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Argus, Gemini, and Sirena PMC Graphics Boards User's Manual

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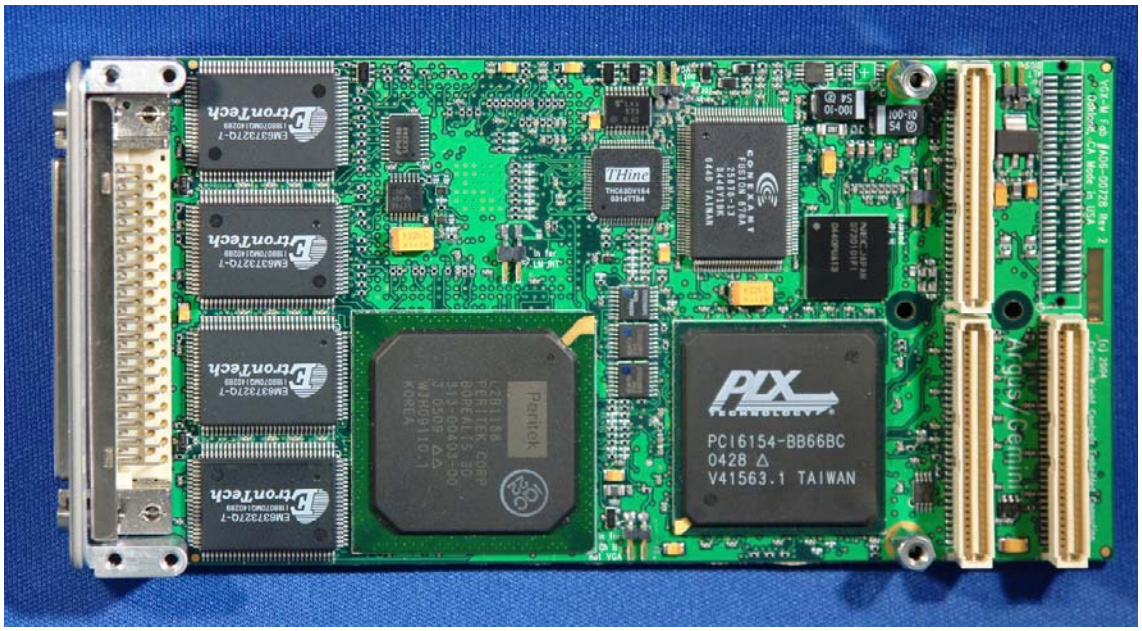
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Introduction

This manual provides information about how to configure, install, and program the Rastergraf Argus, Gemini, and Sirena 128-bit PMC graphics display controllers. When used with appropriate PMC-to-host adapters, PCI and CompactPCI compatible computers can also be supported.

This manual is broken down into six chapters:

Chapter 1: General Information
Chapter 2: Specifications
Chapter 3: Connector Pinouts and Cable Information
Chapter 4: Installing Your Rastergraf Board
Chapter 5: Programming Devices and Memories
Chapter 6: Troubleshooting

Chapters 1-3 provide background material about the graphics boards. Understanding the information in the chapters, however, is not essential for the hardware or software installation. If you want to perform the installation as quickly as possible, start with Chapter 4. If you have problems installing the hardware, refer to Chapter 6 for help.

Getting Help

This installation manual gives specific steps to take to install your Rastergraf board. There are, however, variables specific to your computer configuration and monitor that this manual cannot address. Normally, the default values given in this manual will work. If you have trouble installing or configuring your system, first read Chapter 6, "Troubleshooting". If this information does not enable you to solve your problems, do one of the following:

1) call Rastergraf technical support at (541) 923-5530

2) fax your questions to (541) 923-6475

3) send E-mail to support@rastergraf.com .

If your problem is monitor related, Rastergraf technical support will need detailed information about your monitor.

Board Revisions

This manual applies to the following board revision levels:

Gemini/Argus Fab Rev 2

Sirena Fab Rev 1

Manual Revisions

Revision 1.3	December 6, 2002	First released version
Revision 1.4	December 30, 2002	Fixed minor typos
Revision 2.0	May 3, 2005	Added Sirena and new audio and USB info
Revision 2.0a-i	June 25, 2005	Fixed typos, added power info
Revision 3.0	February 12, 2008	Rastergraf version. Put Sirena Rev 1 info back in.

Notices

Information contained in this manual is disclosed in confidence and may not be duplicated in full or in part by any person without prior approval of Rastergraf. Its sole purpose is to provide the user with adequately detailed documentation to effectively install and operate the equipment supplied. The use of this document for any other purpose is specifically prohibited.

The information in this document is subject to change without notice. The specifications of the Argus, Gemini, and Sirena graphics boards and other components described in this manual are subject to change without notice. Although it regrets them, Rastergraf assumes no responsibility for any errors or omissions that may occur in this manual. Customers are advised to verify all information contained in this document.

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Conventions Used In This Manual

The following list summarizes the conventions used throughout this manual.

`Code fragments`	Code fragments, file, directory or path names and user/computer dialogs in the manual are presented in the `courier` typeface.
Commands or **program names**	Commands, or the names of executable programs, except those in code fragments, are in bold.
System prompts and commands	Commands in code fragments are preceded by the system prompt, a percentage sign (%), the standard prompt in UNIX's C shell, or the hash mark (#), the standard UNIX prompt for the Super-User.
Keyboard usage	**<CR>** stands for the key on your keyboard labeled "RETURN" or "ENTER"

Note	Note boxes contain information either specific to one or more platforms, or interesting, background information that is not essential to the installation.

Caution	Caution boxes warn you about actions that can cause damage to your computer or its software.

Warning!	Warning! boxes warn you about actions that can cause bodily or emotional harm.

Chapter 1
General Information

1.1 Functional Description

1.1.1 Common Feature Set

As an aid to understanding the Argus, Gemini, and Sirena boards, block diagrams are provided at the end of this section. The common feature set includes:

- Two graphics head (Argus/Gemini) or single graphics head (Sirena) boards, which feature:
  128-bit Borealis 2D/3D Graphics Controller
  Embedded VGA controller
  16 MB high speed SGRAM supports multiple display pages
  Hardware pan, zoom, and scroll and bitmapped cursors
  OpenGL 1.1 pipeline
  66 MHz local PCI bus operation
- PLX Technology 6154 Asynchronous PCI-PCI bridge enables Primary (Host) 66/33 MHz, 64/32-bit support and Secondary 66/33 MHz, 32-bit Bus. Argus/Gemini Secondary always runs at 66 MHz. Sirena Secondary runs at 66 MHz unless Bt878 and/or USB are installed.
- Analog non-interlaced, high refresh rate, and Sync-On-Green
- Up to 1920 x 1200 displayable analog resolution
- Up to 1600 x 1200 displayable digital (DVI) resolution
- Quad-Image BIOS (Ch A only) supports FCode, VGA, and DVI and has user selectable Sync-On-Green boot mode
- SDL Graphics Subroutine Package
- Sun Solaris DDX 2D and 3D/OpenGL X Window System Servers
- Xfree86 Version 4.3 X Window System Server with OpenGL for x86/PowerPC Linux and PowerPC VxWorks
- Windows 2K/XP drivers for graphics, USB, and video input
- Compatible with standard Windows, Linux, and Solaris drivers for USB and audio
- Software compatible with Rastergraf ACE Series boards
- Full (Sirena) or partial (Argus/Gemini) function PMC Pn4 Rear panel I/O option
- Available with conformal coating and extended temperature (Argus requires high air flow)
- Note: There is no local 3.3V regulator option so these boards will not work with CWCEC 179 and 181-183 CPUs. Contact factory for alternate solutions.

Table 1-1 Board Feature Summary

	Argus	Gemini	Sirena
Number of Borealis 2D/3D graphics engines	2	2	1
Graphics memory	16 MB/ch	16 MB/ch	32 MB
Standard display resolution (DVI & VGA)	1600x1200	1600x1200	1600x1200
USB and Audio Stereo	yes	no	yes
Independent NTSC/PAL Video In controllers	2	no	1
Sync-On-Green	yes	yes	yes
On-board programmable BIOS	yes	yes	yes
Front Panel VGA connector option	no	dual	single
Front Panel DVI connector option	no	no	single
Front Panel USB connector	no	no	yes
Front Panel Audio I/O connector	no	no	yes
68 pin Multifunction connector	yes	option	no
VGA and DVI PMC rear I/O option	Ch 1 only	Ch 1 only	single
Audio, USB rear I/O option	yes	no	yes
Video input rear I/O option	yes	no	yes
PCI Bus Signaling	3.3V & 5V	3.3V & 5V	3.3V & 5V
PCI Bus Width	32/64 bit	32/64 bit	32/64 bit
PCI Bus Speed	33/66 MHz	33/66 MHz	33/66 MHz
PCI Compatibility	PCI	PCI	PCI, PCI-X
Local 3.3V regulator	no	no	no
CCPMC form factor compatible	no	no	yes

1.1.2 Argus Unique Features

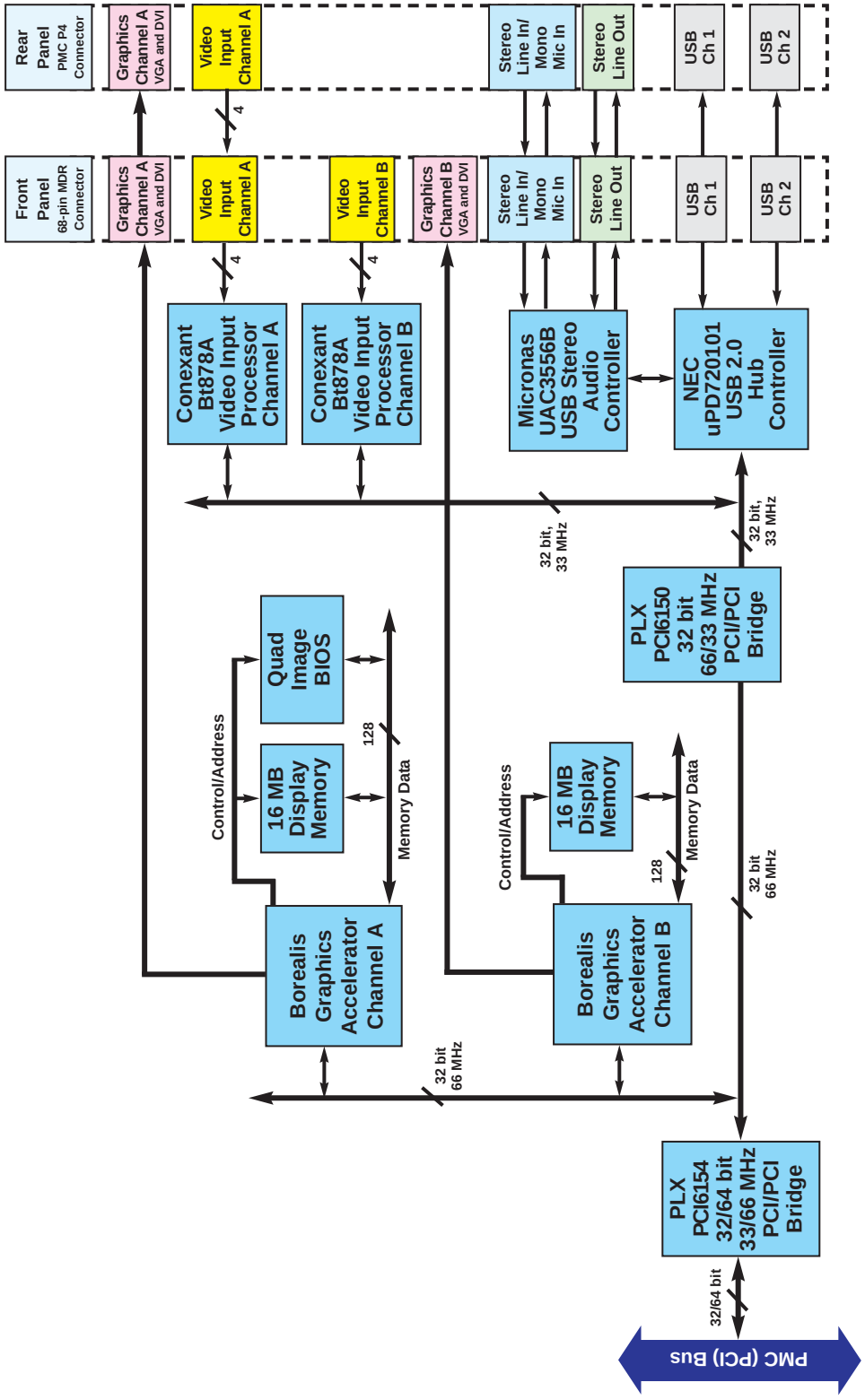
- Dual, completely independent graphics engines
- 68-pin connector provides RGBHV, DVI, S-Video in, audio stereo line-in or mono MIC in, stereo out, and High Speed USB 2.0 I/O. Rastergraf can supply cable assemblies.
- PLX Technology 6150 Tertiary 66/33 MHz bridge isolates traffic for video input and USB
- Twin Conexant Bt878A NTSC/PAL video digitizers
- NEC uPD720101 multi-channel USB 2.0 (480 Mb/s) hub controller
- Micronas UAC3556B USB Stereo Audio I/O controller (Rev 1 and on)
- 2 Kb serial EEPROM and LM75 thermal sensor

1.1.3 Gemini Unique Features

- Dual, completely independent graphics engines
- Base level Gemini features two standard VGA connectors
- Analog or Analog/DVI configurations

1.1.4 Sirena Unique Features

- Functionally identical to single channel version of Argus except tertiary bridge is eliminated
- 16 MB or 32 MB graphics memory
- Front panel connectors include standard USB, 3.5 mm stereo audio jacks, VGA, and DVI-I connectors. Using breakout cable, spare pins on DVI-I are used for video in and second USB port.
- Lower cost single-sided assembly except for 32 MB version
- CCPMC primary thermal interface compatible
- Conexant Bt878A NTSC/PAL video digitizer (uses DVI-I connector)
- Dual channel Philips ISP1561 USB 2.0 (480 Mb/s) hub controller
- Micronas UAC3556B USB Stereo Audio I/O controller
- 2 Kb serial EEPROM and LM75 thermal sensor



Fiqure 1-1 Arqus Block Diagram

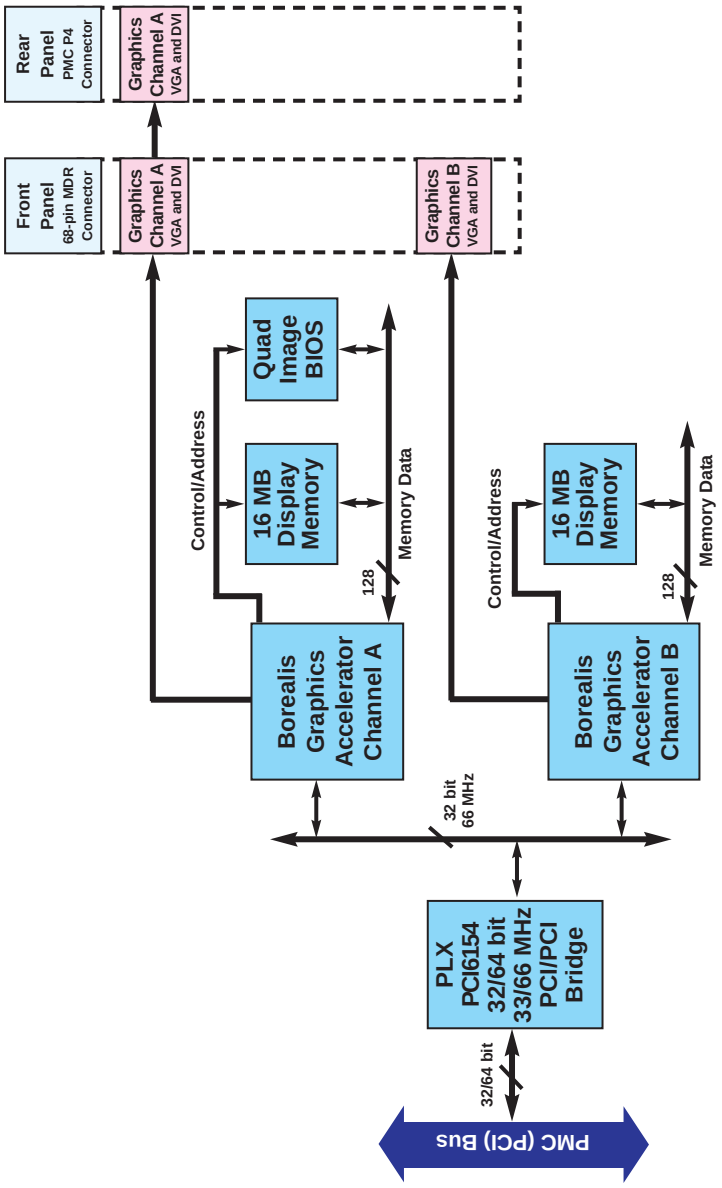


Figure 1-2 Gemini Block Diagram

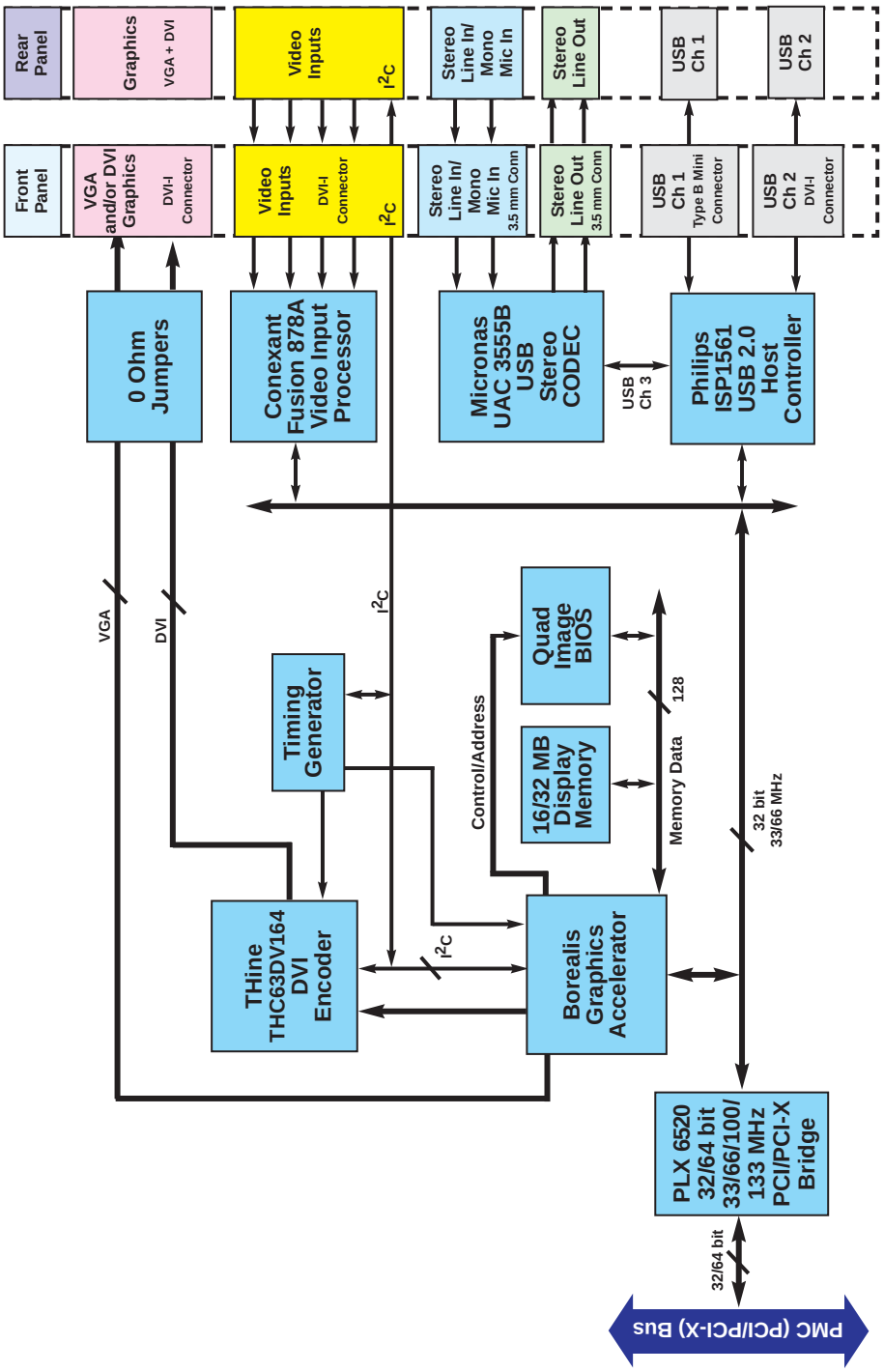


Figure 1-3 Sirena Block Diagram

1.1.5 Borealis Graphics Controller

Key Borealis Device Features

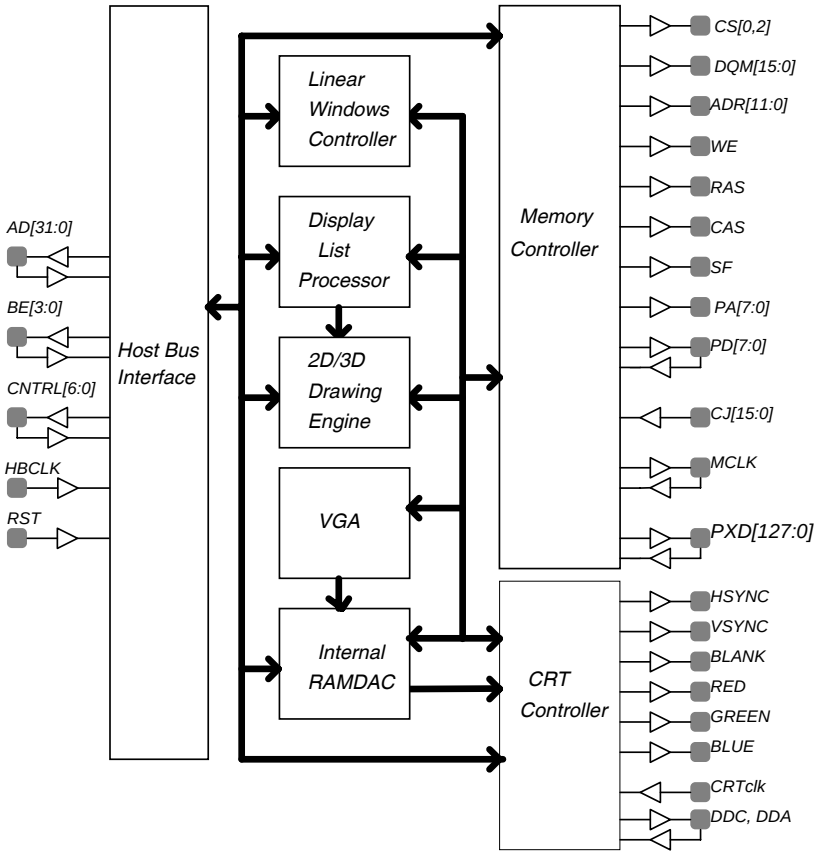
- 33/66 MHz PCI 2.1 Interface
- 128-bit internal and local memory data paths
- PCI Bus Master Event Notification
- 100 MHz SGRAM Memory Controller with Block Writes
- Texture Mapping Capabilities
- Perspective Correction
- Point Sampling, Bilinear and Trilinear filtering
- Full Level-of-Detail Per-Pixel MIP Mapping
- Separate Texture Mipmapping Minification and Magnification filtering
- Full OpenGL Texture Decal, Blend and Modulation Modes
- RGB Modulation Lighting Effects
- Support Palletized Textures: 1, 2, 4 and 8 bit
- Support Non-Palette Textures: 8, 16, and 32 bit
- Floating-point Triangle Setup with Vertex Level Commands
- Flat and Gouraud Shaded line drawing, with patterning
- Table and Vertex Fog and Specular Highlighting
- Full Alpha blending and Alpha Compare Testing
- 3D Color Keying with Color Range Support
- Backface Culling
- Bilinearly Filtered Scaling
- Power of 2 Display Zooming
- 8, 16, 32 bits per pixels Destination Format
- 16 and 24 bit per pixel Z Buffer Support
- Hardware 3D Volume Clipping
- 16-bit Logical Addressing in both X and Y
- Two configurable frame buffer windows
- Transparent BLT and Two operand BitBLT
- Display List Processor
- YUV-RGB Conversion
- VGA
- 250 MHz RAMDAC
- 0.35 micron 3.3 volt CMOS process
- 388 PBGA (Plastic Ball Grid Array)

The Borealis design is based on technology licensed from S3/Number Nine. The chip itself is manufactured by LSI Logic using LSI's .35u G-10P ASIC process.

