digital filtering can be performed at very high speeds. The VPM features a 16 x 16 bit hardware multiplier and 16 bit ALU for exceptional processing precision at 10 MHz rates.

PROCESSOR MEMORY

SR 4 SR 8	Static RAM 4K or 8K x 32 bit high speed, dual port memory used for processor working memory, microcode memory, or character generation font storage. Dual SR 4 available on one card.
ROM 16 ROM 32	Read Only Memory 16K, 32K, or 64K x 16 Read Only Memory Modules. Used for function look-up and/or firmware storage. Sine and cosine functions standard. 100 nsec access.

MASS IMAGE STORAGE

KD 64	Disk and Controller KD 64 disk provides 64 Mbytes of formatted storage for unencoded image storage or encoded image storage for real-time playback of animated sequences.
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ANIMATION

RLI 8	Run Length Decoder (Intensity Control) Color/Intensity Run Length Decoder uses 8 bits of encoded color to address Color Look-Up Table. Displayed shade is determined by multiplying 8 bit red, green, and blue output of the map by an encoded intensity value.
RLU 24	Run Length Decoder (Unencoded Shade) Shade Look-Up Run Length Decoder uses 1024 x 24 Color Look-Up Table. 10 bit color code selects one of over 1000 colors without changing table entries.
RLS 10	Run Length Decoder (Shade Look-Up) Direct Shade Run Length Decoder is used for codes which contain 8 bits each red, green, and blue, as well as the run length. This decoder requires no Color Look-Up Table.

INTERFACES/CONTROLLERS

IF	Host Interface Fast DMA or memory mapped interfaces for popular minicomputers are available.
MPC	Multifunction Peripheral Controller Versatile 68000 microprocessor based module combining external interfacing, data preprocessing, and simple interaction with the IKONAS display system on a single card. Significant flexibility and choice in both number and format of inputs: RS-232C ports, TTL pulse ports, parallel (16 bit) digital ports, analog ports.

INTERACTIVE DEVICES

Various interactive devices including joystick, trackball, dials, buttons, and data tablet are available from IKONAS. Interfaces to host computer or MPC Module can be provided.

IMAGE MEMORY

DR 64B	Image Memory Full 512 x 512 x 8 on one printed circuit board. Software addressable as 512 x 512 x 8, 1024 x 1024 x 2, or 64K x 32. 300 nsec access, 400 nsec cycle. Video rate input port and video rate output port for image processing applications.
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VIDEO OUTPUT

FB/HC	Frame Buffer Controller FB/HC controls transparent refresh of the video display. Pixel pan and scroll and integer zoom features are standard. Software selectable line and frame rates. Full window and viewport control. Full screen cross-hair cursor.
XBS 24	Cross Bar Switch Cross Bar Switch, XBS 24, allows 24 bits of display bus data to be mapped into three user defined eight bit fields. The output format of the XBS 24 is set by the user from the IKONAS Bus. The XBS 24 is located on the Display bus between the Frame Buffer Controller (FB/HC) and the color look-up table (LU 24) or Video Output Module (if no look-up is used). Option: 32 bit Cross Bar Switch, XBS 32.
LU 24 LU 30	Color Look-Up Table Dual ported 1K x 24 memory used for color Look-Up Table (palette/color map). One port is interfaced to the IKONAS Bus so that the module appears as a static memory to the remainder of the system. The other port is interfaced to the Display Bus allowing the module to receive data from the Frame Buffer Controller and send data on to the Video Output Module. 10 MHz throughput. Option: LU 30—1K x 30 memory for use with VO 30/HS.
LU 24/HS LU 30/HS	High Speed Color Look-Up Table High speed version of the LU 24 designed to provided color Look-Up Table for 1024 ² display systems. 40 MHz throughout. Option: LU 30/HS—1K x 30 memory for use with VO 30/HS.
VO 24/HS VO 30/HS	Video Output Module VO 24/HS receives standard red, green, and blue data from the display bus and converts it to RS-170 or RS-343A analog video signals with high speed digital to analog converters. The D/A converters 8 bit input and will operate at 40 MHz for 1024 ² display. Video amplifiers designed to drive standard 75 ohm coaxial lines. Option: VO 30/HS—10 bit DAC's.
NTSC	NTSC Encoder NTSC Encoder unit converts RGB signals to industry compatible NTSC Encoded video. Not restricted to 525 line standard.