The Borealis graphics controller is implemented using a highly pipelined graphic processor architecture. This architecture allows for high performance 2D and 3D rendering. After a sequence of commands and parameters are written, the Borealis executes the selected command without any further host processor intervention. A Display List Processor enables the Borealis to repetitively execute strings of commands.

The Borealis supports a local frame buffer with 16 MB SGRAM (Argus and Gemini) or 32 MB (Sirena) using a 128-bit wide data bus. The frame buffer may be accessed as linear buffers through the frame buffer interface or through the drawing engine. The local buffer may be used as a display buffer, as well as off-screen memory to be used for the storage and manipulation of bitmaps, texture maps, Z buffering or fonts.

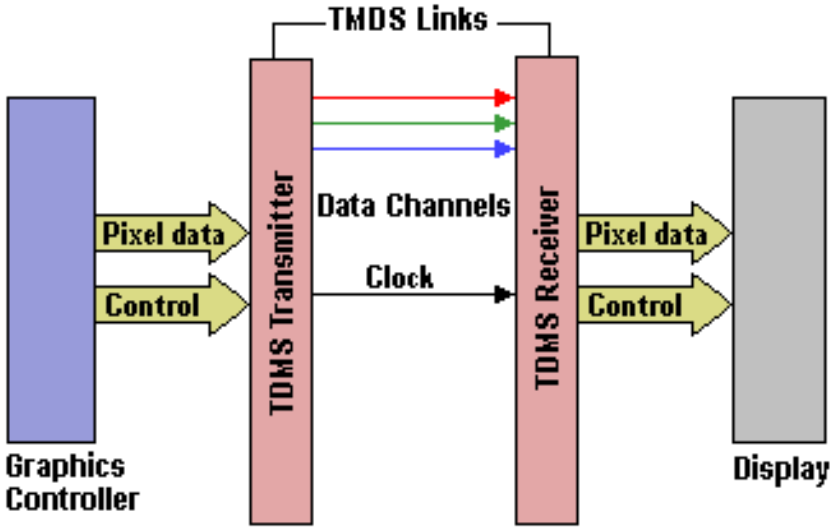
Figure 1-4 Borealis Block Diagram



1.1.6 DVI Digital Output

A DVI compliant transmitter provides high quality 24-bit true color digital output over twisted pair cables up to 5 meters in length. This length may be increased by using shielded twin-ax or fiber-optic cables. Displays ranging up to 1600 x 1280 are supported. Three TMDS data channels send data at 1.65 Gbps per channel. Connections are made through the front panel 68-pin multipurpose connector. DVI is standard on Argus and Sirena and optional on Gemini.

Figure 1-5 DVI Digital Video Block Diagram



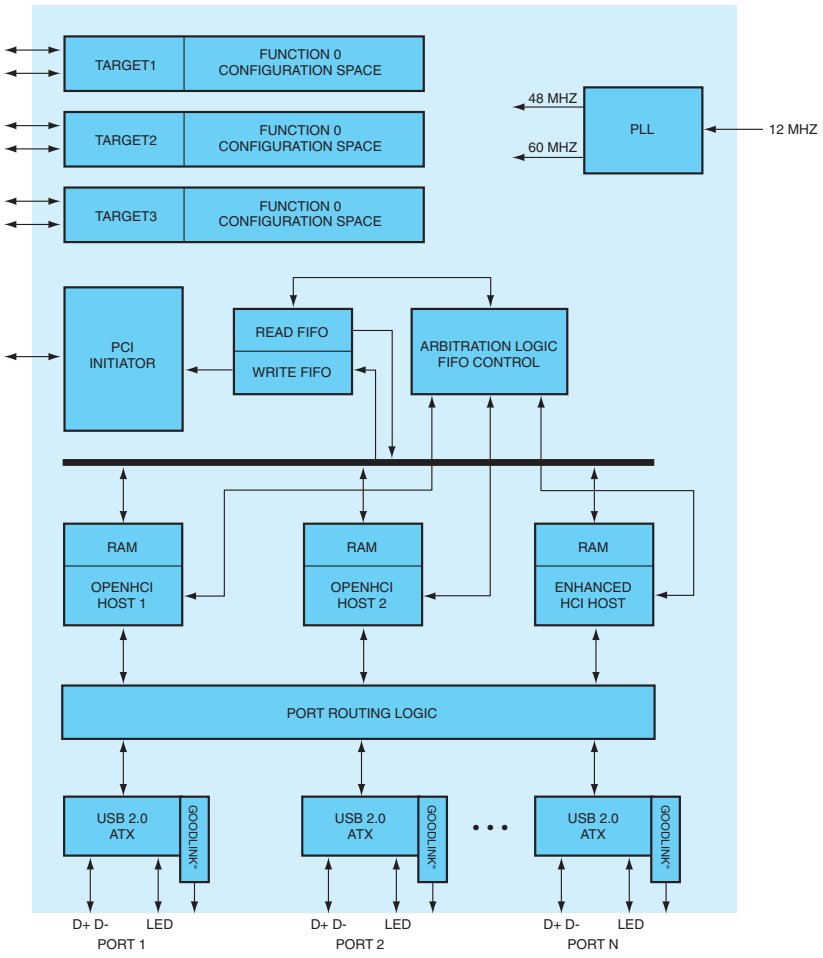
1.1.7 USB Hub Controller (Argus and Sirena)

The Argus and Sirena have a high-speed USB 2.0 hub controller which can be used to connect to devices such as mouse, trackball, keyboard, scanner, and video.

Note: the Argus Rev 2 uses the NEC uPD720101 USB controller, while the Sirena and Argus Rev. 0 and 1 use the Philips ISP1561.

Either chip is compliant with USB Spec. Rev. 2.0 and the Open Host Controller Interface (OHCI) and Enhanced Host Controller Interface (EHCI) specifications. They are supported by OS vendor OpenHCI and EHCI drivers for Microsoft Windows 2K/XP, Linux, and Solaris. ***Linux and Windows 2K USB audio drivers are supported only on Argus***.

Figure 1-6 USB 2.0 Controller Block Diagram



The integrated OHCI and EHCI protocols and USB 2.0 compliant transceivers enable the 1561 or 720101 controller to work with all USB 1.1 and USB 2.0 devices. The chip supports all three USB modes: high-speed (480 Mbps), full-speed (12 Mbps) and low-speed (1.5 Mbps). Partial dynamic port-routing capability for downstream facing port is implemented for efficient usage of USB bandwidth.

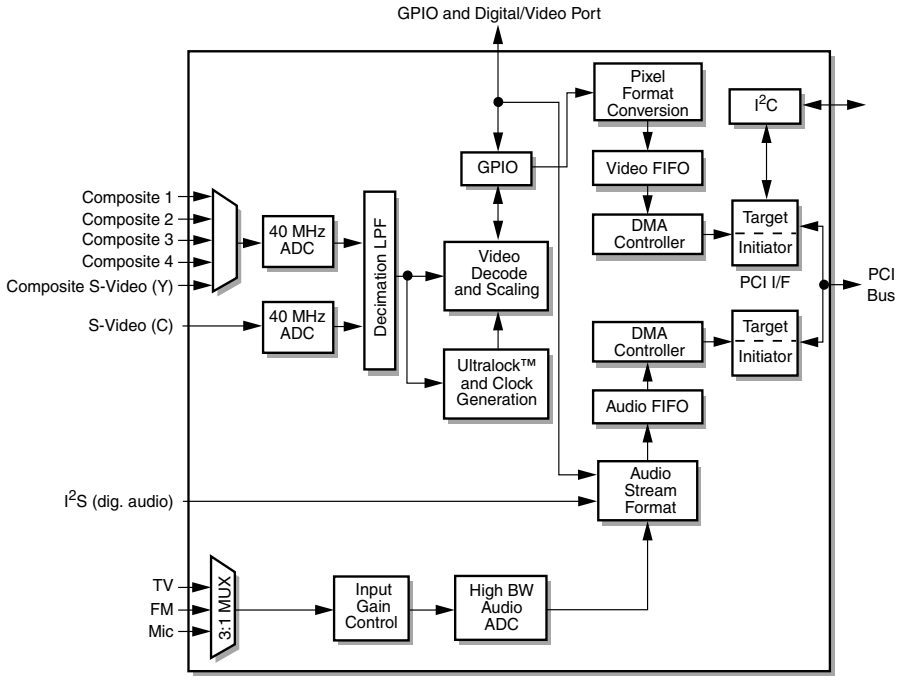
As used on the Argus or Sirena, one port is allocated to the USB audio controller and one or two additional ports are provided on the front or rear panel I/O. Each port has switched, 1 Amp current limited +5 peripheral power supplied by Micrel MIC25262 USB power switches controlled by the USB controller. An overcurrent condition is reported back to the chip. The port power will return to normal when the overload is removed.

1.1.8 Video Input Digitizers (Argus and Sirena)

The Argus and Sirena provide video input capability using two (Argus) or one (Sirena) Conexant Bt878A devices. The features include:

- 4-input multiplexer with S-Video support
- NTSC/PAL/SECAM composite, S-Video, and CCIR 656 capture
- Integrates advanced chroma and luma comb filters/scalers
- Y/C, 6-tap luma/2-tap chroma polyphase filter
- X-Y scaling, clipping, and color space control of source field by field
- Supports capture resolutions up to 768 x 576 (full PAL)
- multiple YCrCb and RGB pixel output formats
- Selectable pixel density: 8, 16, 24, and 32 bits per pixel
- vertical blanking interval (VBI) capture for closed captioning, teletext, and intercast data decoding
- Vital product data in EEPROM
- PCI DMA controller with byte alignment and "Scatter/Gather"
- Audio section not used – Argus/Sirena use Micronas USB audio – see next section
- As used on Sirena, requires DVI-I connector for access

Figure 1-7 Bt878A Digitizer Block Diagram



The Bt878A can place data directly into CPU (host) memory for capture applications or into the local frame buffer for video overlay applications. The Bt878A contains a small pixel data FIFO to decouple the high-speed PCI bus from the continuous video data stream.

The video data input may be scaled, color translated, and burst transferred to a target location on a field basis. This allows for simultaneous preview of one field and capture of the other field. Alternatively, the Bt878A is able to capture or preview both fields simultaneously. The fields may be interlaced into memory or sent to separate field buffers.

The video input for Argus uses an S-Video connector, which can be configured either as a Composite NTSC/PAL/SECAM Input or S-Video (separate chrominance and luminance).

An adapter cable is included to enable to the VIN input used on the S-Video connector to be used as a composite input.

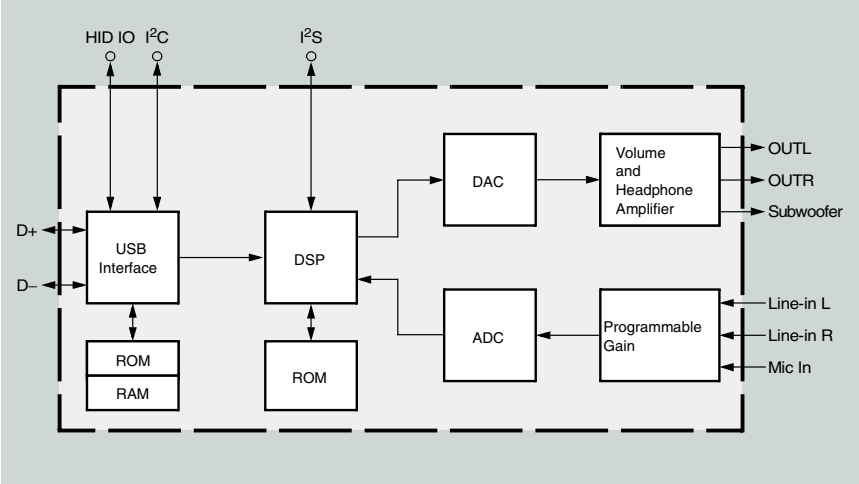
Upon special order, more video inputs can be had at the expense of the audio in and S-Video functions and a non-standard cable.

Each input is conditioned with a low pass filter and presents a 75-ohm impedance to the driving source. The Input multiplexer is ***not*** break-before-make, so inputs will be *momentarily* connected together when switching from one input to another.

1.1.9 Stereo Audio I/O Controller (Argus and Sirena)

While the Bt878 includes an audio input section, it is not supported by any commercially available software. Therefore, the Argus and Sirena (Rev 1 and on) utilize the Micronas UAC3556B USB stereo audio I/O controller.

Figure 1-8 Micronas UAC3556B USB Stereo Controller Block Diagram



- USB specification 2.0 compliant
- Standard Windows, Solaris, and Linux driver compatible
- stereo audio A/D and D/A converter supports 8/16-bit mono/stereo recording and up to 24-bit playback with THD better than −90 dB
- independent adaptive sample rates of 6.4 to 48 kHz for USB recording and playback (enhanced full duplex)
- audio controls: bass, treble, loudness, volume, balance, and mute and 5-band parametric equalizer, and dynamic bass management
- integrated low-power stereo headphone amplifier

1.1.10 Board Connections

While it is nice to have standard connectors on the front panel, the limited space on the PMC panel makes it difficult or impossible, especially with high functional content boards like Argus. The following table summarizes the boards and connector options:

Table 1-2 Boards and Connector Summary

Board Model	Features	Breakout Cable
ArgusPMC	Dual VGA, Dual DVI, Dual USB, S-Video Inputs Stereo Audio I/O	68-pin MDR to 2x DVI, 2x VGA, 2x USB, 2x l 3.5 mm stereo jacks, 2x video-in using S-Video with S-Video to BNC adapter
GeminiPMC	Dual VGA	VGA extension cable with narrow moldings (see note below)
GeminiPMC/DVI	Dual VGA Dual DVI	68-pin MDR to dual DVI-I (VGA and DVI)
SirenaPMC	VGA, USB, stereo audio I/O	Standard VGA connector Dual 3.5mm stereo jacks Mini (type B) USB jack
SirenaPMC/DVI	VGA, USB, video in, stereo audio I/O Video in and second USB are brought out on DVI-I spare pins	DVI-I to DVI, VGA, USB, and video-in using 2x BNC and S-Video with S-Video to BNC adapter (uses spare pins on DVI for audio, USB, and video in)

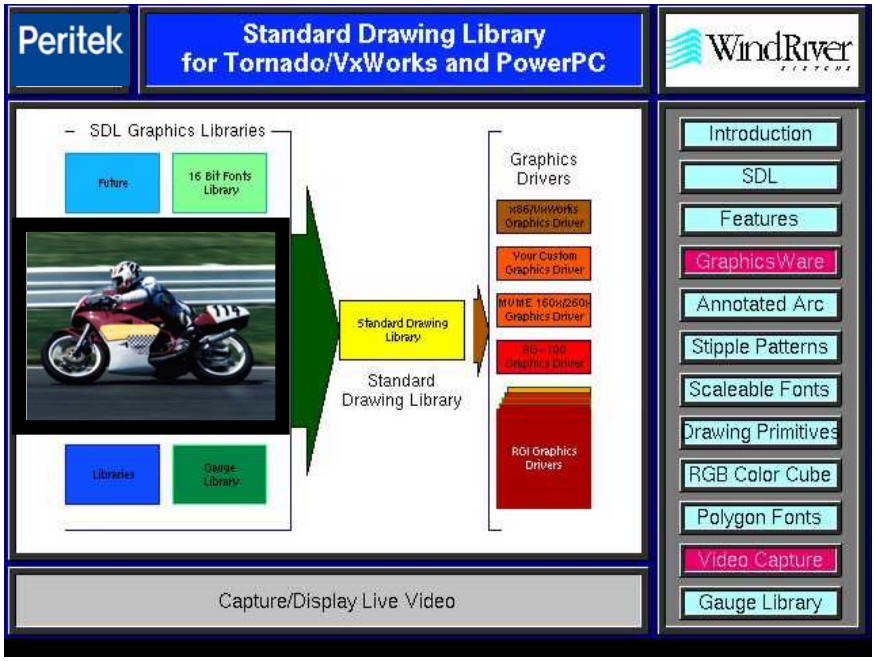
Note: GeminiPMC has two standard VGA connectors. Due to the tight spacing imposed by the PMC front panel, a few monitor-side VGA cable connectors are too wide to allow two cables to be plugged in simultaneously. Rastergraf can supply an extension cable that fits.

1.1.11 Software Support

Rastergraf software support is available for Solaris 2.6-10, Linux, LynxOS, VxWorks, and Windows 2000/XP. Please consult Rastergraf for specifics, as all packages are not available on all systems. In general, we have:

- SDL Graphics Subroutine Library
- Windows 2000/XP Audio I/O, Video Input, Graphics, and USB
- Sun/Solaris Accelerated 2D and OpenGL X Window System Server
- Sun/Solaris Audio I/O, Video Input, and USB
- X Windows X11R6 (Xfree86 Version 4.3) for Linux and LynxOS
- Linux Audio I/O, Video Input, and USB
- LynxOS Video Input
- Quad-Image-BIOS supports FCode, VGA, DVI, and Sync-On-Green

1.1.12 Additional Details About SDL



SDL is a graphics library designed to be a device-independent programming interface. SDL is ideally suited to demanding board level and embedded systems applications. Drivers are available for selected host CPU boards and operating systems. SDL is supplied in object library format, which means that its target code size can be controlled by limiting the number of functions used in a given application. SDL has been

designed to run on any CPU and operating system that uses linear addressing and is supported by the GNU C compiler and linker. SDL is available in source for an additional cost – please contact Rastergraf sales.

SDL is easy to use. It includes a complete set of graphics primitives that interface to the SM731 graphics controller's accelerated functions. SDL also supports Stratus' video capture capabilities. All graphics primitives are drawn as single pixel lines. Rectangles, polygons, circles, ellipses, and chords can be filled with a solid color or stipple patterns.

Complete information about *SDL* is contained in the ***Standard Drawing Library* C Reference Manual** that is available for download from our web site at http://www.rastergraf.com

SDL Feature Summary

- Solid (thin and wide) and dashed lines, polylines, and rectangles
- Pixblits to/from the display and host memory
- Filled and hollow polygons, ellipses, circles, sectors, and chords
- Solid and Pattern Fills – Pixel Processing
- Proportional and Fixed Width Fonts
- Clipping Rectangle and Logical Origin
- Video Capture Extensions

Feature	Supported
VGA 640x480 to 1600x1200	Yes
8/16/24 bpp	Yes
DVI Output	Yes
Sync On Green	Yes
Video Capture - NTSC/PAL	Yes
Video Capture - (RGB) via AD9882	Yes
Video Capture - (mono) via AD9882	Yes
TV Out - NTSC/PAL	Yes
STANAG-A Timing	Yes

Table 1-3 SDL Functional Summary

1.2 Product Line Summary

The Argus, Gemini, and Sirena boards are part of the Rastergraf line of graphics modules for PCI, VMEbus, and CompactPCI computers. For more information about our products, please contact Rastergraf Worldwide Sales at (541) 923-5530 or consult our web page at http://www.rastergraf.com

GeminiPMC and ArgusPMC

Common Features

Two Borealis 2D/3D 128-bit graphics accelerators, UVGA resolution, OpenGL pipeline, and 16 MB SGRAM/channel. A 33/66 MHz, 32/64-bit asynchronous PCI bridge maximizes throughput and enables the local PCI bus to always operate at 66 MHz.

GeminiPMC **A**nalog and/or DVI outputs. Base version has 2 standard VGA connectors. VGA + DVI version uses 68-pin multipurpose connector and requires breakout cable.

ArgusPMC Adds two Conexant Bt878A NTSC/PAL/SECAM video digitizers, an NEC uPD720101 USB 2.0 controller, and a Micronas UAC3556B USB stereo audio controller. A secondary 66/33 MHz bridge isolates traffic for the digitizers and USB. All versions use 68-pin multipurpose connector and require a breakout cable

SirenaPMC

SirenaPMC Borealis 2D/3D 128-bit graphics accelerator, UVGA resolution, OpenGL pipeline, 16/32 MB SGRAM, and analog and DVI outputs. A 33/66 MHz, 32/64-bit asynchronous PCI/PCI-X bridge maximizes throughput.

Includes a Conexant Bt878A NTSC/PAL/SECAM video digitizer, a Philips ISP1561 USB 2.0 controller, and a Micronas UAC3556B USB stereo audio controller.

CCPMC form factor. Front panel standard connectors: VGA or DVI-I, stereo Audio I/O plus one USB mini Type AB. A special breakout cable connected to the DVI-I connector provides video inputs and a second USB port. PMC Pn4 rear panel I/O option is available.

Eclipse3

Eclipse3 Borealis 2D/3D high performance 128-bit graphics processor supports 16 or 32 MB SGRAM, analog RGB ***and/or*** DVI output. Available in **PMC**, **CompactPCI** (3U and 6U panel options), and **PCI** form factors. A 33/66 MHz, 32-bit host interface maximizes PCI bus speed.

TopazPMC and GarnetPMC

TopazPMC TopazPMC/1 and TopazPMC/2 replace the earlier Tropos and Stratus versions. Options include front panel LVDS and STANAG 3350 A-C. Replaces front panel MDSM with MDR-20 for easier connectivity.

GarnetPMC Rugged, conduction-cooled version of Topaz.

Adapters and Carriers

PMA-P Single PMC to short PCI passive (bridgeless) adapter board;

PMB-P Single PMC to short PCI active (bridged) adapter board;

PMA-C Single PMC to 3U CPCI passive (bridgeless) adapter board;

PMB-C Dual PMC to 6U CPCI active (PLX PCI6154) adapter board;

1.3 Additional References

Rastergraf documentation includes (hardware) User's Manuals and Standard Drawing Library (SDL) Manual. You can obtain some technical literature from the Rastergraf web page (http://www.rastergraf.com). Note that web links do change, so if the links given below are broken, just go the manufacturer's main web page and start your way in.

Conexant Bt878A Video Decoder:

http://www.conexant.com/products/entry.jsp?id=272

PLX PCI6150 and PCI5154PCI/PCI Bridges:

http://www.plxtech.com/products/fastlane_bridges/default.asp

NEC uPD720101 USB 2.0 Host Controller:

http://www.necel.com/usb/en/product/upd720101.html

Philips ISP1561 USB 2.0 Host Controller:

http://www.semiconductors.philips.com/buses/usb/products/host/isp156x/index.html

THine THC63DV164 DVI encoder:

http://www.thine.co.jp/products_e/DVI/164_161/164_161.html

Micronas UAC3556B USB Stereo Audio Controller:

http://www.micronas.com/products/documentation/consumer/uac355xb/index.php

1386-2001 and 1386.1-2001:
IEEE Standard for a Common Mezzanine Card Family: CMC and IEEE Standard Physical and Environmental Layers for PCI Mezzanine Cards

http://shop.ieee.org/store/product.asp?prodno=SS94922

The ***PCI Local Bus 2.2 Specification*:**

http://www.pcisig.com/home

Graphics Textbooks

Fundamentals of Interactive Computer Graphics
Addison Wesley, 1993. Foley and Van Dam

Principles of Interactive Computer Graphics
McGraw-Hill, 1979 Newman and Sproull

Chapter 2
Specifications

2.1 General

Graphics Processor(s): Dual (Argus/Gemini) or single (Sirena) Borealis 2D/3D High Performance 128-Bit Graphics Processors have 2D/3D functions and programmable video timing. The Borealis supports SGRAM color and write-per-bit register functions and includes a VGA core. The maximum supported frequencies are 250 MHz for the pixel clock and 100 MHz for the memory clock.

Display Memory: Display memory is 16 MB (32 MB for Sirena) of 128-bits/word, byte addressable, no-wait state SGRAM provides eight pages of 1600 x 1200 using 8-bit pixels, four pages using 16-bit pixels, or two pages using 32 bpp. 24 bpp packed pixel mode is not supported.

EEPROM Memory: 128 KB Flash EEPROM contains the Rastergraf Quad Image BIOS (QIB) that supports SPARC FCode, VGA BIOS, DVI, and Sync-On-Green (SOG). A user jumper enables the QIB to select SOG.

Graphics Display: The Borealis chip features an internal 250 MHz RAMDAC. It has a 256 entry Look Up Table (LUT), which is most commonly used for conversion of 8-bit pixels into full 24-bit RGB pixels. The RAMDAC has a programmable four-color bit-mapped 64 x 64 cursor. It supports VGA and common non-interlaced displays ranging from 640 x 480 up to better than 1600 x 1200. Signature registers enable display analysis for end-to-end testing.

The pixel size can be 8, 15, 16, or 32-bits. For 15 and 16 bpp, the pixel is divided into Red, Green, and Blue: 5:5:5 or 5:6:5. For 32 bpp, pixel is divided into Red, Green, and Blue (bits 24-31 are unused): 8:8:8:8.

Scroll, Pan, and Zoom: Scroll - single line (smooth scroll).
Pan - anywhere on 16 byte boundaries
Zoom: horizontal: 2, 4, 8, 16, vertical: 2, 3 ,...,15, 16

I^2C Channels: I^2C is a simple low-speed 2 wire serial bus that is used to control a variety of on-board devices. Most devices are associated with a particular master device and are on independent I^2C buses. Devices include: THC63DV164 DVI transmitters, LM75 thermal sensor, AT24C02 2 Kb serial EEPROMs, and DDC2B display monitor controls.

Digital Output:
(Optional on Gemini

Digital output up to 1600 x 1200 uses a THine THC63DV164 encoder. The Borealis Video Out Bus supplies TTL level RGBHV to the encoder which samples and multiplexes the data and drives four differential pairs.

Because of the high frequency nature of the TMDS signals, it is vital that matched length, shielded pair cable be used for DVI connections.

Composite Video Signal:

A jumper can be installed to select Sync-On-Green operation on boot-up. The signal has the following approximate values:

1 Volt peak to peak consisting of:
660 mV Reference White +
54 mV Reference Black +
286 mV Sync Level

Fuse Element:

The +5V supplied to the front panel connectors is protected by a Positive Temperature Coefficient (PTC) resistor. It resets automatically when an overload is removed.

Thermal Sensor:

An LM75 thermal sensor is mounted in the center of the board on Side 1. Software available from Rastergraf can read and report the on-board temperature.

Bus Loading:

One PCI 2.1 compatible load

Module Size:

IEEE 1386, 149 mm x 74 mm, 32/64-bit; Pn1-Pn3, Pn4 option

Power Requirements:

All versions of Argus, Gemini, and Sirena ***REQUIRE***

+3.3V, +/- 5% @Current - please see next page
+5V, +/- 5% @Current - please see next page.

There is no provision for an on-board (local) 3.3V regulator. This means that Argus, Gemini, and Sirena will not run in CWCEC 179, 181, 182, or 183 CPUs.

IMPORTANT: GOOD AIRFLOW IS REQUIRED.

You should be able to measure at least 400 Linear Feet per Minute (LFM) on the PMC board if you want to operate at the upper temperature limits. You can usually get this much air by using a 100 CFM-rated fan.

Power Measurements: The following power consumption figures have been measured with an effort to simulate worst case, with high-resolution displays and as much other simultaneous activity as possible.

Testing Conditions: Windows 2000, display format is 1600 x 1200 x 32 bpp, single or dual head.

Cautionary Note: ***"Your mileage may vary".***

It would be prudent to add +10% for a maximum power estimate.

ArgusPMC: DVI out, USB optical mouse, USB 2.0 card reader attached, both channels capturing and playing an audio CD

Total power: 12.14W 5V, 0.87A
3.3V, 2.36A

GeminiPMC VGA out

Total power: 7.75W 5V, 0.13A
3.3V, 2.15A

SirenaPMC: DVI out, USB 2.0 card reader attached, playing an audio CD

Total power: 6.01W 5V, 0.37A
3.3V, 1.26A

SirenaPMC/DVI: DVI out, capturing video, USB 2.0 card reader attached, playing an audio CD

Total power: 7.11W 5V, 0.55A
3.3V, 1.32A

PMC Compatibility: Complies with IEEE 1386-2001 except:

PMC Side 2 Clearance The Argus and Gemini violate the PMC Side 2 specification. This is not a big deal. Only ***non-conductive*** component elements are involved.

Background: the interboard separation plane dimension defines the dividing line between two host boards in an IEEE 1101 type chassis. This dimension is 16.26 mm above the plane of the host board. You must not exceed this value.

The standard PMC Side 2 height limit = [3.5 mm - PCB thickness]. The Argus/Gemini PCB thickness is 1.6 mm, so the standard height limit would be 1.9 mm. However,

16.26 mm	host side 1 surface to interboard separation
- 10 mm	PMC standoff
- 1.6 mm	Argus/Gemini PCB thickness
= 4.66 mm	net maximum distance to separation plane.

We have chosen to use 4.0 mm as specification "override" for ***non-conductive*** components. As applied to the Argus, the PLX PCI6150 PCI-PCI bridge uses a QFP package which has a ***non-conductive*** standoff of **up to 4.0 mm**. Some other components, also in ***non-conductive*** packages, have a standoff of **not more than 3.1 mm.**

Almost ten years and several generations of PMC boards have not revealed any customer problems with this expanded limit.

Power

Due to the high component density and functionality of the Argus maximum power consumption significantly exceeds the PMC 7.5W specification. It is possible that under worst-case conditions, Gemini and Sirena may also exceed this limit. Many boards do this, but it is still necessary to be careful about it. We have seen problems when:

a) the carrier board current limits the power supplied to the PMC slot. Most carriers allow at least 7.5W *per supply* (3.3 and 5), but, quite rarely, some are more picky and do enforce a limit of 7.5W total.

   If this is the case, you need to contact your carrier vendor to see if you can override the limit. See below for specific board power requirements. Note that the Argus can still exceed the 7.5W limit just at 3.3V (see above).

b) the board is mounted on a PCI carrier and there is no fan. This is a common failing in PCI-based enclosures. Overheating and temporary failure can result. Rastergraf can supply a PMA-P or PMB-P PMC-PCI carrier that does include fans. It has been demonstrated to cure most overheating problems related to running in under-cooled PC-compatible enclosures.

Of the two problems mentioned above, we have seen most often item (b), where there is no air circulation and a PCI system is being used. VME and CompactPCI systems almost never have a problem.

Remember that the Argus is not generally recommended for extended temperature operation. Contact Rastergraf if you need this.

Environment: Humidity: 5% to 90%, non-condensing

Temperature: -55 to +85 degrees C, storage

Argus Temperature: 0° to 55° C, operating

Gemini Temperature: 0° to 70° C, operating

Sirena Temperature: 0° to 70° C, operating

IMPORTANT: GOOD AIRFLOW IS REQUIRED.

You should be able to measure at least 400 Linear Feet per Minute (LFM) on the PMC board if you want to operate at the upper temperature limits. You can usually get this much air by using a 100 CFM-rated fan.

Ruggedization Option: Rastergraf offers a semi-ruggedized version of the Argus, Gemini, and Sirena boards that includes a MIL-compliant silicone or acrylic conformal coating and extended temperature testing. Argus will not generally pass in the higher ranges unless you have very good airflow.

Rastergraf board designs use standard distribution commercial temperature range parts***. No formal component tracking is maintained.*** .

Boards are protected with either Acrylic (Miller-Stephenson MS-475) or Silicone (Miller-Stephenson MS-460) or equivalent and are MIL-I-46058C, Type SR and MIL-T-152B compliant. The board is tested under extended temperature conditions as shown on the next page.

Ruggedization Levels: The following table shows the standard ruggedization levels. At the time of writing, complete shock and vibration testing has not been performed, but some boards have been tested enough to expect full acceptance is possible. Please contact Rastergraf Sales if you need this information.

Table 2-1 Rastergraf Ruggedization Levels Chart

Spec	Air-Cooled Level 0	Air-Cooled Level 50	Air-Cooled Level 100	Air-Cooled Level 200	Conduction-cooled Level 100	Conduction-cooled Level 200
Applicable Graphics Board(s)	Argus Gemini Sirena Eclipse3 Topaz Garnet	Gemini Sirena Eclipse3 Topaz Garnet	Gemini Sirena Eclipse3 Topaz Garnet	Eclipse3 Topaz Garnet	Garnet	Garnet
Operating Temperature (4, 6)	0°C to 50°C	-20°C to 65°C	-40°C to 71°C	-40°C to 85°C	-40°C to 71°C	-40°C to 85°C
Storage	-40°C to 85°C	-40°C to 85°C	-55°C to 125°C	-55°C to 125°C	-55°C to 125°C	-55°C to 125°C
Humidity Operating	0 to 95% non-condensing	0 to 100% non-condensing	0 to 100% non-condensing	0 to 100% non-condensing	0 to 100% non-condensing	0 to 100% non-condensing
Humidity Storage	0 to 95% condensing	0 to 100% condensing	0 to 100% condensing	0 to 100% condensing	0 to 100% condensing	0 to 100% condensing
Vibration Sine (1)	2 g peak 15-2 kHz	2 g peak 15-2 kHz	10 g peak 15-2 kHz	10 g peak 15-2 kHz	10 g peak 15-2 kHz	10 g peak 15-2 kHz
Vibration Random (2)	0.01 g2/Hz 15-2 kHz	0.02 g2/Hz 15-2 kHz	0.04 g2/Hz 15-2 kHz	0.04 g2/Hz 15-2 kHz	0.1 g2/Hz 15-2 kHz	0.1 g2/Hz 15 Hz-2 kHz
Shock (3)	20 g peak	20 g peak	30 g peak	30 g peak	40 g peak	40 g peak
Conformal Coat (5)	optional	optional	optional	optional	yes	yes
Order Option (7)	/CA or /CS	/A5A or /A5S	/A1A or /A1S	/A2A or /A2S	/C1A or /C1S	/C2A or /C2S

Notes:

1. Sine vibration based on a sine sweep duration of 10 minutes per axis in each of three mutually perpendicular axes. May be displacement limited from 15 to 44 Hz, depending on specific test equipment. Shock and Vibration values not completely verified.
2. Random vibration 60 minutes per axis, in each of three mutually perpendicular axes.
3. Three hits in each axis, both directions, 1/2 sine and saw tooth. Total 36 hits.
4. Standard air-flow is 8 cfm at sea level. Some higher-powered products may require additional airflow. Consult the factory for details.
5. Conformal coating type to be specified by customer. Consult the factory for details.
6. Temperature is measured at the card interior (not at edge).
7. Last letter in ordering option: A for Acrylic Conformal Coating, S for Silicone Conformal Coating

2.2 Specifications Unique to Argus

Enhanced Functionality: The Argus is the full-featured version of the Argus/Gemini boards. See the block diagrams at the end of Chapter 1.

It adds an NEC uPD720101 USB 2.0 controller, a Micronas UAC3556B stereo audio controller, two Conexant Bt878A video digitizers, configuration Serial EEPROMs, and an LM75 thermal sensor. It also has a secondary PCI bridge, a PLX PCI6150, which isolates the slower (33 MHz PCI) digitizer and USB devices from the primary 66 MHz local bus.

Sections 1.1.1-1.1.10 cover the features of the devices mentioned above.

2.3 Specifications Unique to Sirena

Enhanced Functionality: The Sirena is essentially a single channel Argus, but has some special features all its own: it has a 32 MB memory option, it is laid out on one side of a PCB (except for the 32 MB memory option, and it provides standard VGA or DVI-I, USB, and 3.5 mm audio connectors instead of requiring a breakout cable for everything. A breakout cable is only required to access the video in and second USB. See the block diagrams at the end of Chapter 1.

Over and above the common feature set described in Section 2.1, it uses the Philips ISP1561 USB 2.0 controller, a Micronas UAC3556B stereo audio controller, a Conexant Bt878A video digitizer, configuration Serial EEPROMs, and an LM75 thermal sensor.

It leaves out the tertiary bridge, so that the local bus runs at 33 MHz instead of 66 MHz. This does not have a significant impact on overall performance.

Chapter 1, Sections 1.1.1-1.1.10 covers the features of the devices mentioned above.

2.4 Display Timing

The Borealis chip display timing is programmable. The following tables provide the timing values provided by Rastergraf software. Please note that the timing parameters vary by application.

Table 2-1 Argus, Gemini, and Sirena BIOS Display Timing Specifications

Active Display	Analog/ DVI	Format	Bits per Pixel	Vertical Refresh	Horizontal Refresh	Pixel Clock
640 x 400	Analog or DVI	VGA	8	60 Hz	31.55 KHz	27 MHz

Table 2-2 Argus, Gemini, and Sirena VGA/Windows Display Timing Specifications

Active Display	Analog/ DVI	VESA Format	Bits per Pixel	Vertical Refresh	Horizontal Refresh	Pixel Clock
640 x 480	Both	n/a VGA VGA VGA	8, 16, 32	60 Hz 72 Hz 75 Hz 85 Hz	31.5 KHz 37.9 KHz 37.5 KHz 43.4 KHz	25.175 MHz 31.5 MHz 31.5 MHz 36 MHz
800 x 600	Both	SVGA	8, 16, 32	60 Hz 72 Hz 75 Hz 85 Hz	37.9 KHz 48.1 KHz 46.9 KHz 53.7 KHz	40 MHz 50 MHz 49.5 MHz 56.25 MHz
1024 x 768	Both	UVGA	8, 16, 32	60 Hz 70 Hz 75 Hz 85 Hz	48.4 KHz 56.5 KHz 60.0 KHz 68.7 KHz	65 MHz 75 MHz 78.75 MHz 94.5 MHz
1152 x 864	Both	Sun	8, 16, 32	75 Hz	67.5 KHz	108 MHz
1280 x 1024	Both Analog Analog	SXGA	8, 16, 32	60 Hz 75 Hz 85 Hz	64 KHz 80 KHz 91.1 KHz	108 MHz 135 MHz 157.5 MHz
1600 x 1200	Analog	UXGA	8, 16, 32	60 Hz 70 Hz 75 Hz 85 Hz	75 KHz 87.5 KHz 93.8 KHz 106.3 KHz	162 MHz 189 MHz 202.5 MHz 229.5 MHz
1920 x 1200	Analog	GTF (WUXGA)	8, 16, 32	60 Hz	75 KHz	194.4 MHz

Table 2-3 Argus, Gemini, and Sirena SDL Display Timing Specifications

Active Display	Analog/ DVI	Format	Bits per Pixel	Vertical Refresh	Horizontal Refresh	Pixel Clock
640 x 480	Analog	VGA	8, 16, 32	60 Hz	31.55 KHz	27 MHz
800 x 600	Analog	SVGA	8, 16, 32	60 Hz	39.35 KHz	42 MHz
1024 x 768	Analog	UVGA	8, 16, 32	70 Hz	58.86 KHz	80.52 MHz
1152 x 900	Analog	Sun	8, 16, 32	66 Hz	64.92 KHz	99.72 MHz
1280 x 1024	Analog	SXGA	8, 16, 32	74 Hz	82.86 KHz	141.5 MHz
1600 x 1200	Analog	UXGA	8, 16, 32	60 Hz	75 KHz	162.0 MHz
1920 x 1200	Analog	WUXGA	8, 16, 32	60 Hz	75 KHz	194.4 MHz

Table 2-4 Argus, Gemini, and Sirena FCode/Solaris Display Timing Specifications

Active Display	Analog/ DVI	Index	Bits per Pixel	Vertical Refresh	Horizontal Refresh	Pixel Clock
640 x 480	Both	8 9	8, 16, 32	60 Hz 75 Hz	31.5 KHz 37.5 KHz	25.2 MHz 31.5 MHz
800 x 600	Both	6 7	8, 16, 32	60 Hz 75 Hz	37.9 KHz 46.9 KHz	40 MHz 49.5 MHz
1024 x 768	Both	0 1	8, 16, 32	60 Hz 75 Hz	48.4 KHz 60.0 KHz	65.0 MHz 78.8 MHz
1152 x 864	Both	2 3	8, 16, 32	60 Hz 75 Hz	56.7 KHz 67.5 KHz	87.1 MHz 108 MHz
1152 x 900	Both	a b	8, 16, 32	60 Hz 75 Hz	59.0 KHz 73.8 KHz	90.7 MHz 114.5 MHz
1280 x 1024	Both Analog	4 5	8, 16, 32	60 Hz 75 Hz	64.0 KHz 80.0 KHz	108 MHz 135 MHz
1600 x 1200	Analog	c	8, 16, 32	60 Hz	75 KHz	162.0 MHz
1920 x 1200	Analog	d	8, 16, 32	60 Hz	75 KHz	194.4 MHz

2.4 PCI Information

Each PCI device has a unique Vendor ID and Device ID. The codes are hardwired by the manufacturer.

Table 2-5 PCI Vendor and Device IDs

Device	PCI Function	Channel	Used On	Vendor ID	Vendor	Device ID
PCI6520 Primary PCI Bridge	(single)	-	Sirena	0x10B5	PLX	0x6520
PCI6154 Primary PCI Bridge	(single)	-	Argus, Gemini	0x3388	PLX	0x0020
Borealis 2D/3D Graphics	(single)	A, B	All boards	0x105D	Rastergraf	0x5348
PCI6150 Secondary PCI Bridge	(single)	-	Argus	0x3388	PLX	0x0022
Bt878A Video In	Video	A, B	Argus, Sirena	0x109E	Conexant	0x036E
ISP1561 USB 2.0	OHCI 1&2	-	Sirena	0x1131	Philips	0x1561
	EHCI					0x1562
uPD720101 USB 2.0	OHCI 1&2	-	Argus	0x1033	NEC	0x0035
	EHCI					0x00E0

Subsystem IDs: All PCI devices except bridges have Subsystem Vendor and Device ID registers that the Rastergraf loads on power up using data from a Serial EEPROM or pullup resistors.

Table 2-6 PCI Subsystem Vendor and Device IDs

Device	PCI Function	Channel	Used On	Subsystem Vendor ID	Subsystem Vendor	Subsystem Device ID
Borealis 2D/3D Graphics	Graphics	A, B	All boards	0x10F0	Rastergraf	0x0003
Bt878A Video In	Video	A, B	Argus, Sirena	EEPROMs	EEPROMs	EEPROMs
ISP1561 USB 2.0	OHCI 1&2	-	Sirena	EEPROMs	EEPROMs	EEPROMs
	EHCI					EEPROMs
uPD720101 USB 2.0	OHCI 1&2	-	Sirena	EEPROMs	EEPROMs	EEPROMs
	EHCI					EEPROMs

IDSEL Usage: IDSEL lines are used for PCI device setup. The PMC bus is connected to the carrier PMC bus, the SAD bus is the PCI6154 (Argus/Gemini) or PCI6520 (Sirena) secondary bus, and the TAD bus is the PCI6150 secondary bus.

Table 2-7 PCI IDSEL Usages

Device	Channel	Bus	Argus IDSEL Line	Gemini IDSEL Line	Sirena IDSEL Line
PCI6520 Primary PCI Bridge	-	PMC			PMC IDSEL
PCI6154 Primary PCI Bridge	-	PMC	PMC IDSEL	PMC IDSEL	
Borealis 2D/3D Graphics	A	SAD	SAD16	SAD16	SAD20
Borealis 2D/3D Graphics	B	SAD	SAD17	SAD17	
PCI6150 Secondary PCI Bridge	-	SAD	SAD20		
Bt878A Video In	A	TAD	TAD16		SAD24
Bt878A Video In	B	TAD	TAD17		
ISP1561 USB 2.0	-	SAD			SAD28
uPD720101 USB 2.0	-	TAD	TAD20		

PCI Bus Interrupts: PCI bus INTA-C interrupts are mapped as follows:

Table 2-8 PCI Bus Interrupt Connections

Device	Channel	Argus PMC Interrupt	Gemini PMC Interrupt	Sirena PMC Interrupt
Borealis 2D/3D Graphics	A	INTA	INTA	INTA
Borealis 2D/3D Graphics	B	INTB	INTB	
Bt878A Video In	A	INTA		INTA
Bt878A Video In	B	INTB		
ISP1561 USB 2.0				INTA
uPD720101 USB 2.0	-	INTA, INTB, INTC		
LM75 Thermal Sensor	-	INTA (via jumper)	INTA (via jumper)	INTA (via jumper)

Local DMA Usage: PMC, PCI6154 (Argus/Gemini), PCI6520 (Sirena), and PCI6150 (Argus) request/grants are mapped as follows:

Table 2-9 Local DMA Usages

Device	Argus DMA Channel	Gemini DMA Channel	Sirena DMA Channel
PCI6520 Primary PCI Bridge			PMC Bus
PCI6154 Primary PCI Bridge	PMC Bus	PMC Bus	
Borealis 2D/3D Graphics	PCI6154-0	PCI6154-0	PCI6520-0
Borealis 2D/3D Graphics	PCI6154-1	PCI6154-1	
PCI6150 Secondary PCI Bridge	PCI6154-2		
Bt878A Video In	PCI6150-1		PCI6520-2
Bt878A Video In	PCI6150-2		
ISP1561 USB 2.0			PCI6520-1
uPD720101 USB 2.0	PCI6150-0		

2.5 Monitor Requirements

Rastergraf boards can be used with a variety of monitors. For best performance a monitor should have the following features:

- VGA compatible 5 Wire RGB with separate TTL horizontal and vertical sync or 3 Wire RGB with sync on green (see note below)
- Switchable Termination (for monitor loopthrough)
- Height, pincushion, width, phase, and position controls
- Autotracking horizontal and vertical synchronization
- High bandwidth: 135 MHz at 1280 x 1024
180 MHz at 1600 x 1200
- Horizontal refresh rate: 70 kHz at 1280 x 1024
90 kHz at 1600 x 1200
- See Section 2.4 for complete display timing information

Notes

The Argus, Gemini, and Sirena software defaults to standard Multiscan 5-wire RGBHV (VGA compatible) settings. If you require Sync On Green, be sure to select **SYNC ON GREEN** when setting the Video Parameters.