VIDEO INPUT

VI 8	Video Input Real-time storage of video signals—frame grabber. 16 MHz sample rate, 8 bits per sample resolution. Full windowing and viewport controls allow multiple images to be stored and viewed.
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MONITORS

MON 19	19" 15 MHz RGB Monitor Ultrahigh resolution 15MHz CRT with 0.31mm tridort pitch. RGB video input, RS-170 signal. Rackmount or cabinet.
MON 19/HS	19" 40 MHz RGB Monitor Ultrahigh resolution 40MHz CRT with 0.31mm tridort pitch. RGB video input, RS-343A signal. Rackmount or cabinet.

HARD COPY

HC	Color Hard Copy Unit Color Hard Copy Unit accepts RGB and Sync inputs and can provide 8 x 10 color photographs, 35mm slides, or movie output.
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MECHANICAL

CBP 12	Chassis and Power Supply Chassis, backplane, and power supply unit with a capacity of 12 38 cm. x 38 cm. (15" x 15") printed circuit boards. Multiple cage configurations are possible. Slide mounted, fan cooled. Dimensions: 48.3 cm. x 57.8 cm. x 71.1 cm. (19" x 22.75" x 28") including cabling. Weight: approx. 45 kg. (100 lbs.)
RK 6	Rack

RDS-3000 SYSTEM CONFIGURATION GUIDE

The flexible, expandable nature of IKONAS RDS-3000 graphics systems makes a multitude of system configurations possible. The modular design of IKONAS products makes it possible to begin with a small frame buffer system and later to add more image memory and processor elements. The following system configuration guide lists those modules which are essential to a frame buffer system, those which are essential for a system including a processor, and those which may be added to the basic systems.

BASIC FRAME BUFFER CONFIGURATION

Function	Module Name
Image Memory	DR 64B
Frame Buffer Controller	FB/HC
Video Output	VO 24/HS or VO 30/HS
Host Interface	IF
Card Cage/Power Supply	CBP 12

Each DR 64B can be accessed as $512^2 \times 8$ or $1024^2 \times 2$. Minimum configuration contains one DR 64B. Maximum standard configurations are $512^2 \times 64$ or $1024^2 \times 32$. The CBP 12 Card Cage holds 12 boards. Multiple cage configurations are possible. Larger image memories are available on a custom basis. Look-Up Table and Video Output require only one card. Frame Buffer Controller and Host Interface require only one card.

The basic frame buffer configuration does not include a color look-up table. One of the modules LU 24 or LU 24/HS adds color look-up capability to the system.

The Video Input Module, VI 8, can be added to the system to provide real time storage of video signals. The VI 8 is a "frame grabber".

Mass Image Storage, KD 64, can be added to the system to store unencoded images or, for real time playback, run-length encoded images (animated sequences).

Animation capability can be added to the system by including the Mass Image Storage and one of the modules RLI 8, RLS 10, or RLU 24 for run-length decoding.

BASIC PROCESSOR CONFIGURATION

Function	Module Name
Bipolar Processor and Sequencer	BPS 32
Microprogram Memory (2 Modules Required)	SR 4, SR 8
Processor Working Memory	SR 4, SR 8
Frame Buffer System (from above)	

The processor is designed to be used in a system that contains a frame buffer. Additional processing power may be added by including one or more Multiplier-Accumulator Modules, MA 1024. Multiple MA 1024's may be programmed to run in parallel. Perspective division can be added with the /D option to the MA 1024. The Video Processing Module, VPM, can be added to the system to allow video rate processing of 512^2 images.

ROM modules may be added to the system to provide function look-up tables and/or firmware storage.