Argus, Gemini, and Sirena graphics boards **DO NOT** support interlaced operation.

Composite Video Signal: 1 Volt peak to peak consisting of:
660 mV Reference White +
54 mV Reference Black +
286 mV Sync Level

2.6 Configuration Information

Gemini The basic **Gemini** graphics board includes:

- Dual Borealis Graphics Processors
- 16 MB SGRAM per channel
- 8, 16, or 32 bit/pixel color
- hardware interrupts, pan, scroll, and zoom and cursors
- analog video outputs
- VGA and FCode BIOS with SOG and DVI feature selects
- Dual VGA front panel connectors

Options include:

- Dual DVI output. VGA connectors change to a single 68-pin multi-purpose connector. A breakout cable is required.

Argus The **Argus** graphics board includes the ***Gemini with DVI*** features, plus:

- Dual Conexant Bt878A Video input digitizers
- USB 2.0 Host Controller
- Micronas UAC3556B USB Audio Stereo Controller

Sirena The **Sirena** graphics board is essentially a single channel Argus board laid out on one side of the PCB. It adds standard connectors and a 32 MB option (which does use Side 2 of the PCB):

- Single channel Argus uses Side 1 or PCB
- Standard VGA or DVI-I, 3.5 mm audio jack, USB Type B socket
- 32 MB memory option (uses side 2 of PCB)

Table 2-10 Common Configurations

Model	Display Channels	Video Input	USB 2.0	Front Panel Connector	SGRAM per channel	DVI	Sync On Green BIOS
Gemini	2	no	no	dual VGA	16 MB	no	jumper
Gemini/DVI	2	no	no	68-Pin	16 MB	yes	jumper
ArgusPMC	2	yes	yes	68-Pin	16 MB	yes	jumper
SirenaPMC	1	no	yes	VGA, USB Type B, 3.5 mm audio	32 MB	no	jumper
SirenaPMC/ DVI	1	yes	yes	DVI-I, USB Type B, 3.5 mm audio	32 MB	yes	jumper

2.7 Software Support

Rastergraf provides a broad range of software support. The following table shows the current availability. Please contact Rastergraf Sales for special requirements.

Table 2-11 Software

Software	Operating System				
	Solaris 2.6 - 10	**Linux**	**VxWorks**	**Windows 2000, XP**	**LynxOS 4**
X Window System	DDX (for SunX)	XFree86 4.3	XFree86 4.3		XFree86 4.3
OpenGL (Accelerated)	GLDX	GLDX	GLDX	ICD	GLDX
Video Input Extension	bttv	bttv	bttv	btwincap	bttv
USB	part of OS	part of OS	part of OS	part of OS	n/a
Audio I/O	part of OS	part of OS	part of OS	part of OS	n/a
BIOS (supports analog RGBHV, sync-on-green, and DVI)	FCode	VGA (x86)		VGA	n/a
SDL (Graphics Subroutine Library)		yes	yes		yes
WindML (runs under SDL)			yes		yes
BIST (runs under SDL)			yes		yes

Chapter 3
Connector Pinouts and Cable Information

3.1 Introduction

A variety of connectors and both standard and breakout cables are required for the Argus, Gemini, and Sirena boards and are covered in the following sections. Rastergraf can supply you with the breakout and extension cables you need. An adapter connector, Molex 88741-8700, is also available that adapts the DVI-I to a standard VGA connector.

Gemini The GeminiPMC (no DVI) uses two **VGA** connectors. ***See important Note in Section 3.2.*** The GeminiPMC (w/DVI) uses the **Multifunction** connector with a breakout cable that splits into two DVI-I connectors.

Argus All connections are made through the **Multifunction** connector with a breakout cable that splits into dual sets of DVI-I, USB, and 2 x 3.5 mm stereo audio in/out, S-Video, and BNC.

Sirena The SirenaPMC (no DVI) uses **VGA, 3.5 mm audio**, and **Mini Type AB USB** connectors. The SirenaPMC/DVI (w/DVI) uses a **DVI-I** connector with a breakout cable that splits into a VGA, DVI, S-Video, and BNC.

Table 3-1 Connector Usage

Section	Connector Type	Where Used
3.2	15-pin D-Sub VGA	Gemini and Sirena (board side), Breakout Cables
3.3	29-pin DVI-I	Sirena (board side)
3.4	Mini Type AB USB Type A	Sirena (board side) Argus and Sirena Breakout Cables
3.5	3.5 mm Audio Stereo	Sirena (board side), Breakout Cables
3.6	S-Video	Breakout Cables
3.7	68-pin MDR	Gemini and Argus (board side)
3.8	68-pin MDR	Argus Multifunction Breakout Cable
3.9	68-pin MDR	Gemini DVI Breakout Cable
3.10	29-pin DVI-I	Sirena Multifunction Breakout Cable
3.11	4 x 64 PMC	Gemini, Argus, Sirena PMC (Pn1-Pn4)

Cable Sources

Rastergraf uses an outside contractor to build its production cables: Lynn Products, Inc. http://www.lynnprod.com

3.2 VGA Connector

Analog graphics output is provided on a standard VGA style compressed 15 pin D-Sub and is used with an "Autoscan" type monitor. You must use the correct initialization, since a VGA monitor depends on the sync polarities to determine operating frequency. The polarities of the Vertical/Composite Sync and Horizontal Sync are controlled by the Borealis graphics controller chip (see Section 5.2). ***See the* Note *in Section 2.4 concerning composite sync on green and RGBHV video out modes.*** If you have problems, please contact Rastergraf for assistance.

The R, G, and B video outputs are driven by the Borealis graphics controller chip which is capable of driving terminated cable (75 ohms) to standard RS-330/IRE levels. Cable length should be limited to 50 feet unless you use low loss RG-59.

If you really want to roll you own, the PMC board side VGA connector is an AMP 788574-1. Be sure to use 75-ohm coax for the R, G, B. You can use TP or coax on H, and V. A cable that would work is Mogami W3206-8 (http://www.mars-cam.com/ccd/mogami/digital3.html).

Important Note

Because two VGA connectors are a tight fit on a PMC board, some VGA connector moldings are too wide to allow two cables to be plugged in simultaneously. Rastergraf can supply cables that are known to fit. The cable part number is A31-00599-1012 (see below, two pages on).

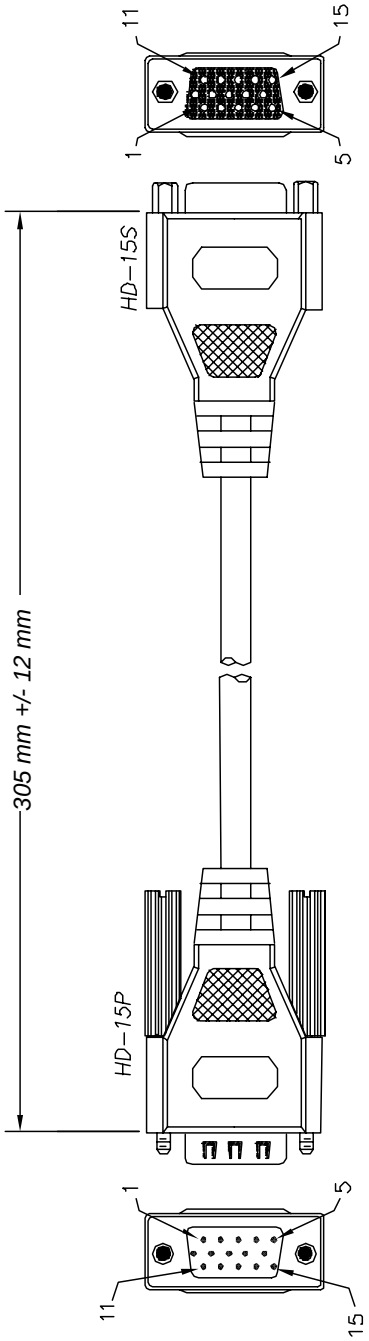
Table 3-1 Analog (VGA) Video Connector Pinout

VGA Pin	Description	Ground Type	Cable Type
1	Red		75 ohm Coax with pin 6 GND
2	Green		75 ohm Coax with pin 7 GND
3	Blue		75 ohm Coax with pin 8 GND
4	not used		
5	DDC Ground	Circuit Ground	
6	Red Ground	Circuit Ground	
7	Green Ground	Circuit Ground	
8	Blue Ground	Circuit Ground	
9	Fused +5 Volts, .25A max		
10	Sync Ground	Circuit Ground	
11	Ground	Circuit Ground	
12	DDCDA		Twisted Pair with pin 10 GND
13	HSYNC		Twisted Pair with pin 5 GND
14	VSYNC		Twisted Pair with pin 10 GND
15	DDCCK		Twisted Pair with pin 5 GND
-	Connector Shell	Chassis Ground	
-	Outer Shield (Cable Jacket)	Chassis Ground	

Warning:

The Chassis Ground **MUST NOT BE CONNECTED** to Circuit Ground.

Figure 3-1 VGA to VGA Extension Cable (A31-00599-1012)



3.3 DVI-I Connector

Argus, Gemini, and Sirena boards that support DVI use industry standard DVI-I (analog/digital) connectors either on the front panel or on a breakout cable. The DVI-I carries both the DVI digital and the traditional RGBHV analog graphics signals. See http://www.ddwg.org/ for more information.

The DVI protocol uses the TMDS encoded data format. Each of the three differential data pairs encodes nine digital video (TTL) signals. A separate pair carries the clock. DVI requires all pairs be closely matched in length..

The Argus, Gemini, and Sirena boards use a THine THC63DV164 DVI transmitter (http://www.thine.co.jp). To ensure best quality, we strongly urge you to obtain commercially manufactured cables and/or adapters that are available from Rastergraf, Molex, and other well-known suppliers.

Table 3-2 Argus/Gemini DVI-I Connector Pinout

DVI-I Pin	Description
1	DVI_TX2L
2	DVI_TX2H
3	DVI_TX2 Shield/Ground
6	DDCCK
7	DDCDA
8	Vertical Sync
9	DVI_TX1L
10	DVI_TX1H
11	DVI_TX1 Shield/Ground
14	Fused +5 Volts, .25A max
15	Ground
17	DVI_TX0L
18	DVI_TX0H
19	DVI_TX0 Shield/Ground
22	DVI_TXC Shield/Ground
23	DVI_TXCH
24	DVI_TXCL
4, 5, 12, 13, 16, 20, 21	n/c
C1	Red
C2	Green
C3	Blue
C4	Horizontal Sync
C5	Analog Ground

On the DVI-optioned SirenaPMC/DVI, a DVI-I connector is used. If you need ONLY the VGA output (not the DVI, USB, or video in), a cable-based or modular adapter can be used to supply just VGA to a standard VGA ***computer side*** connector. See the diagrams on this and the following page.

Figure 3-2 Molex 88741-8700 DVI-I to VGA Adapter

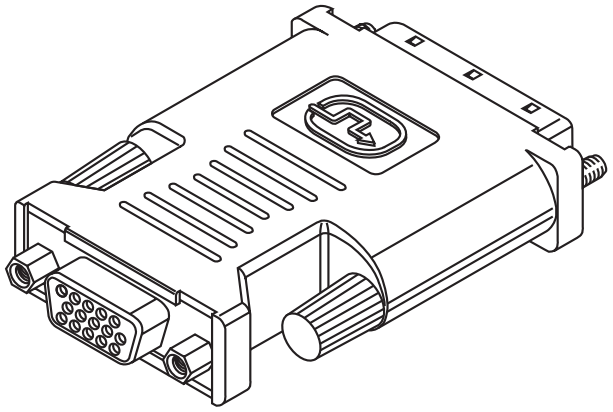
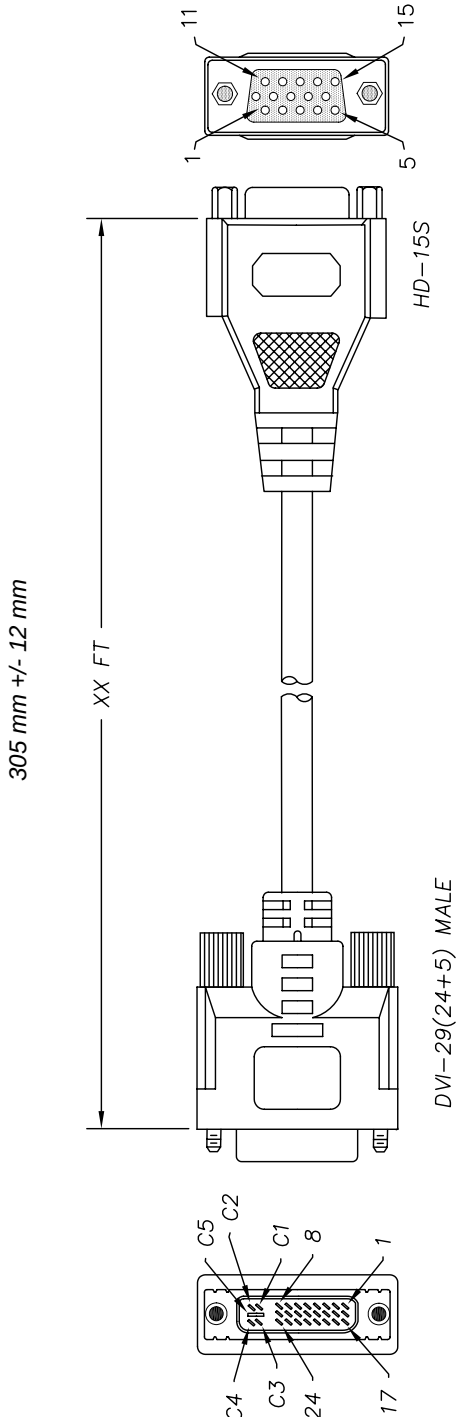


Figure 3-3 DVI to VGA Adapter Cable (A31-00599-5012)



SirenaPMC/DVI Modified DVI-I Connector

The SirenaPMC/DVI uses the standard DVI-I connector on its front panel. However, in order to get access to the video input capability and a second USB port, the SirenaPMC/DVI uses the DVI pins reserved for super-high-resolution dual-link DVI. Dual link will never be supported on Sirena.

A breakout cable (A31-00749-1012) is available. See Section 3.10 for more information.

The table below shows the usage of the DVI-I pins for SirenaPMC/DVI. Non-standard usages are shown in ***bold italic***.

Table 3-3 SirenaPMC/DVI DVI-I Connector Pinout

DVI-I Pin	Description
1	DVI_TX2L
2	DVI_TX2H
3	DVI_TX2 Shield/Ground
4	***FUSB_D2L (USB Data)***
5	***FUSB_D2H (USB Data)***
6	DDCCK
7	DDCDA
8	Vertical Sync
9	DVI_TX1L
10	DVI_TX1H
11	DVI_TX1 Shield/Ground
12	***A_MUX1 (Video In Mux 1)***
13	***RA_CIN (CIN for S-Video)***
14	Fused +5 Volts, .25A max
15	Ground
16	***RUSB_V2 (USB Switched Power)***
17	DVI_TX0L
18	DVI_TX0H
19	DVI_TX0 Shield/Ground
20	***A_MUX2 (Video In Mux 2)***
21	***A_MUX0 (Video In Mux 0/YIN for S-Video)***
22	DVI_TXC Shield/Ground
23	DVI_TXCH
24	DVI_TXCL
C1	Red
C2	Green
C3	Blue
C4	Horizontal Sync
C5	Analog Ground

3.4 USB Connectors

The USB 2.0 ports offer a great deal more flexibility than earlier USB 1.1, being able to support up to 480 Mbps data rate, which is more than adequate for video and audio input, not to mention hard disk, keyboard, mouse, and sound synthesizers. See Section 1.1.6 for more information about the USB ports.

The Argus has USB connectors as part of its breakout cable (see Section 3.8) as does the SirenaPMC/DVI for USB Port 2 (see Section 3.10). These cables both use USB Type A, which are normally used for the host side USB connections.

Table 3-4 USB Connector - USB Type A

USB Pin	Name
1	Switched Power
2	Data –
3	Data+
4	Ground

The Sirena boards come with a front panel USB connector (J011A2), but for space reasons it is a Type AB (actually, a USB Mini Type AB OTG). It works with either Mini Type A or Mini Type B plugs. We are using it as a Type A, host mode, no OTG features supported. Is it Molex 56579-0511.

You can get a Type A receptacle to Type B Mini plug adapter ("AF to Mini BM" or "AF - Mini BM") here: http://www.abccables.com/ca-000306.html.. They are not easy to find.

Table 3-5 USB Connector - USB Type AB Mini

USB Pin	Name
1	Switched Power
2	Data –
3	Data+
4	ID (Ground)
5	Power Ground

Figure 3-4 Type A Receptacle to Type AB Mini Plug Adapter



3.5 3.5mm Audio Connectors

We use 3.5 mm connectors because they are the most common type and are widely used on PCs and personal audio equipment. This makes it easy to get cables and connectors. See Section 1.1.7 for more information about the Audio ports.

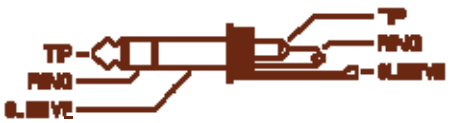
The Argus has 3.5 mm USB connectors as part of its breakout cable (see Section 3.8). The Sirena boards have 2 connectors on the front panel: J011A3 (Stereo In) and J021A2 (Stereo Out).

In both cases, the input connector mode can be changed using a jumper to change from Stereo Line Input to Mono MIC Input. In the latter case, a bias voltage is also supplied for MICs that need power.

A control setting can put the audio chip into mono, in which case the MIC signal is directed to both channels.

The following diagram shows the naming conventions.

Figure 3-5 3.5mm Audio Connector



Stereo 3.5mm Plug

Pin	Line Input Mode	Microphone Input Mode
	Impedance: 11K	Impedance: 44K @midgain
Tip	Left channel	MIC Input
Ring	Right channel	MIC Bias BIAS V = 4V@.5mA
Sleeve	Ground/shield	Ground/shield

3.6 S-Video Connector

We use the S-Video connector for high quality video-in because it is the most common type and is also widely used on PCs and personal video equipment. This makes it easy to get cables and connectors.

The Argus has two S-Video connectors as part of its breakout cable (see Section 3.8). The SirenaPMC/DVI has a single S-Video connector as part of its breakout cable (see Section 3.10).

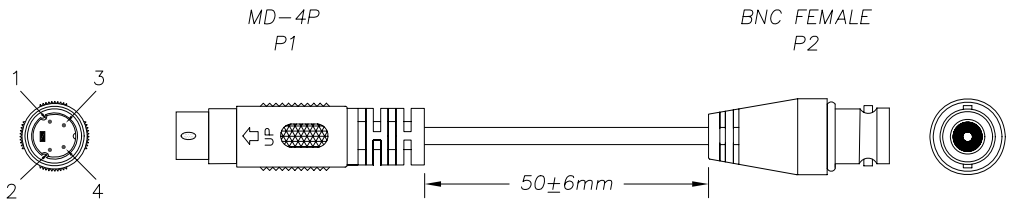
In both cases, one pin on the S-Video cable can also be used as a standard composite input. S-Video to BNC adapter cables are supplied to enable use of that pin for that purpose.

The following diagram shows the naming conventions.

Figure 3-6 7 S-Video Connector

	Pin	Description
 Male connector solder side view	1	Ground (Y)
	2	Ground (C)
	3	Y (Luminance = intensity + Sync.) or Composite Video In
	4	C (Chrominance = color)

Figure 3-8 S-Video to BNC Adapter (A31-00709-1003)



3.7 MDR68 Multifunction Connector

There are two connector choices for the Argus and Gemini graphics boards:

VGA, which is the common PC-type 15-pin compatible connector. RGBHV (Red, Green, Blue, and Horizontal and Vertical sync) and DDC/DDA monitor control signals are supplied. These are used only on the GeminiPMC.

Multifunction, which is a 68-pin high density MDR connector used to efficiently provide the entire signal set of the Argus/Gemini to the front panel.

It can support stereo audio in and out and two channels each of DVI, VGA, S-Video in, and USB. The DVI and VGA are supplied together on a DVI-I connector, which is a 29-pin connector now popular because it supports ***both*** analog VGA and digital DVI and has better high frequency response. As described in Section 3.9, Rastergraf supplies both full signal breakout and dual DVI-I breakout cables. The connector itself is described in this section.

Figure 3-9 Typical MDR Connector (not a 68 pin)

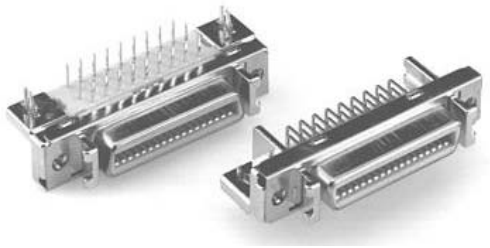


Table 3-6 Argus Multifunction Connector Pinout

3M Pin Number	Description		
	Function	Channel	Name
1	DVI-I	Ch B	Pair 2+
2	DVI-I	Ch B	Pair 2-
3	DVI-I	Ch B	Pair 2 Ground
4	DVI-I	Ch B	Pair 1+
5	DVI-I	Ch B	Pair 1-
6	DVI-I	Ch B	Pair 1 GND
7	DVI-I	Ch B	Pair 0+
8	DVI-I	Ch B	Pair 0-
9	DVI-I	Ch B	Pair 0 Ground
10	DVI-I	Ch B	Pair CK+
11	DVI-I	Ch B	Pair CK-
12	DVI-I	Ch B	Pair CK GND
13	USB	Ch 1	Switched Power
14	USB	Ch 1	Data-
15	USB	Ch 1	Data +
16	USB	Ch 1	Ground
17	AIN/VIN	Audio or Ch B	Right Audio In/Ch B Video Mux 1
18	AIN/VIN	Audio or Ch B	Left Audio In/Ch A Video Mux 1
19	USB	Ch 3	Ground
20	USB	Ch 3	Switched Power
21	USB	Ch 3	Data+
22	USB	Ch 3	Data-
23	DVI-I	Ch A	Pair CK Ground
24	DVI-I	Ch A	Pair CK-
25	DVI-I	Ch A	Pair CK+
26	DVI-I	Ch A	Pair 0 GND
27	DVI-I	Ch A	Pair 0-
28	DVI-I	Ch A	Pair 0+
29	DVI-I	Ch A	Pair 1 Ground
30	DVI-I	Ch A	Pair 1-
31	DVI-I	Ch A	Pair 1+
32	DVI-I	Ch A	Pair 2 GND
33	DVI-I	Ch A	Pair 2-
34	DVI-I	Ch A	Pair 2+

Table 3-6 Argus Multifunction Connector Pinout (continued)

3M Pin Number	Description		
	Function	Channel	Name
35	DVI-I	Ch B	Red
36	DVI-I	Ch B	Red Ground
37	DVI-I	Ch B	Blue Ground
38	DVI-I	Ch B	Blue
39	DVI-I	Ch B	SDA
40	DVI-I	Ch B	F5V
41	DVI-I	Ch B	Green
42	DVI-I	Ch B	Green Ground
43	DVI-I	Ch B	HS
44	DVI-I	Ch B	VS
45	DVI-I	Ch B	Sync/DDC Ground
46	DVI-I	Ch B	SCL
47	VIN	Ch B	CIN/MUX Ground
48	VIN	Ch B	CIN (S-Video)
49	VIN	Ch B	Mux 0
50	AOUT	Audio	Audio Ground
51	AOUT	Audio	Right Audio Out
52	VIN	Ch A	Mux 0
53	VIN	Ch A	CIN/MUX Ground
54	VIN	Ch A	CIN (S-Video)
55	AOUT	Audio	Left Audio Out
56	AOUT	Audio	Audio Ground
57	DVI-I	Ch A	VS
58	DVI-I	Ch A	HS
59	DVI-I	Ch A	Red Ground
60	DVI-I	Ch A	Red
61	DVI-I	Ch A	SCL
62	DVI-I	Ch A	Sync/DDC Ground
63	DVI-I	Ch A	Blue Ground
64	DVI-I	Ch A	Blue
65	DVI-I	Ch A	SDA
66	DVI-I	Ch A	F5V
67	DVI-I	Ch A	Green
68	DVI-I	Ch A	Green Ground

Table 3-7 Gemini Multifunction Connector Pinout

3M Pin Number	Description		
	Function	Channel	Name
1	DVI-I	Ch B	Pair 2+
2	DVI-I	Ch B	Pair 2-
3	DVI-I	Ch B	Pair 2 Ground
4	DVI-I	Ch B	Pair 1+
5	DVI-I	Ch B	Pair 1-
6	DVI-I	Ch B	Pair 1 GND
7	DVI-I	Ch B	Pair 0+
8	DVI-I	Ch B	Pair 0-
9	DVI-I	Ch B	Pair 0 Ground
10	DVI-I	Ch B	Pair CK+
11	DVI-I	Ch B	Pair CK-
12	DVI-I	Ch B	Pair CK GND
13-22	not used	not used	not used
23	DVI-I	Ch A	Pair CK Ground
24	DVI-I	Ch A	Pair CK-
25	DVI-I	Ch A	Pair CK+
26	DVI-I	Ch A	Pair 0 GND
27	DVI-I	Ch A	Pair 0-
28	DVI-I	Ch A	Pair 0+
29	DVI-I	Ch A	Pair 1 Ground
30	DVI-I	Ch A	Pair 1-
31	DVI-I	Ch A	Pair 1+
32	DVI-I	Ch A	Pair 2 GND
33	DVI-I	Ch A	Pair 2-
34	DVI-I	Ch A	Pair 2+

Table 3-7 Gemini Multifunction Connector Pinout (continued)

3M Pin Number	Description		
	Function	**Channel**	**Name**
35	DVI-I	Ch B	Red
36	DVI-I	Ch B	Red Ground
37	DVI-I	Ch B	Blue Ground
38	DVI-I	Ch B	Blue
39	DVI-I	Ch B	SDA
40	DVI-I	Ch B	F5V
41	DVI-I	Ch B	Green
42	DVI-I	Ch B	Green Ground
43	DVI-I	Ch B	HS
44	DVI-I	Ch B	VS
45	DVI-I	Ch B	Sync/DDC Ground
46	DVI-I	Ch B	SCL
47-56	not used	not used	not used
57	DVI-I	Ch A	VS
58	DVI-I	Ch A	HS
59	DVI-I	Ch A	Red Ground
60	DVI-I	Ch A	Red
61	DVI-I	Ch A	SCL
62	DVI-I	Ch A	Sync/DDC Ground
63	DVI-I	Ch A	Blue Ground
64	DVI-I	Ch A	Blue
65	DVI-I	Ch A	SDA
66	DVI-I	Ch A	F5V
67	DVI-I	Ch A	Green
68	DVI-I	Ch A	Green Ground

3.8 ArgusPMC Breakout Cable (A31-00734-1012)

The Argus board suffer from the common PMC problem of insufficient front panel space to allow the use of standard connectors. The only solution is to use high-density connectors and breakout cables that provide standard connectors on their far ends.

The previous sections document the use of each connector. Please refer to them from pin connections and descriptions. If you need more information, please contact Rastergraf Sales.

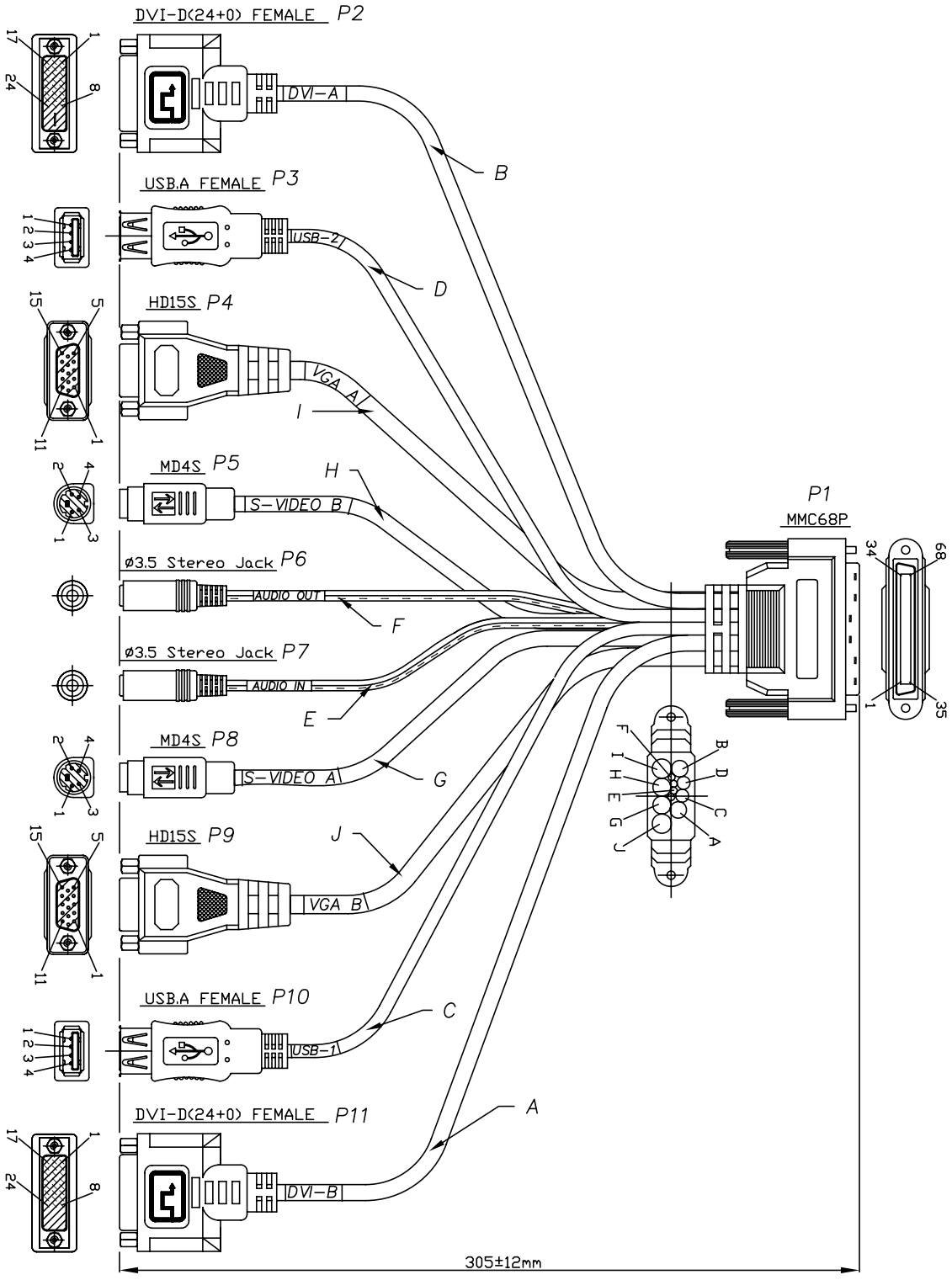
ArgusPMC Breakout Cable (A31-00734-1012)

This cable breaks out all the Argus functions from an MDR68 pin connector. It can support stereo audio in and out and two channels each of DVI, VGA, S-Video In, and USB.

The pin lists and diagram of the breakout cable for the Argus are shown on the following pages.

The connectors are shown in the same order as is in the diagram, P2 – P11. Note that P1 is documented in Section 3.7.

Figure 3-10 Argus Full Signal Breakout Cable (A31-00734-1012)



3.8.1 P2 - DVI Channel A

Table 3-8 P2 - DVI Channel A - DVI-D Connector

3M Pin Number	DVI Pin Number	Wire Type	Description		
			Function	Channel	Name
62	15	straight	DVI/VGA	Ch A	Sync/DDC Ground
65	7	straight	DVI/VGA	Ch A	SDA
61	6	straight	DVI/VGA	Ch A	SCL
66	14	straight	F5V		
25	23	TP+S #C	DVI	Ch A	Pair CK+
24	24	TP+S #C	DVI	Ch A	Pair CK-
23	22	TP+S #C	DVI	Ch A	Pair CK GND
28	18	TP+S #0	DVI	Ch A	Pair 0+
27	17	TP+S #0	DVI	Ch A	Pair 0-
26	19	TP+S #0	DVI	Ch A	Pair 0 GND
31	10	TP+S #1	DVI	Ch A	Pair 1+
30	9	TP+S #1	DVI	Ch A	Pair 1-
29	11	TP+S #1	DVI	Ch A	Pair 1 GND
34	2	TP+S #2	DVI	Ch A	Pair 2+
33	1	TP+S #2	DVI	Ch A	Pair 2--
32	3	TP+S #2	DVI	Ch A	Pair 2 GND

3.8.2 P3 - USB Port 2

Table 3-9 P3 - USB Port 2 - USB Series A receptacle

3M Pin Number	USB Pin Number	Wire Type	Description		
			Function	Channel	Name
21	3	TP	USB	Ch 2	Data+
22	2	TP	USB	Ch 2	Data –
20	1	straight	USB	Ch 2	Switched Power
19	4	straight	USB	Ch 2	Ground

3.8.3 P4 - VGA Channel A

Table 3-10 P4 - VGA Channel A - VGA Connector

3M Pin Number	VGA Pin Number	Wire Type	Description		
			Function	Channel	Name
67	2	75 coax #G	VGA	Ch A	Green
68	7	75 coax #G	VGA	Ch A	Green Ground
64	3	75 coax #B	VGA	Ch A	Blue
63	8	75 coax #B	VGA	Ch A	Blue Ground
60	1	75 coax #R	VGA	Ch A	Red
59	6	75 coax #R	VGA	Ch A	Red Ground
57	14	TP+S #V	VGA	Ch A	VS
63	10	TP+S #V	VGA	Ch A	Sync Ground
58	13	TP+S #H	VGA	Ch A	HS
63	11	TP+S #H	VGA	Ch A	Ground
65	12	straight	DVI/VGA	Ch A	SDA
61	15	straight	DVI/VGA	Ch A	SCL
62	5	straight	DVI/VGA	Ch A	DDC Ground
66	9	straight	F5V		

3.8.4 P5 – S-Video Input Channel B

Table 3-11 P5 – S-Video Channel B – Mini DIN Connector

3M Pin Number	MiniDIN Pin Number	Wire Type	Description		
			Function	Channel	Name
49	3	75 coax #Y	Video In	Ch B	YIN/VIN0
50	1	75 coax #Y	Video In	Ch B	Ground
48	4	75 coax #C	Video In	Ch B	CIN
47	2	75 coax #C	Video In	Ch B	Ground

3.8.5 P6 – Audio Stereo Out

Table 3-12 P6 – Audio Stereo Out – 3.5mm Connector

3M Pin Number	MiniDIN Pin Number	Wire Type	Description		
			Function	Channel	Name
55	Tip	50 coax #L	Audio Out	n/a	Left Out
56	Sleeve	50 coax #L	Audio Out	n/a	Ground
51	Ring	50 coax #R	Audio Out	n/a	Right Out
50	Sleeve	50 coax #R	Audio Out	n/a	Ground

3.8.6 P7 – Audio Stereo In/Mono MIC In

Table 3-13 P7 – Audio Stereo In/Mono MIC In – 3.5mm Connector

3M Pin Number	MiniDIN Pin Number	Wire Type	Description		
			Function	Channel	Name
18	Tip	50 coax #L	Audio In	n/a	Left In/MIC In
53	Sleeve	50 coax #L	Audio In	n/a	Ground
17	Ring	50 coax #R	Audio In	n/a	Right Out/MIC Bias
47	Sleeve	50 coax #R	Audio In	n/a	Ground

3.8.7 P8 – S-Video Input Channel A

Table 3-14 P8 – S-Video Channel A – Mini DIN Connector

3M Pin Number	MiniDIN Pin Number	Wire Type	Description		
			Function	Channel	Name
52	3	75 coax #Y	Video In	Ch A	YIN/VIN0
53	1	75 coax #Y	Video In	Ch A	Ground
54	4	75 coax #C	Video In	Ch A	CIN
56	2	75 coax #C	Video In	Ch A	Ground

3.8.8 P9 - VGA Channel B

Table 3-15 P9 - VGA Channel B - VGA Connector

3M Pin Number	VGA Pin Number	Wire Type	Description		
			Function	Channel	Name
41	2	75 coax #G	VGA	Ch B	Green
42	7	75 coax #G	VGA	Ch B	Green Ground
38	3	75 coax #B	VGA	Ch B	Blue
37	8	75 coax #B	VGA	Ch B	Blue Ground
35	1	75 coax #R	VGA	Ch B	Red
36	6	75 coax #R	VGA	Ch B	Red Ground
44	14	TP+S #V	VGA	Ch B	VS
37	10	TP+S #V	VGA	Ch B	Sync Ground
58	13	TP+S #H	VGA	Ch B	HS
63	11	TP+S #H	VGA	Ch B	Ground
39	12	straight	DVI/VGA	Ch B	SDA
46	15	straight	DVI/VGA	Ch B	SCL
36	5	straight	DVI/VGA	Ch B	DDC Ground
40	9	straight	F5V		

3.5.9 P10 - USB Port 1 Connector

Table 3-16 P10 - USB Port 1 - USB Series A receptacle

3M Pin Number	USB Pin Number	Wire Type	Description		
			Function	Channel	Name
15	3	TP	USB	Ch 1	Data+
14	2	TP	USB	Ch 1	Data –
13	1	straight	USB	Ch 1	Switched Power
16	4	straight	USB	Ch 1	Ground

3.8.10 P11 - DVI Channel B

Table 3-17 P11 - DVI Channel B - DVI-D Connector

3M Pin Number	DVI Pin Number	Wire Type	Description		
			Function	Channel	Name
45	15	straight	DVI/VGA	Ch B	Sync/DDC Ground
39	7	straight	DVI/VGA	Ch B	SDA
46	6	straight	DVI/VGA	Ch B	SCL
40	14	straight	F5V		
10	23	TP+S #C	DVI	Ch B	Pair CK+
11	24	TP+S #C	DVI	Ch B	Pair CK-
12	22	TP+S #C	DVI	Ch B	Pair CK GND
7	18	TP+S #0	DVI	Ch B	Pair 0+
8	17	TP+S #0	DVI	Ch B	Pair 0-
9	19	TP+S #0	DVI	Ch B	Pair 0 GND
4	10	TP+S #1	DVI	Ch B	Pair 1+
5	9	TP+S #1	DVI	Ch B	Pair 1-
6	11	TP+S #1	DVI	Ch B	Pair 1 GND
1	2	TP+S #2	DVI	Ch B	Pair 2+
2	1	TP+S #2	DVI	Ch B	Pair 2--
3	3	TP+S #2	DVI	Ch B	Pair 2 GND

3.9 GeminiPMC Breakout Cable (A31-00736-0012)

The GeminiPMC board suffers from the common PMC problem of insufficient front panel space to allow the use of standard connectors. The only solution is to use high-density connectors and breakout cables that provide standard connectors on their far ends.

The previous sections document the use of each connector. Please refer to them from pin connections and descriptions. If you need more information, please contact Rastergraf Sales.

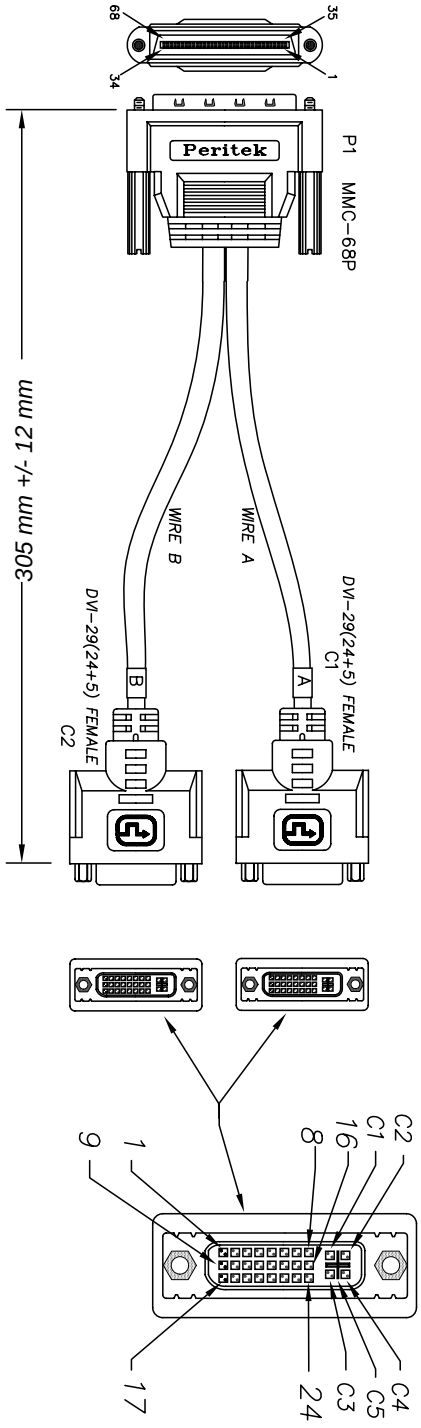
GeminiPMC Breakout Cable (A31-00736-0012)

This cable breaks out the Gemini functions from an MDR68 pin connector. It can support two channels each of DVI and VGA.

The pin lists and diagrams of the breakout cables for the Gemini are shown in the following pages.

The connectors are shown in the same order as is in the diagram, C1 and C2. Note that P1 is documented in Section 3.7.

Figure 3-11 Gemini Full Breakout Cable (A31-00736-0012)



3.9.1 C1 – DVI/VGA Channel A

Table 3-18 C1 – DVI/VGA Channel A - DVI-I Connector

3M Pin Number	DVI Pin Number	Wire Type	Description		
			Function	Channel	Name
67	26	75 coax #G	VGA	Ch A	Green
68	30	75 coax #G	VGA	Ch A	Green Ground
64	27	75 coax #B	VGA	Ch A	Blue
63	29	75 coax #B	VGA	Ch A	Blue Ground
60	25	75 coax #R	VGA	Ch A	Red
59	29	75 coax #R	VGA	Ch A	Red Ground
57	8	TP+S #V	VGA	Ch A	VS
62	10	TP+S #V	VGA	Ch A	Sync Ground
58	28	TP+S #H	VGA	Ch A	HS
62	15	TP+S #H	VGA	Ch A	Sync/DDC Ground
65	7	TP+S #A	DVI/VGA	Ch A	SDA
62	15	TP+S #A	DVI/VGA	Ch A	Sync/DDC Ground
61	6	TP+S #F	DVI/VGA	Ch A	SCL
66	14	TP+S #F	F5V		
25	23	TP+S #C	DVI	Ch A	Pair CK+
24	24	TP+S #C	DVI	Ch A	Pair CK-
23	22	TP+S #C	DVI	Ch A	Pair CK GND
28	18	TP+S #0	DVI	Ch A	Pair 0+
27	17	TP+S #0	DVI	Ch A	Pair 0-
26	19	TP+S #0	DVI	Ch A	Pair 0 GND
31	10	TP+S #1	DVI	Ch A	Pair 1+
30	9	TP+S #1	DVI	Ch A	Pair 1-
29	11	TP+S #1	DVI	Ch A	Pair 1 GND
34	2	TP+S #2	DVI	Ch A	Pair 2+
33	1	TP+S #2	DVI	Ch A	Pair 2--
32	3	TP+S #2	DVI	Ch A	Pair 2 GND

3.9.2 C2 – DVI/VGA Channel B

Table 3-19 C2 – DVI/VGA Channel B - DVI-I Connector

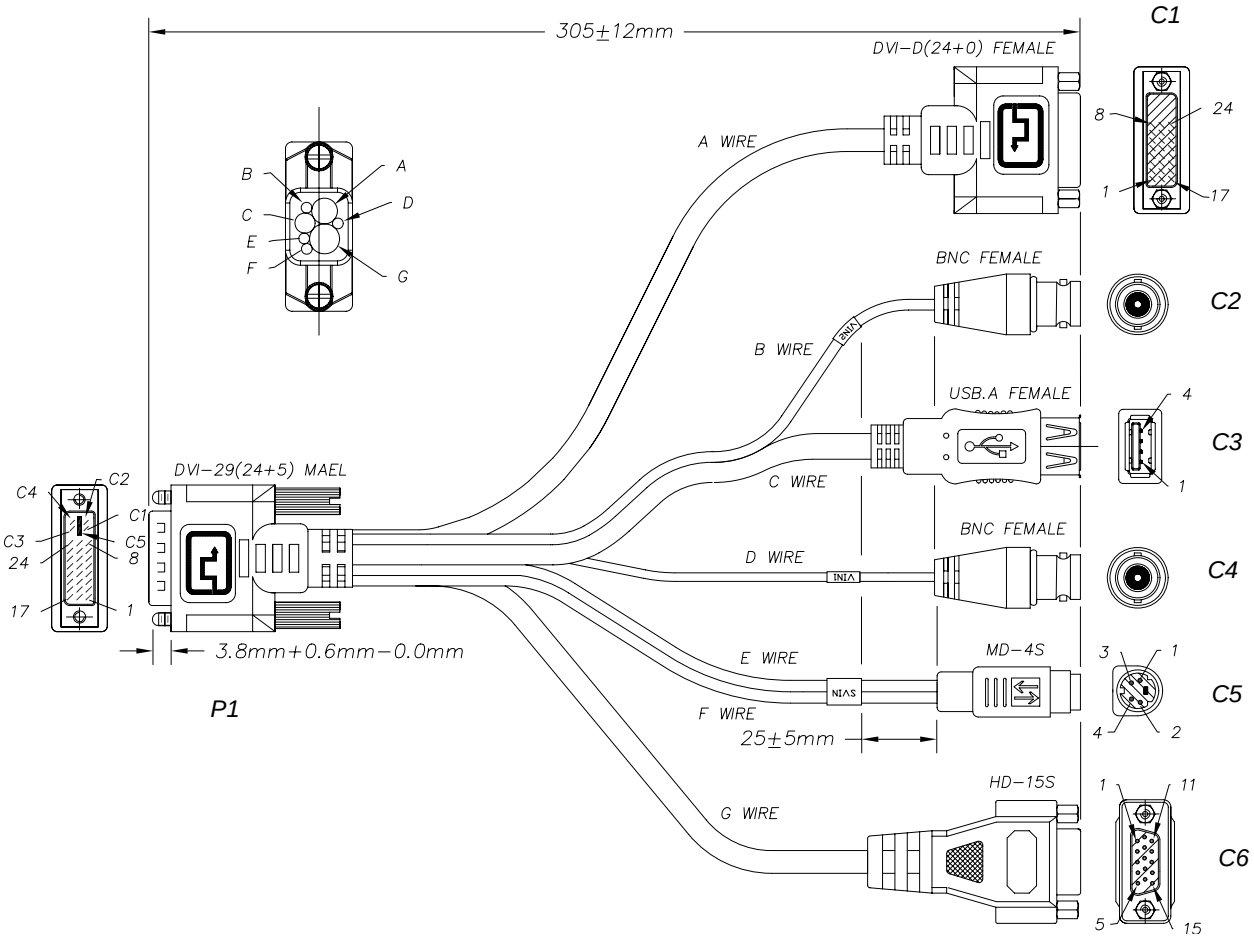
3M Pin Number	DVI Pin Number	Wire Type	Description		
			Function	Channel	Name
41	26	75 coax #G	VGA	Ch B	Green
42	30	75 coax #G	VGA	Ch B	Green Ground
38	27	75 coax #B	VGA	Ch B	Blue
37	29	75 coax #B	VGA	Ch B	Blue Ground
35	25	75 coax #R	VGA	Ch B	Red
36	29	75 coax #R	VGA	Ch B	Red Ground
44	8	TP+S #V	VGA	Ch B	VS
45	15	TP+S #V	VGA	Ch B	Sync/DDC Ground
43	28	TP+S #H	VGA	Ch B	HS
45	15	TP+S #H	VGA	Ch B	Sync/DDC Ground
39	7	TP+S #A	DVI/VGA	Ch B	SDA
45	15	TP+S #A	DVI/VGA	Ch B	Sync/DDC Ground
46	6	TP+S #F	DVI/VGA	Ch B	SCL
40	14	TP+S #F	F5V		
10	23	TP+S #C	DVI	Ch B	Pair CK+
11	24	TP+S #C	DVI	Ch B	Pair CK-
12	22	TP+S #C	DVI	Ch B	Pair CK GND
7	18	TP+S #0	DVI	Ch B	Pair 0+
8	17	TP+S #0	DVI	Ch B	Pair 0-
9	19	TP+S #0	DVI	Ch B	Pair 0 GND
4	10	TP+S #1	DVI	Ch B	Pair 1+
5	9	TP+S #1	DVI	Ch B	Pair 1-
6	11	TP+S #1	DVI	Ch B	Pair 1 GND
1	2	TP+S #2	DVI	Ch B	Pair 2+
2	1	TP+S #2	DVI	Ch B	Pair 2--
3	3	TP+S #2	DVI	Ch B	Pair 2 GND

3.10 SirenaPMC Breakout Cable (A31-00749-1012)

The SirenaPMC Breakout cable addresses the common PMC problem of insufficient front panel space to allow access to all of its functions. Using spare pins on the DVI-I connector, it provides extra signal sets, including stereo audio in and out, and VGA, DVI, and one USB port.