IKONAS GRAPHICS SYSTEMS, INC. is a supplier of high performance hardware for raster computer graphics and image display. IKONAS systems incorporate state-of-the-art concepts in computer architecture and implementation. Extensive use of microprogrammed controllers allows maximum flexibility and the exploitation of concurrently operating processes. The systems are conservatively designed using high performance but thoroughly proven components.

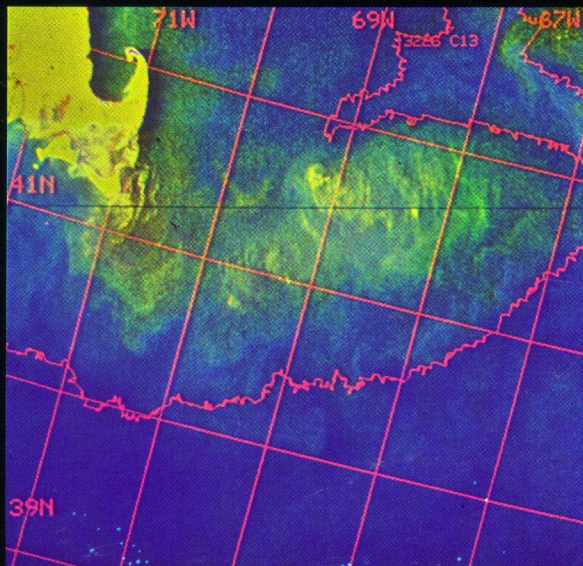
The extremely flexible architecture of IKONAS graphics systems means that not only is future expandability assured, but also that each system is individually configured to meet a customer's needs. In order to provide the most appropriate equipment for a particular customer IKONAS can supply standard products, modifications to standard products, or complete custom design. Our philosophy is to provide our customers with the hardware they want and need rather than forcing them to compromise. IKONAS strives to meet the graphics requirements of advanced, high-technology research groups.

IKONAS personnel have the background in computer graphics and image processing hardware and software to understand your problems and to provide equipment to solve those problems with state-of-the-art hardware and firmware at a reasonable cost.

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- IKONAS's architecture is particularly suitable for 3-D shaded graphics and image processing. The Speed, Power, and Programmability designed into IKONAS products makes them top performers in the most demanding applications.
- CAD/CAM: fast point transformation and vector drawing
- Simulation: fast 3-D shaded surface generation
- Image Processing: fast filtering and image enhancement

- High Performance Processing Modules for Graphics Generation and Image Processing
- Software Selectable 512² or 1024⁴ Display Format
- Modular/Expandable/Customized Systems