The connectors are shown in the same order as is in the diagram, C1 – C6. Note that P1 is documented in Section 3.3.

Figure 3-12 Sirena Breakout Cable (A31-00749-1012)



3.10.1 C1 – DVI Output

Table 3-20 C1 - DVI - DVI-D Connector

DVI-I Pin Number	DVI-D Pin Number	Wire Type	Description	
			Function	Name
15	15	straight	DVI/VGA	Sync/DDC Ground
7	7	straight	DVI/VGA	SDA
6	6	straight	DVI/VGA	SCL
14	14	straight	F5V	
23	23	TP+S #C	DVI	Pair CK+
24	24	TP+S #C	DVI	Pair CK-
22	22	TP+S #C	DVI	Pair CK GND
18	18	TP+S #0	DVI	Pair 0+
17	17	TP+S #0	DVI	Pair 0-
19	19	TP+S #0	DVI	Pair 0 GND
10	10	TP+S #1	DVI	Pair 1+
9	9	TP+S #1	DVI	Pair 1-
11	11	TP+S #1	DVI	Pair 1 GND
2	2	TP+S #2	DVI	Pair 2+
1	1	TP+S #2	DVI	Pair 2--
3	3	TP+S #2	DVI	Pair 2 GND

3.10.2 C2 - Video Input 2

Table 3-21 C2 –Video Input 2 – BNC Connector

DVI-I Pin Number	BNC Pin Number	Wire Type	Description	
			Function	Name
20	Center	75 coax	Video In	MUX 2
3	Shield	75 coax	Video In	Ground

3.10.3 C3 - USB Port 2

Table 3-22 C3 - USB Port 2 - USB Series A receptacle

DVI-I Pin Number	USB Pin Number	Wire Type	Description	
			Function	Name
5	3	TP	USB	Data+
4	2	TP	USB	Data –
16	1	straight	USB	Switched Power
15	4	straight	USB	Ground

3.10.4 C4 - Video Input 1

Table 3-23 C4 –Video Input 1 – BNC Connector

DVI-I Pin Number	BNC Pin Number	Wire Type	Description	
			Function	Name
12	Center	75 coax	Video In	MUX 1
11	Shield	75 coax	Video In	Ground

3.10.5 C5 – S-Video

Table 3-24 C5 – S-Video – Mini DIN Connector

DVI-I Pin Number	MiniDIN Pin Number	Wire Type	Description	
			Function	Name
21	3	75 coax #Y	Video In	YIN/VIN0
19	1	75 coax #Y	Video In	Ground
13	4	75 coax #C	Video In	CIN
22	2	75 coax #C	Video In	Ground

3.10.6 C6 - VGA

Table 3-25 C6 - VGA - VGA Connector

DVI-I Pin Number	VGA Pin Number	Wire Type	Description	
			Function	Name
26	2	75 coax #G	VGA	Green
30	7	75 coax #G	VGA	Green Ground
27	3	75 coax #B	VGA	Blue
29	8	75 coax #B	VGA	Blue Ground
25	1	75 coax #R	VGA	Red
29	6	75 coax #R	VGA	Red Ground
8	14	TP+S #V	VGA	VS
22	10	TP+S #V	VGA	Sync Ground
28	13	TP+S #H	VGA	HS
15	11	TP+S #H	VGA	Ground
7	12	straight	DVI/VGA	SDA
6	15	straight	DVI/VGA	SCL
11	5	straight	DVI/VGA	DDC Ground
14	9	straight	F5V	

3.11 Connections to the PMC Bus

3.11.1 Pn1 Connector

Pin	Signal Name	Signal Name	Pin
1	JTAGTCK	n/c	2
3	GND	PINTAL	4
5	PINTBL	PINTCL	6
7	BUSMODE1L	VCC (5V)	8
9	PINTDL	n/c	10
11	GND	n/c	12
13	PCICLK	GND	14
15	GND	PMCGNTL	16
17	PMCREQL	VCC (5V)	18
19	byp (Vio)	AD31H	20
21	AD28H	AD27H	22
23	AD25H	GND	24
25	GND	C/BE3L	26
27	AD22H	AD21H	28
29	AD19H	VCC (5V)	30
31	byp (Vio)	AD17H	32
33	FRAMEL	GND	34
35	GND	IRDYL	36
37	DEVSELL	VCC (5V)	38
39	GND	LOCKL	40
41	n/c	n/c	42
43	PAR	GND	44
45	byp (Vio)	AD15H	46
47	AD12H	AD11H	48
49	AD09H	VCC (5V)	50
51	GND	C/BE0L	52
53	AD06H	AD05	54
55	AD04H	GND	56
57	byp (Vio)	AD03H	58
59	AD02H	AD01H	60
61	AD00H	VCC (5V)	62
63	GND	REQ64L	64

Notes: byp means the pin is connected to a bypass capacitor on the graphics board but is otherwise not used.

3.11.2 Pn2 Connector

Pin	Signal Name	Signal Name	Pin
1	n/c	JTAGRST	2
3	JTAGTMS	JTAGTMS	4
5	JTAGTDI	GND	6
7	GND	n/c	8
9	n/c	n/c	10
11	BUSMODE2L	VDD (3.3V)	12
13	PCIRSTL	BUSMODE3L	14
15	VDD (3.3V)	BUSMODE4L	16
17	n/c	GND	18
19	AD30H	AD29H	20
21	GND	AD26H	22
23	AD24H	VDD (3.3V)	24
25	IDSEL	AD23H	26
27	VDD (3.3V)	AD20H	28
29	AD18H	GND	30
31	AD16H	C/BE2L	32
33	GND	n/c	34
35	TRDYL	VDD (3.3V)	36
37	GND	STOPL	38
39	PERRL	GND	40
41	VDD (3.3V)	SERRL	42
43	C/BE1L	GND	44
45	AD14	AD13H	46
47	M66EN	AD10H	48
49	AD08H	VDD (3.3V)	50
51	AD07H	n/c	52
53	VDD (3.3V)	n/c	54
55	n/c	GND	56
57	n/c	n/c	58
59	GND	n/c	60
61	ACK64L	VDD (3.3V)	62
63	GND	n/c	64

3.11.3 Pn3 Connector

Pin	Signal Name	Signal Name	Pin
1	n/c	GND	2
3	GND	C/BE7L	4
5	C/BE6L	C/BE5L	6
7	C/BE4L	GND	8
9	byp (Vio)	PAR64H	10
11	AD63H	AD62H	12
13	AD61H	GND	14
15	GND	AD60H	16
17	AD59H	AD58H	18
19	AD57H	GND	20
21	byp (Vio)	AD56H	22
23	AD55H	AD54H	24
25	AD53H	GND	26
27	GND	AD52H	28
29	AD51H	AD50H	30
31	AD49H	GND	32
33	GND	AD48H	34
35	AD47H	AD46H	36
37	AD45H	GND	38
39	byp (Vio)	AD44H	40
41	AD43H	AD42H	42
43	AD41H	GND	44
45	GND	AD40H	46
47	AD39H	AD38H	48
49	AD37H	GND	50
51	GND	AD36H	52
53	AD35H	AD34H	54
55	AD33H	GND	56
57	byp (Vio)	AD32H	58
59	n/c	n/c	60
61	n/c	GND	62
63	GND	n/c	64

Notes: byp means the pin is connected to a bypass capacitor on the graphics board but is otherwise not used.

3.11.4 Pn4 Connector

The signal sets presented on the rear panel are the same as the front panel versions with one exception: the Micronas UAC3556B I^2S audio signals are connected ***only*** to the rear panel. The I^2S port extends the codec function of the UAC3556B by allowing various digital audio-processing systems to be connected to it (e.g., Dolby Digital or MP3 decoding chips).

At this time, Rastergraf does not have any rear panel adapter cards or cables for any of the boards.

Note that while using rear panel I/O is very attractive for some applications, there can be some serious difficulties in successfully deploying it. That is because graphics signals are routed across the carrier or host board, whose PMC Pn4 traces have possibly not been routed with low noise or differential pairs in mind.

Before committing to a rear panel solution, it is a good idea to contact the carrier or host board vendor so as to obtain the necessary information to make a good decision. Note that this problem with rear panel I/O is endemic to PMCs, and is not isolated to the boards in this manual or to graphics boards in general.

Note: rear panel connections must be inner-layer matched length for DVI signals. Other I/Os require inner-layer signal + ground pairs.

The following table defines the names and uses for the signals on the rear panel connectors.

Please contact Rastergraf Sales for additional information.

Table 3-26 Rear Panel Signal Definitions

Pn4/Schematic Name	Function
RUSB_D3L, etc.	USB Differential Pair. Numeral indicates USB physical port number.
RUSB_PFLT3L, etc.	USB power fault signal. Used only for testing.
B_MUX2, etc.	MUX indicates a Bt878 video input multiplexer input. Numeral indicates which physical port. B_xxxx or A_xxxx means Channel A or Channel B Bt878A. xx_CIN is used only for S-Video.
I_MCLK, etc.	Part of the Micronas UAC3556B I^2S port.
RIOATXCP or DVIB_TXCP, etc.	Part of the DVI Graphics output. RIOAxxx means graphics channel A. Note that all lines must be the same length and each pair must use twisted pair with shield cabling. Each shield must be separately tied to ground, not all shields together and then to ground.
REAR_BLUE_OUT or RIOA_BD_BLU, etc. AMON_SDCH or REAR_SDC	Part of the VGA output. RIOAxxx means graphics channel A. RED, GREEN, and BLUE must use 75-ohm coax . Each shield must be separately tied to ground, not all shields together and then to ground. HSYNC and VSYNC should each be twisted pair with a ground. SDC and SDA can be straight or twisted pairs.
A_INC_R, A_OUTC_R, etc.	Audio in and out. R means Right. All signals must use 50-ohm coax. Each shield must be separately tied to ground, not all shields together and then to ground. When MIC jumper is installed, A_INC_L becomes A_MIC_IN and A_INC_R becomes _MIC_BIAS.

3.11.4.1 Argus Pn4 Connector

Pin	Signal Name	Signal Name	Pin
1	RUSB_D3L	B_MUX2/RB_CIN	2
3	RUSB_D3H	Ground	4
5	RUSB_PFLT3L	A_MUX2/RA_CIN	6
7	RUSB_V3	Ground	8
9	Ground	RB_MUX1	10
11	Ground	Ground	12
13	RUSB_D4L	RA_MUX1	14
15	RUSB_D4H	Ground	16
17	RUSB_PFLT4L	A_INC_R	18
19	RUSB_V4	Ground	20
21	Ground	A_INC_L	22
23	I_MCLK	Ground	24
25	Ground	A_OUTC_R	26
27	I_BITCK	Ground	28
29	Ground	A_OUTC_L	30
31	I_WDSTB	Ground	32
33	Ground	n/c	34
35	I_DAIN	Ground	36
37	Ground	AMON_SDAH	38
39	I_DAOUT	Ground	40
41	Ground	AMON_SDCH	42
43	RIOATXCP	F5V	44
45	RIOATXCN	RIOA_BHSYNC	46
47	Ground	Ground	48
49	RIOATX2P	RIOA_BVSYNC	50
51	RIOATX2N	Ground	52
53	Ground	RIOA_BD_BLU	54
55	RIOATX1P	Ground	56
57	RIOATX1N	RIOA_BD_GRN	58
59	Ground	Ground	60
61	RIOATX0P	RIOA_BD_RED	62
63	RIOATX0N	Ground	64

3.11.4.2 Gemini Pn4 Connector

Pin	Signal Name	Signal Name	Pin
1	n/c	n/c	2
3	n/c	Ground	4
5	n/c	n/c	6
7	n/c	Ground	8
9	Ground	n/c	10
11	Ground	Ground	12
13	n/c	n/c	14
15	n/c	Ground	16
17	n/c	n/c	18
19	n/c	Ground	20
21	Ground	n/c	22
23	n/c	Ground	24
25	Ground	n/c	26
27	n/c	Ground	28
29	Ground	n/c	30
31	n/c	Ground	32
33	Ground	n/c	34
35	n/c	Ground	36
37	Ground	AMON_SDAH	38
39	n/c	Ground	40
41	Ground	AMON_SDCH	42
43	RIOATXCP	F5V	44
45	RIOATXCN	RIOA_BHSYNC	46
47	Ground	Ground	48
49	RIOATX2P	RIOA_BVSYNC	50
51	RIOATX2N	Ground	52
53	Ground	RIOA_BD_BLU	54
55	RIOATX1P	Ground	56
57	RIOATX1N	RIOA_BD_GRN	58
59	Ground	Ground	60
61	RIOATX0P	RIOA_BD_RED	62
63	RIOATX0N	Ground	64

3.11.4.3 Sirena Pn4 Connector

Pin	Signal Name	Signal Name	Pin
1	RUSB_D1L	RUSB_D2L	2
3	RUSB_DIH	RUSB_D2H	4
5	Ground	Ground	6
7	n/c	n/c	8
9	Ground	DVIB_TXCN	10
11	A_INC_R	DVIB_TXCP	12
13	Ground	DVIB_TX2N	14
15	A_INC_L	DVIB_TX2P	16
17	Ground	DVIB_TX1N	18
19	A_OUTC_R	DVIB_TX1P	20
21	Ground	A_MUX2	22
23	A_OUTC_L	A_MUX1	24
25	Ground	Ground	26
27	Ground	RA_CIN	28
29	n/c	DVIB_TX0N	30
31	n/c	DVIB_TX0P	32
33	Ground	RUSB_V2	34
35	REAR_SDA	Ground	36
37	Ground	REAR_PTC_5V	38
39	REAR_VSYNC	Ground	40
41	Ground	I_MCLK	42
43	REAR_HSYNC	Ground	44
45	Ground	I_DAIN	46
47	A_MUX0	I_DAOUT	48
49	REAR_RED_OUT	Ground	50
51	Ground	REAR_GREEN_OUT	52
53	Ground	Ground	54
55	REAR_BLUE_OUT	I_BITCK	56
57	Ground	Ground	58
59	Ground	I_WDSTB	60
61	RUSB_V1	n/c	62
63	REAR_SCL	n/c	64

Chapter 4
Installing Your Graphics Board

4.1 Introduction

There are 2 steps involved in getting your Rastergraf board to work in your system:

- Unpack and install the Rastergraf board.
- Install the software

This chapter shows you how to install the Rastergraf board in your computer. Your Rastergraf software User's Manual (e.g. SDL) provides instructions on how to install the software.

4.2 Unpacking Your Board

When you unpack your board, inspect the contents to see if any damage occurred in shipping. If there has been physical damage, file a claim with the carrier at once and contact Rastergraf for information regarding repair or replacement. Do not attempt to use damaged equipment.

> **Caution**
>
> Be careful not to remove the board from its antistatic bag until you are ready to install it. It is preferable to wear a grounded wrist strap whenever handling computer boards.

Some operating systems require that you reboot your system after installing a device driver, because only after the reboot will your system utilize the driver and recognize the board. If yours is such an operating system, you might like to install your Rastergraf software **before** installing the board since you will have to shut down the computer to install the board anyway. If you want to install the software before shutting down the computer, proceed to the correct part of the relevant software manual and return to this chapter afterwards.

4.3 Preparing for Installation

The Argus, Gemini, and Sirena boards are manufactured as PMC boards. However, they can be installed in PCI and CompactPCI backplanes by using a Rastergraf PMA-P or PMA-C passive bus adapter. Rastergraf also supplies active carriers for PCI, the PMB-P, and a CompactPCI carrier, the PMB-C, which can hold two PMC boards. In order to ease the procedure, there follows individual sections that deal with each board type.

4.3.1 Interrupt Settings

	INTA	INTB	INTC
ArgusPMC	yes	yes	yes
GeminiPMC	yes	yes	
SirenaPMC	yes	yes	yes

In some computers, each slot ***may*** map its local interrupt lines to a permuted set of INTA-INTD, which means that the board will show up on a different interrupt line according to the slot it is plugged into. The device driver will usually notice this and compensate for it. In any case, the user has no direct control (e.g. jumpers) over what interrupt lines the graphics board will use.

4.3.2 Address Settings

Since the PCI bus and the graphics boards are configured by the operating system and/or BIOS while booting up, there aren't any address jumpers. The address settings are programmable and are set up by the software as a result of information supplied by the OS at boot time. Refer to the Rastergraf software User's Manuals for more information.

The software sets up the BARs (Base Address Registers) and other relevant control registers in all of the PCI devices on the graphics board. The Rastergraf device drivers will load the BARs if the O/S or BIOS did not. If you can determine the actual PCI base address, you might even be able to probe the address spaces with an on-line debugger once the driver code has run. Section 5.2 has details on how the Borealis controls access to the on-board registers.

The ability to probe the board is dependent on the CPU memory map as implemented by the system OS and the address ranges of the PCI bus as determined by the CPU hardware. These things change from OS to OS,

board-to-board, and vendor-to-vendor, making it a difficult task. Most likely, if you use Rastergraf supplied software, the board will show up and you will get pictures.

4.3.3 Changing the Jumpers

In the following subsections, please refer to ***Figures 4-1*** and ***4-2*** in this section**.** Note instruction for the jumper settings for the PMA-C and PMB-C (***Section 4.6***) and PMA-P or PMB-P (***Section 4.5***) must be obtained from the ***PMA Series*** or ***PMB-C Manual, respectively***.

VGA PCI Device Jumpers
Argus/Gemini JP11H1 and JP11G6 and Sirena JP011M4

JP11H1 and JP11G6 enable Graphics Channels A and B, respectively, to respond either as a PCI sub-class "VGA Controller Device" (default) or as an "Other Display Controller" (jumper installed). Sirena has just one channel so it has JP011M4.

If you are running in a PC compatible machine and you want some other graphics board to run as console, you may need to install this jumper, at least on Channel A (JP11H1). This will prevent the system BIOS from loading a VGA BIOS from the Rastergraf board as well as the other graphics board.

Sync-On-Green Select Jumper
Argus/Gemini JP11M1 and Sirena JP011M5

The Argus, Gemini, and Sirena have the Rastergraf Quad Image BIOS (QIB) PROM, which supports FCode, VGA, DVI, and Sync-On-Green (SOG). The firmware can "determine" the need to run FCode or VGA, and if the DVI monitor is plugged in, it will select DVI mode without user intervention. However, a separate jumper is needed to "tell" the firmware that SOG is required. Normally, if SOG is requested prior to order shipment, the jumper is installed at the factory. But, if it has been omitted, then install the jumper to enable SOG.

4.3.3 Changing the Jumpers (continued)

Mono MIC/Stereo In
Argus JP11L2 and Sirena JP011L4

The Argus and Sirena audio input can be configured to be either Mono MIC In with MIC Bias or Stereo Line In.

Install the jumper for MIC mode.

A program option in the software can be used to put the UAC3556B into mono mode, which directs the MIC signal to both inputs. If this is not done, the MIC signal appears only on the Left channel.

As used in the MIC mode, the input impedance is called “Hi Impedance”, but actually varies with signal attenuation from about 100K down to about 10K at maximum input. MIC Bias supplies about 4V@.5mA.

For the Line In mode, the impedance is 11K.

LM75 Interrupt Enable
Argus/Gemini JP11F3

The LM75 is programmed by default to interrupt at 75C. As the Argus and Gemini do run warm, it is a good idea to use this interrupt and take advantage of code available from Rastergraf to report the problem. This can help protect the graphics board from overheating.

Install the jumper to enable the interrupt to be asserted on the Argus/Gemini INTA line.

If no jumper is installed, you will never get a thermal overrun error.

Figure 4-1 Jumper Locations for the Fab Rev 2 Argus/Gemini Board

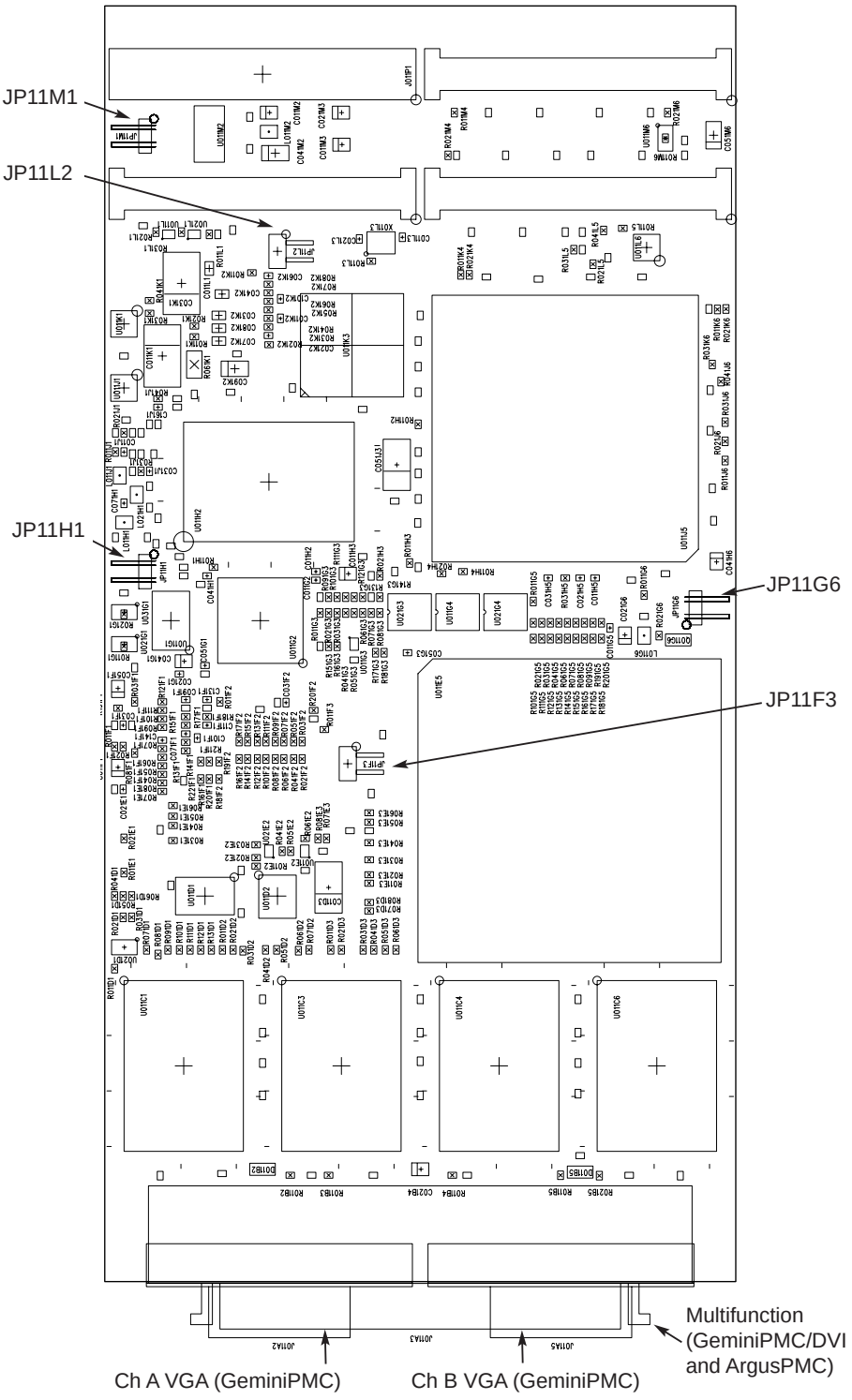
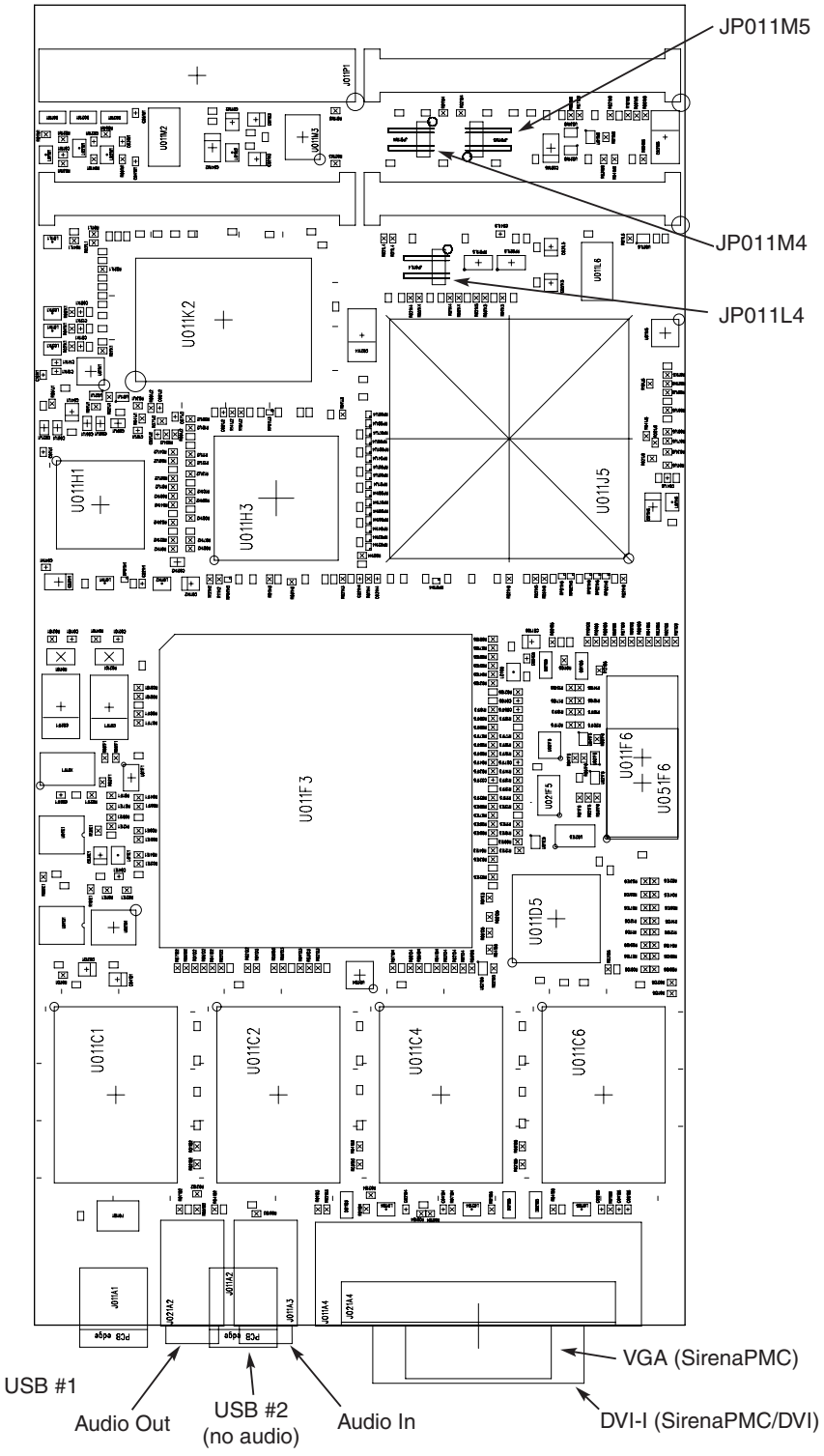


Figure 4-2 Jumper Locations for the Fab Rev 1 Sirena Board



4.4 graphics Board Installation

The graphics board can plug into any 32 or 64-bit, 33 or 66 MHz, 5V or 3.3V signaling IEEE 1386-2001 compatible single module PMC location.

The board will also work in CompactPCI or PCI systems by using a Rastergraf **PMA-C** passive (bridgeless) PMC to CompactPCI or **PMB-C** active (PCI6154 bridge) dual PMC to CompactPCI adapter (see ***Section 4.6***), or a **PMA-P** passive (bridgeless) PMC to PCI adapter or **PMB-P** active (PCI6154 bridge) single PMC to PCI adapter (see ***Section 4.5***).

Note:

Older VME host or carrier boards may not supply 3.3V to the PMC connectors. The graphics board requires both 3.3V and 5V. It will not operate correctly in any system that does not supply BOTH 5V and 3.3V. Please contact Rastergraf for assistance.

Installation Procedure

Note:

Refer to ***Section 4.3.3*** for the jumper settings.

1. Shut down the operating system and **turn off the power**.

Warning!

Never open the computer without turning off the power supply. Unless internal AC wiring is exposed, leave the power cord plugged in, so as to ground the computer chassis. You can easily get shocked, ruin computer parts or both unless you turn off the power. Even with power switched off, lethal voltages can exist in the equipment.

2. Open the computer and remove the CPU board onto which the graphics PMC board is to be installed. Identify an empty PMC location (generally there are one or two on a given CPU board). The graphics PMC board is a Universal PMC/PCI device and can be plugged into a PMC port which uses either 5V or 3.3V signaling.

   THE CARRIER MUST SUPPLY BOTH 3.3V AND 5V.

3. Take care to optimize airflow by blocking off unused slots in the card cage, and arrange the boards to permit optimum airflow through them.

> **Caution**
>
> The static electricity that your body builds up normally can seriously damage the components on the graphics board.

Figure 4-3 Installation of a PMC Module into an Emerson MVME2604

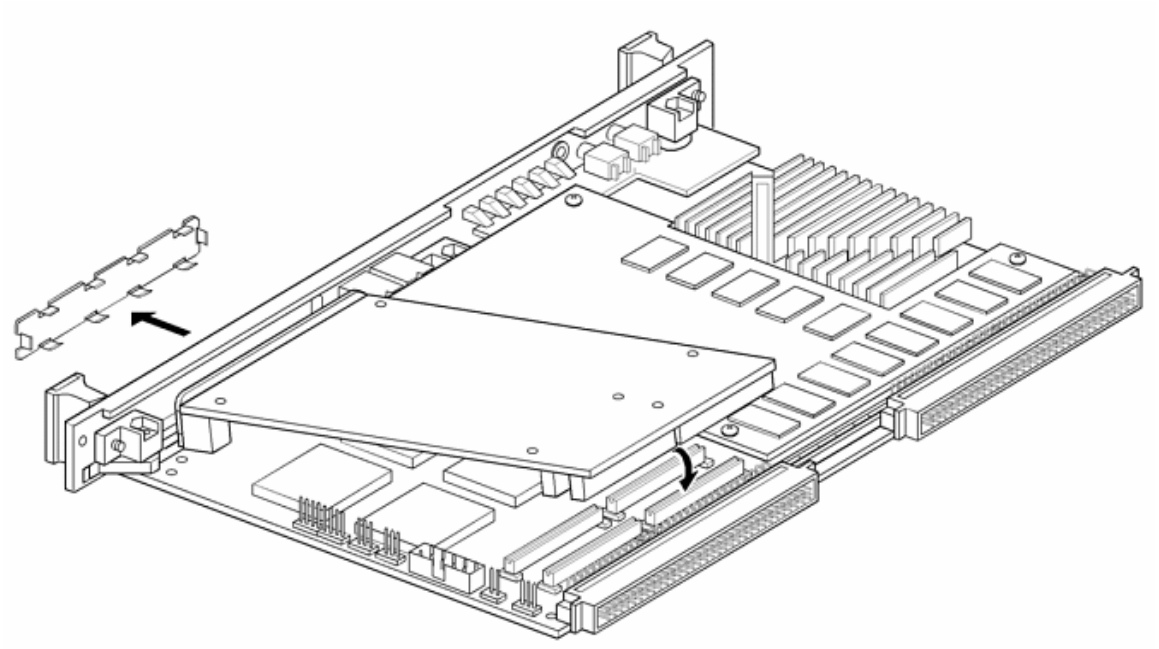
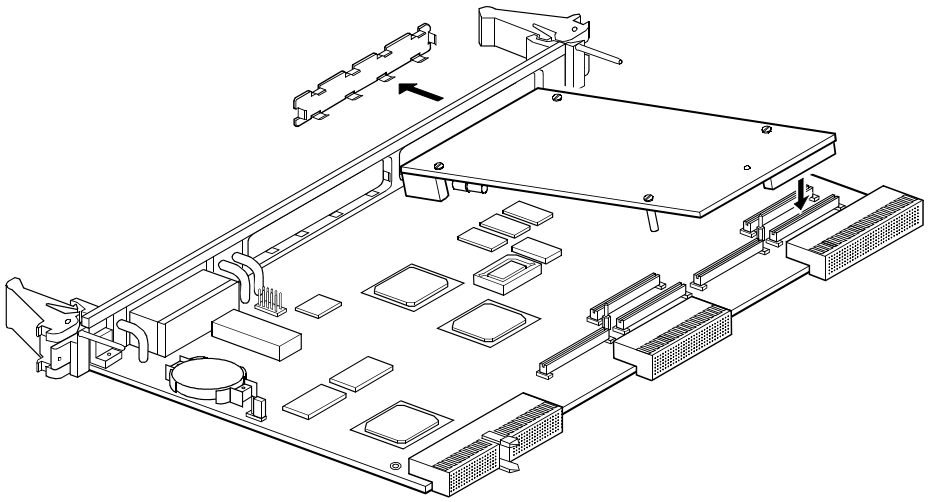


Figure 4-4 Installation of the PMC Module into an Emerson CPV3060



4. Touch a metal part of the computer chassis, remove the graphics board from its anti static bag, and immediately slip it into the slot. After ensuring that the board is seated correctly, install the mounting screws (two near the front and two near the PMC connectors).

Note

Sometimes the graphics board front panel can hang up going into the carrier front panel hole. This can be because there is a little rubber EMI gasket that is installed in a slot cut into the graphics board front panel. If the hole in the carrier board is “on the small side” it can be difficult if not impossible to install the graphics board. In this case, you will have to remove and discard the gasket.

5. Close the computer.

Now, go to Section 4.7.

4.5 Installing in a PCI Backplane using a Carrier

You can install the graphics board into a PCI computer if you first plug it into a Rastergraf ***PMA-P*** or ***PMB-P*** PMC-to-PCI adapter board. The adapters are designed to plug into any standard PCI 2.2 specification compatible backplane.

> **Note:**
>
> Most AT style motherboards do not supply 3.3V to the PCI connectors. If the computer is listed as PCI 2.0 or 2.1 compliant, it probably does not supply 3.3V. Since both the PMA-P and PMB-P have an on-board 3.3V regulator, this should not be a problem. Make sure that the carrier is correctly configured to supply local 3.3V.

Installation Procedure

1. Shut down the operating system and **turn off the power**.

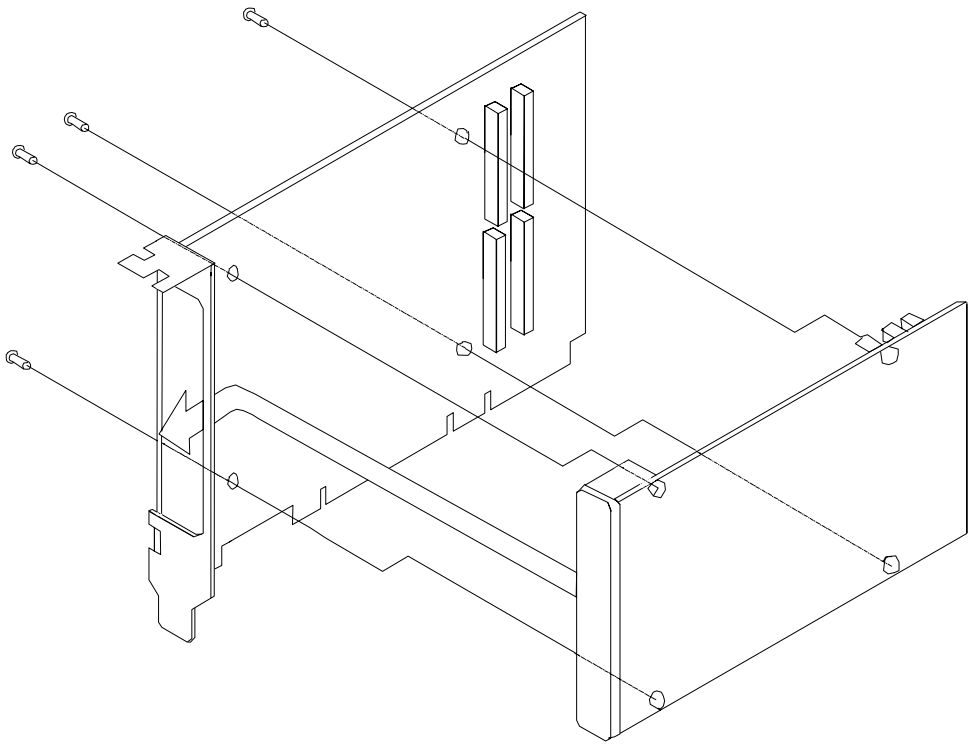
> **Warning!**
>
> Never open the computer without turning off the power supply. Unless internal AC wiring is exposed, leave the power cord plugged in, so as to ground the computer chassis. You can easily get shocked, ruin computer parts or both unless you turn off the power. Even with power switched off, lethal voltages can exist in the equipment.

2. Open the computer and find an empty PCI slot.

   Both the graphics board and the carrier are Universal PCI devices and can be plugged into a slot which uses either 5V or 3.3V signaling protocol.

   The carrier also has both 32 and 64-bit PCI connectors. This allows it to take advantage of extra power and ground pins.

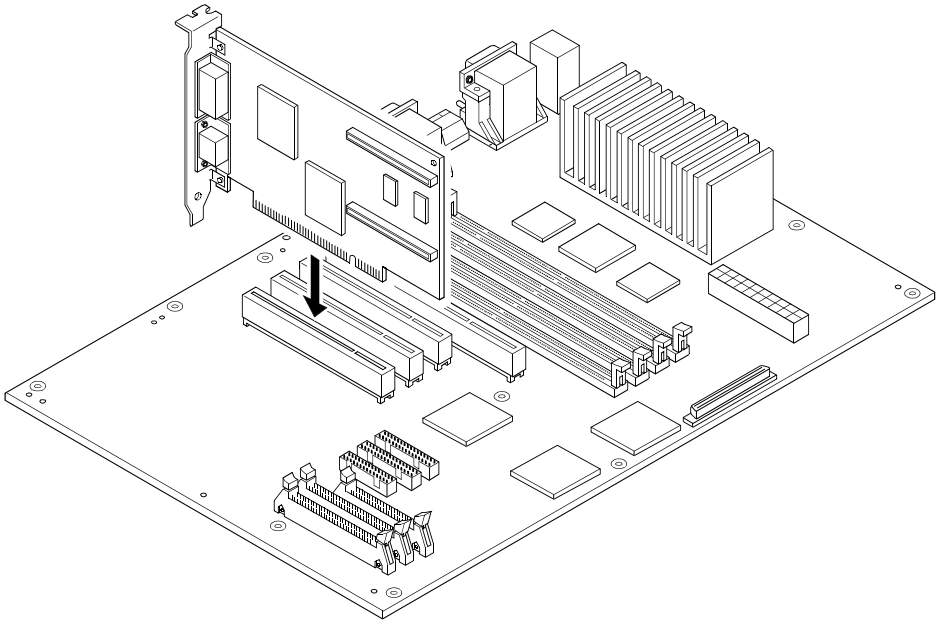
Figure 4-5 Installation of a PMC Module onto a PMA-P or PMB-P



Caution
The static electricity that your body builds up normally can seriously damage the components on the graphics board.

3. Wear a grounded wrist strap and touch a metal part of the computer chassis. Remove the card slot blocking plate from the chassis. Then, remove the graphics board from its anti static bag, and immediately slide it into the slot.

Figure 4-6 Installation of a PCI Module into an Emerson MTX



4. After making sure the board is seated correctly, install the screw into the place where the blocking plate was and which (now) holds the graphics board's front panel

5. Close the computer.

Now, go to Section 4.7.

4.6 Installing in a CompactPCI Backplane using a Carrier

You can install the graphics board into a CompactPCI computer if you first plug it into a Rastergraf ***PMA-C*** or ***PMB-C*** PMC-to-CompactPCI adapter board.

The PMA-C is a 3U CompactPCI board and it accepts a single PMC module. It is designed to plug into any 32 or 64-bit, 5V or 3.3V signaling CompactPCI slot. It can be supplied with either a 3U or 6U faceplate.

The PMA-C is a 6U CompactPCI board and it accepts two standard PMC modules. It is designed to plug into any 32 or 64-bit, 5V or 3.3V signaling CompactPCI slot.

Installation Procedure

1. Shut down the operating system and **turn off the power**.

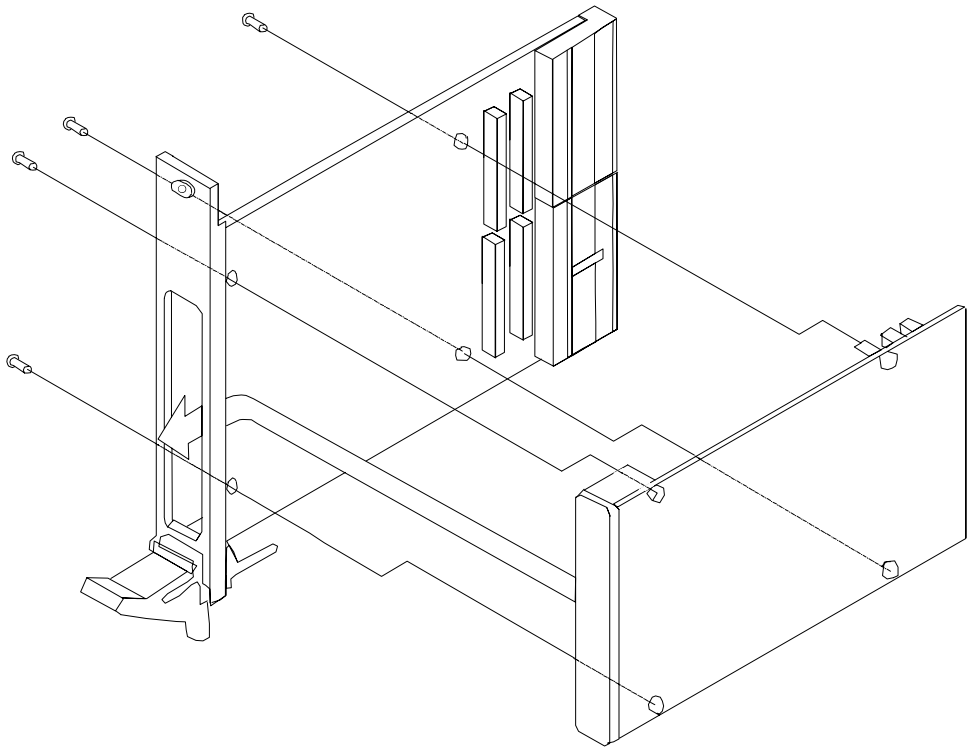
> **Warning!**
>
> Never open the computer without turning off the power supply. Unless internal AC wiring is exposed, leave the power cord plugged in, so as to ground the computer chassis. You can easily get shocked, ruin computer parts or both unless you turn off the power. Even with power switched off, lethal voltages can exist in the equipment.

2. Open the computer and identify the empty slot in the card cage that is closest to the CPU. Do not leave any slots empty between the graphics board and the CPU.

   Both the graphics board and the carrier are Universal PCI devices and can be plugged into a slot which uses either 5V or 3.3V signaling protocol. Therefore, a CompactPCI J1 connector signaling key plug is not necessary.

   The PMA-C has both J1 and J2 connectors. This allows it to take advantage of extra power and ground pins.

Figure 4-7 Installation of a PMC Module onto a PMA-C



Caution

The static electricity that your body builds up normally can seriously damage the components on the graphics board.

3. Wear a grounded wrist strap. Touch a metal part of the computer chassis, remove the graphics board from its anti static bag, and immediately slide it into the slot.