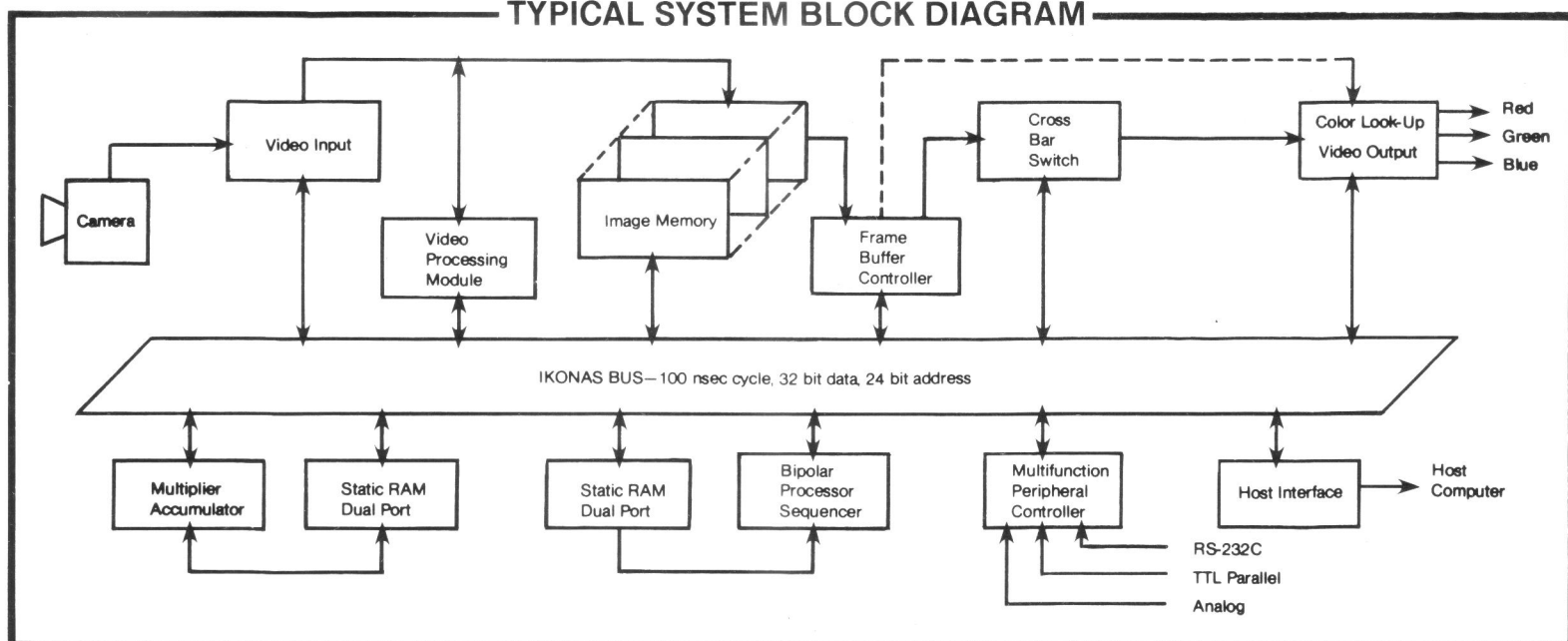
The Graphics System for the 80's

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RDS-3000 Graphics Processor and Raster Display System

TYPICAL SYSTEM BLOCK DIAGRAM



Powerful Processor

- High speed architecture for generating graphics data
- 32 bit, 200 nsec bipolar processor
- Fully user microprogrammable
- 64 bit wide microcode word stored in standard static RAM
- Microcode storage up to 32K words of RAM/ROM

Multiplier Accumulator Module

- Hardware 16 x 16 bit multiply and 35 bit add/subtract accumulate in 200 nsec
- 1024 x 16 on-card coefficient memory
- Microprogram controlled by on-card firmware/software
- Easy, fast 3-D transformations and vector products
- Optional division circuitry for perspective

Custom Engineering

- IKONAS can supply standard products, modifications to standard products or complete custom design
- IKONAS strives to meet the graphics requirements of advanced, high-technology research groups

Flexible Display Controller

- Software selectable 512² or 1024² display
- Pan and scroll in pixel increments
- Zoom in integer ratios: 1:1 to 256:1
- Programmable line and frame rates
- Full window and viewport control
- Fast look-up tables for pseudo-color and gamma correction
- 10 bit D/A converters available

Video Input

- RS-170 compatible signal input
- 8 bits/sample; 16 MHz maximum sample rate
- Real time "frame grabber"
- Architecture allows simultaneous video input and video display and 2 Mbyte/sec host transfer
- Full window and viewport control (independent of display window and viewport)

Video Processing Module

- 16 x 16 bit hardware multiplier
- High precision 16 bit ALU
- 10 MHz processing rate for image addition, subtraction, etc. in real time
- Filtering and convolution capability

Expandable System

- All components are modular and attach to a common communication bus
- Chassis has capacity for 12 cards
- Multiple chassis configurations are possible
- Begin with a simple frame buffer and add processing elements and video input at a later time

Software

- IKASM, Microcode Cross Assembler, written in standard FORTRAN, supplied with the processor
- IDL, IKONAS Display Language, features graphics primitives to draw vectors, conics, characters, fill areas, and perform 2-D and 3-D transformations

Animation

- Image memory can serve as encoded animation buffer
- Run-length and color map animation supported
- Variety of run-length decoders and color maps available

Photo Credits:

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