Figure 4-8 Installation of a PMC Module into the PMB-C

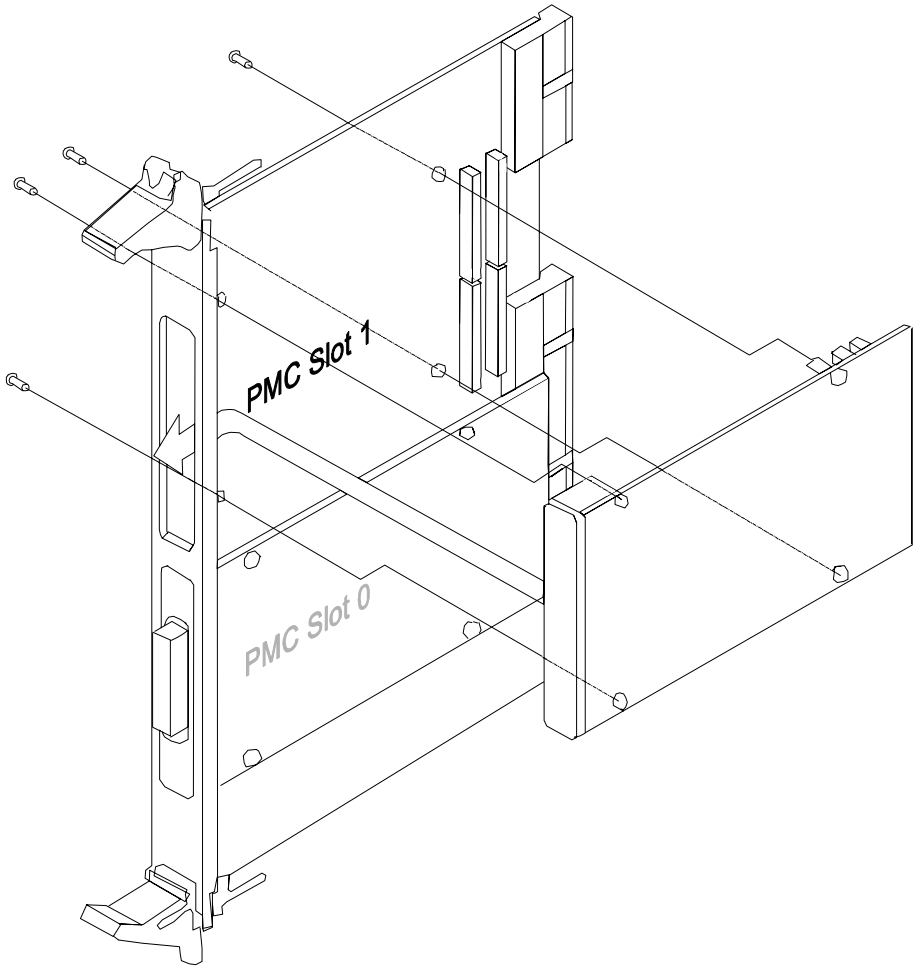
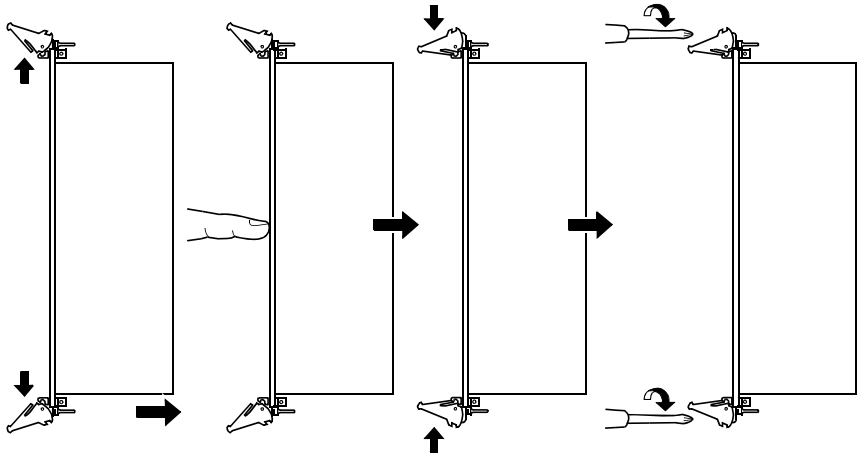


Figure 4-9 Installing a CompactPCI Board



4. After making sure the board is seated correctly, lever the card in with the injector(s) and tighten the screwlock on each end of the faceplate.

Now, go to Section 4.7.

4.7 Finishing the Installation

4.7.1 Connecting to the Monitor

Be sure to snug the connector's thumbscrews down, as it may otherwise work loose and cause unreliable operation.

Connecting to the ArgusPMC Breakout Cable

There are two DVI-D and two VGA connectors. You can plug DVI or VGA monitor cables directly into these. You can only use one connector at a time per channel. You can't connect both Ch A VGA and Ch A DVI connectors to monitors at the same time (or Ch B). Section 3.8 has more information about the breakout cable.

Connecting to the GeminiPMC or SirenaPMC

You can plug VGA or DVI cables directly into the front panel connectors.

> **Note**
>
> Because two VGA connectors are a tight fit on a PMC board, some VGA cable connector moldings are too wide to allow two cables to be plugged in simultaneously on the GeminiPMC. Rastergraf can supply cables that are known to fit. Please see Section 3.2.

Connecting to the GeminiPMC/DVI Breakout Cable

There are two DVI-I connectors. You can plug DVI monitor cable directly into these, or, using DVI-I to VGA adapter, connect to VGA monitors. Section 3.9 has more information about the breakout cable.

Connecting to the SirenaPMC/DVI Breakout Cable

There is a DVI-D and a VGA connector. You can plug DVI or VGA monitor cables directly into these. You can only use one connector at a time. Section 3.10 has more information about the breakout cable.

4.7.2 Checking your Display

> **Note**
>
> With the correct board jumper settings and appropriate cable adapters, the graphics boards can supply 3 Wire (RGB with sync on green, BNC connectors) or 5 Wire Video (RGBHV, VGA connector). Rastergraf software defaults to 5 Wire Video (NO sync on green). See Section 4.3.3.
>
> Be aware that if you connect a board that has video parameters set up for sync on green to a VGA compatible monitor you will get a green background on the display.

Now, turn on the power and check your monitor's display.

This is an interesting problem. If you have a Sun SPARC or PC, the BIOS firmware in the graphics board will be invoked and you will get some sort of display on power-up.

But, if you have a PowerPC system running VxWorks, you will not get any visual indication that the board is operational until you load and run some graphics board-specific software like SDL or X Windows.

If you have such a system and are ever in doubt about whether the board really works, you would be well advised to plug it into a PMC to PCI carrier and plug it into a PC to try it out.

Please proceed to the next section.

4.8 Using a Argus, Gemini, or Sirena Board in a PC

4.8.1 Multiboard Operation

The Windows 2000 and Windows XP drivers, Linux and VxWorks SDL, and XFree86 4.3 support multihead operation.

Single Graphics Board

If you are using a PC and the Rastergraf board is to be the system display (and you don't have another VGA controller installed), the system BIOS should find the Rastergraf board, and initialize the display.

Multiple Graphics Boards

If you do have another VGA board in the system, the order in which the boards are plugged into the backplane or motherboard will determine which board will be used for the system display. If the BIOS picks the wrong one, turn off the computer and swap the boards' positions.

If your system has a non-removable VGA controller and you want to use the Rastergraf board as the system display you may have a problem. If the BIOS starts up using the built-in VGA, you may be able to disable it with a BIOS setting. Otherwise, contact the system board manufacturer. Failing these things, you are probably out of luck.

4.8.2 Rastergraf Quad Image BIOS VGA Image

The Rastergraf E3 boards feature four 32KB BIOS images, suitable for both x86 (Windows, DOS, Linux) and FCode (Sun). The images conform to the PCI R2.2 Expansion ROM specification. The PROM is organized as VGA, FCode, VGA with Sync-On-Green, and FCode with Sync-On-Green for a total size of 128KB. For maximum compatibility with non-compliant systems the x86 image precedes the FCode image.

The Sync-On-Green jumper selects the one or the other half of the PROM. On boot up the system BIOS locates and runs the appropriate ROM code. Note: not all E3 boards have the jumper pins installed. Check with your sales representative if you need this feature.

x86 Image Features:

Support for the 16 standard DOS modes as well as 25 extended VESA modes. See the complete list below. Other extended VESA modes may be added in the future. All standard DOS, VESA and VESA32 functions are supported including DVI, refresh rate, power management and DDC.

The Sync-On-Green modes support the standard DOS modes with "XOR" composite sync and VESA modes with true serrated / equalized composite sync with pedestal. This is a separate image, selectable by the JP101 jumper.

The BIOS code will search for and initialize the DVI chip, if that option is installed on the E3 board. The DVI output is simultaneous with the analog output, so either monitor plugged into the E3 will work. In the case of Sync-On-Green image and the E3 has the DVI option installed and a DVI monitor is connected then the Sync-On-Green will be disabled, as it is not compatible with DVI. If a DVI monitor is not detected Sync-On-Green will not be disabled, but if a DVI monitor is later connected it may not display properly.

During boot, the BIOS will display a message screen for 10 seconds before relinquishing control back to the system BIOS. This screen will identify the Argus/Gemini board BIOS, the revision and build date, and copyright Rastergraf Additional messages will be displayed if a DVI option is found, if a DVI monitor is connected, if it is a Sync-On- Green image, if the Sync-On-Green is disabled due to a DVI monitor being detected, and a warning if the motherboard is found to not be fully PCI compliant. Other diagnostic messages may be added in the future.

A TSR image is also available. In the case of booting DOS this allows switching to a different (e.g. more current) version after boot, or switching to or from Sync-on-Green mode. This is recommended for testing only, the longer-term action is to reprogram the image, which can be done at the factory, or in the field in some cases.

Note that both analog (RGB) and DVI are supported by the BIOS code. Connection to a DVI monitor is detected and the appropriate register values are set without the need to have the user set any special flags or jumpers.

Table 4-1 x86 Supported Video Modes

Type	Code	Text	Graphics	Color Range	PC Mode
DOS	0x00,1	40x25	--	4 bits per pixel	CGA
DOS	0x02,3	80x25		2 bits per pixel	CGA
DOS	0x04,5	40x25	320x200	4 bits per pixel	CGA
DOS	0x06	80x25	640x200	monochrome	CGA
DOS	0x07	80x25	--	monochrome	MDA
DOS	0x0D	40x25	320x200	4 bits per pixel	EGA
DOS	0x0E	80x25	640x200	4 bits per pixel	EGA
DOS	0x0F	80x25	640x350	monochrome	EGA
DOS	0x10	80x25	640x200	4 bits per pixel	EGA
DOS	0x11	80x30	640x480	monochrome	VGA
DOS	0x12	80x30	640x480	4 bits per pixel	VGA
DOS	0x13	40x25	320x200	8 bits per pixel	VGA
DOS	0x6A	--	800x600	4 bits per pixel	SVGA

Type	Code		Graphics	Color Range	PC Type
VESA	0x0100		640 x 400	8 bits per pixel	--
VESA	0x0101		640 x 480	8 bits per pixel	VGA
VESA	0x0103		800 x 600	8 bits per pixel	SVGA
VESA	0x0105		1024 x 768	8 bits per pixel	UVGA
VESA	0x0107		1280 x 1024	8 bits per pixel	SXGA
VESA	0x0110		640 x 480	15 bits per pixel	VGA
VESA	0x0111		640 x 480	16 bits per pixel	VGA
VESA	0x0112		640 x 480	32 bits per pixel	VGA
VESA	0x0113		800 x 600	15 bits per pixel	SVGA
VESA	0x0114		800 x 600	16 bits per pixel	SVGA
VESA	0x0115		800 x 600	32 bits per pixel	SVGA
VESA	0x0116		1024 x 768	15 bits per pixel	UVGA
VESA	0x0117		1024 x 768	16 bits per pixel	UVGA
VESA	0x0118		1024 x 768	32 bits per pixel	UVGA
VESA	0x0119		1280 x 1024	15 bits per pixel	SXGA
VESA	0x011a		1280 x 1024	16 bits per pixel	SXGA
VESA	0x011b		1280 x 1024	32 bits per pixel	SXGA
VESA	0x0120		1600 x 1200	8 bits per pixel	UXGA
VESA	0x0121		1600 x 1200	15 bits per pixel	UXGA
VESA	0x0122		1600 x 1200	16 bits per pixel	UXGA
VESA	0x0123		1600 x 1200	32 bits per pixel	UXGA
VESA	0x0124		1152 x 864	8 bits per pixel	Sun
VESA	0x0125		1152 x 864	15 bits per pixel	Sun
VESA	0x0126		1152 x 864	16 bits per pixel	Sun
VESA	0x0127		1152 x 864	32 bits per pixel	Sun

4.9 Using a Argus, Gemini, or Sirena Board in a SPARC CPU

4.9.1 Multiboard Operation

The Rastergraf loadable DDX module supports multihead operation under Solaris 9 with Xinerama.

If you are running on a Sun system, you should have the Rastergraf OpenBoot FCode image loaded into the graphics board. This will enable OpenBoot to correctly identify the graphics board on startup and use it as the console.

Single Graphics Board

If the Rastergraf board is to be the system display (and you don't have another display board installed), OpenBoot should find the Rastergraf board, and initialize the display.

Multiple Graphics Boards

If you do have another display board in the system, the order in which the boards are plugged into the backplane or motherboard will determine which board will be used for the system display. If OpenBoot picks the wrong one, swap cables or turn power off and swap the boards' positions.

If your system has a non-removable VGA controller and you want to use the Rastergraf board as the system display you may have a problem. If OpenBoot starts up using the built-in VGA, you may be able to disable it with an OpenBoot EEPROM setting. Otherwise, contact the system board manufacturer. Failing these things, you are probably out of luck.

4.9.2 Using OpenBoot and the Rastergraf FCode

Eclipse is the name used by the Rastergraf FCode for the graphics board. So, although you have an Argus, Gemini, or Sirena, it will be called Eclipse in the FCode and in the rest of this section.

The graphics board has the capability to function as a console device using the embedded OpenBoot FCode firmware programmed into it.

The display defaults to 1152 x 864 @ 60hz, 8 bits per pixel with separate horizontal and vertical sync signals and black text on a white background. Please skip to Section 4.9.2.6 if you do not wish to change the default

(startup) appearance of the display. Note that both analog (RGB) and DVI are supported by the FCode. Connection to a DVI monitor is detected and the appropriate register values are set without the need to have the user set any special flags or jumpers.

4.9.2.1 Getting Ready to Make the Changes

Shut down the OS and halt the CPU. Wait until the OpenBoot prompt (ok) appears.

Then, disable the CPU from automatically booting until the configuration process is completed:

```
ok setenv auto-boot? false
```

Set the OpenBoot input and output devices to recognize the board.

```
ok setenv input-device keyboard
```

```
ok setenv output-device screen
```

4.9.2.2 NVEDIT Command Summary

The next section makes use of the OpenBoot ***nvedit*** utility to change the default settings that are maintained in the ***nvramrc*** file by OpenBoot for the Rastergraf FCode.

NVEDIT Commands

`Ctrl-N`	Go to the next line
`Ctrl-P`	Go to the previous line
`Ctrl-A`	Go to the beginning of a line
`Ctrl-L`	List the entire contents
`Ctrl-K`	Deletes a line
`Ctrl-C`	Exits the editor

Hitting the <Enter> key while in nvedit causes a new empty line to be inserted in the nvramrc.

Important Note: in order for the changes that have been made in NVRAM to take effect some processor boards (e.g., the Themis UltraSparcII) may require the following to be added as the **last** line of the nvramrc.

```
probe-all install-console banner
```

4.9.2.3 Setting the Console Resolution

The initial system default console resolution of the graphics board is 8 bits per pixel, 1152 x 864 @ 60Hz. It is capable of supporting additional console mode resolutions (all are 8 bpp) as shown in the following table:

Table 4-2 FCode Supported Display Modes

Index	Graphics	Refresh Rate	PC Type
0	1024 x 768	60 Hz	UVGA
1	1024 x 768	75 Hz	UVGA
2 *	1152 x 864	60 Hz	Sun
3	1152 x 864	75 Hz	Sun
4	1280 x 1024	60 Hz	SXGA
5	1280 x 1024	75 Hz	SXGA
6	800 x 600	60 Hz	SVGA
7	800 x 600	75 Hz	SVGA
8	640 x 480	60 Hz	VGA
9	640 x 480	75 Hz	VGA
a	1152 x 900	60 Hz	Sun (old)
b	1152 x 900	75 Hz	Sun (old)
c	1600 x 1200	60 Hz	UXGA
d	1920 x 1200	60 Hz	WUXGA

*** - initial system default**

To change the startup console display mode, identify the desired graphics resolution and refresh rate and enter the corresponding index value (e.g., 6 is the index value for 800 x 600 @ 60hz) in place of the word ***index,*** as shown in the below.

```
[at the ok prompt]
```

type **nvedit**

receive `0:` [if, instead, you receive 0: and some text, type <ctrl-k> to clear the line]

type ***index*** **constant eclipse3-console-mode <return>**

receive `1:` [if, instead, you receive 1: and some text, just ignore it]

type **^C**

receive `ok`

type **nvstore**

receive `ok`

4.9.2.4 Setting the Sync Mode

The initial system default sync signal output type of graphics board is separate, positive polarity. The board is capable of generating additional sync output signals as shown in the following table:

Table 4-3 FCode Sync Output Modes

Mode	Sync Mode	Horizontal Polarity	Vertical Polarity	Blanking Pedestal	Install JP101
0*	Separate	positive	positive	n/a	no
1	Separate	positive	negative	n/a	no
2	Separate	negative	positive	n/a	no
3	Separate	negative	negative	n/a	no
4	Composite	negative	negative	n/a	no
5	Reserved	Reserved	Reserved	Reserved	Reserved
6	Sync on Green	negative	negative	yes	yes
7	Sync on Green	negative	negative	no	yes

*** - initial system default**

If you do not wish to change the display mode, please skip to the next section.

To change the startup sync output mode, identify the desired sync output mode and enter the corresponding index value (e.g., 6 is the index value for Sync On Green with Blanking Pedestal) in place of the word ***mode***, as shown below.

```
[at the ok prompt]
```

type **nvedit**

receive `0: <index> constant eclipse3-console-mode`

[if, instead, you receive 0: but no text, it means that the console mode is not set]

type **<return>**

receive `1:` [if, instead, you receive 1: and some text, type <ctrl-k> to clear the line]

type ***mode*** **constant eclipse3-console-sync <return>**

receive `2:` [if, instead, you receive 2: and some text, just ignore it]

type **^C**

receive `ok`

type **nvstore**

receive `ok`

4.9.2.5 Setting the Console Background and Text Display Appearance

The initial system default console background and text display appearance is **Black Text on a White Background.**. Alternatively, White Text on a Black Background (it will look like this: Eclipse3).

To change the appearance, enter the new mode (0 for Black Text, 1 for White Text) in place of the word ***appear*****,** as shown below.

```
[at the ok prompt]
type    nvedit
receive 0: <index> constant eclipse3-console-mode
        [if, instead, you receive 0: but no text, it means that the console mode is not set]
type    <return>
receive 1: <mode> constant eclipse3-console-sync
        [if, instead, you receive 1: but no text, it means that the console sync is not set]
type    <return>
receive 2:      [if, instead, you receive 2: and some text, type <ctrl-k> to clear the line]
type    appear constant eclipse3-console-background <return>
receive 3:      [if, instead, you receive 3: and some text, just ignore it]
type    ^C
receive ok
type    nvstore
receive ok
```

4.9.2.6 Activating Eclipse Console Mode Features

To display the nvramrc contents:

```
[at the ok prompt]
type    printenv nvramrc
receive 0: <index> constant eclipse3-console-mode
receive 1: <mode> constant eclipse3-console-sync
receive 1: <appear> constant eclipse3-console-background
```

`<index>, <mode>` and `<appear>` will be the values you entered. Now, make OpenBoot to use the information contained within nvram:

```
type    ^C
receive ok
type    setenv use-nvramrc? true
receive ok
type    reset
```

4.10 Using a Argus/Gemini Board in a PowerPC

If the CPU's on-board firmware is VGA aware, it should initialize the graphics board and use it as the system console. However, most PowerPC (PPC) based computers don't have generic VGA support. Newer ones are not "chrp" or "prep" compliant anymore, so they don't know about FCode.

Otherwise, you will have to boot using a serial terminal and only after the graphics software has been installed and run will you see anything.

4.11 Final Checks

If you are running in a PC, then you should get the usual PC displays. If you have multiple graphics boards installed, only one will be initialized by the BIOS. Once you have installed the Windows 2K/XP multihead drivers and reboot, all screens will be initialized as the OS boots.

In the case of X Windows, your monitor should display a uniform stippled raster and a cross-hair cursor, which is controlled by the mouse. If you have multiple graphics boards installed, all screens will be initialized and display the stipple once you have the server installed and running.

For SDL, demo programs are provided that may be run to put test patterns on the screen(s).

Pictures!

Once you have a picture on the screen, you may need to adjust the width, height, brightness, contrast, and hold controls on your monitor to get a good, centered image. If these controls don’t adjust the image properly, the parameters used to set the graphics timing registers might be wrong. If you have any trouble with any part of the installation call or email Rastergraf for assistance, or refer to Chapter 4.

Chapter 5
Programming On-board Devices and Memories

5.1 Introduction

The Argus, Gemini, and Sirena graphics boards are mostly an assemblage of "black box" parts and there isn't a lot of external logic that goes between them. Thus, the following sections don't provide much programming information about the chips themselves. That is left to the published information. Section 1.3 provides a list of appropriate publications that include manufacturer's data sheets and manuals.

Rather, the following sections just summarize the devices and but mostly focus on "hints and kinks". They are intended to supply information unique to the use of the chip on the graphics board.

Rastergraf offers a variety of software to support these graphics boards running under Solaris, Windows 2000 and XP, VxWorks, and Linux. These offerings are covered in detail on the Rastergraf web page (http://www.rastergraf.com).

Note

Please read these sections **before** starting on this chapter:

Section 1.1	Functional description of the Argus, Gemini, and Sirena boards.
Chapter 4	Installation

This chapter includes the following other sections:

5.2 Borealis Graphics Accelerator
5.3 Borealis Clocks
5.4 Synchronous Graphics RAM (SGRAM)
5.5 Video Timing Parameters
5.6 System Management Devices
5.7 Talk to Me Through I^2C
5.8 DVI Digital Video Output
5.9 uPD720101 USB 2.0 Controller
5.10 uPD720101 USB 2.0 Controller
5.11 Bt878A Video Input Digitizer
5.12 Flash EEPROM
5.13 Serial EEPROM

5.2 Borealis Graphics Accelerator

> **Note**
>
> The ***Borealis Technical Manual*** is available from Rastergraf under NDA.

5.2.1 Introduction

This section describes the architecture and includes a block diagram for Borealis high performance graphics controller, which includes a 33/66 MHz PCI compliant interface with no additional external logic required.

Please see the following page for a Block Diagram of the Borealis.

Software may interact with Borealis by directly manipulating pixels through the frame buffer interface or by the Borealis3D's highly pipelined graphic processor architecture. This architecture allows for high performance 2D and 3D Rendering. After a sequence of commands and parameters are written, Borealis executes the selected command without any further host processor intervention.

5.2.2 Host Bus Interface

The Host Bus Interface provides an interface to the PCI system bus. It implements a full PCI slave interface, responding to reads and writes of configuration, memory, and I/O cycles. It also implements a PCI master interface for specific memory writes. It also generates peripheral bus control for flash EPROM.

5.2.3 Frame Buffer

Each Borealis channel supports one local frame buffer of 16 MB with a data bus width of 128 bits to SGRAM memory. The local buffer may be used as a display buffer, as well as off-screen memory to be used for the storage and manipulation of bitmaps, texture maps, Z buffering or fonts. The buffer may be accessed as a linear buffer through the Frame Buffer interface or through the drawing engine.

.

5.2.4 Block Diagram

Borealis is partitioned into the following functional sections:

- Host Bus Interface
- Aperture Controller
- Drawing Engine
- CRT Controller
- Memory Controller
- Internal VGA
- Internal RAMDAC

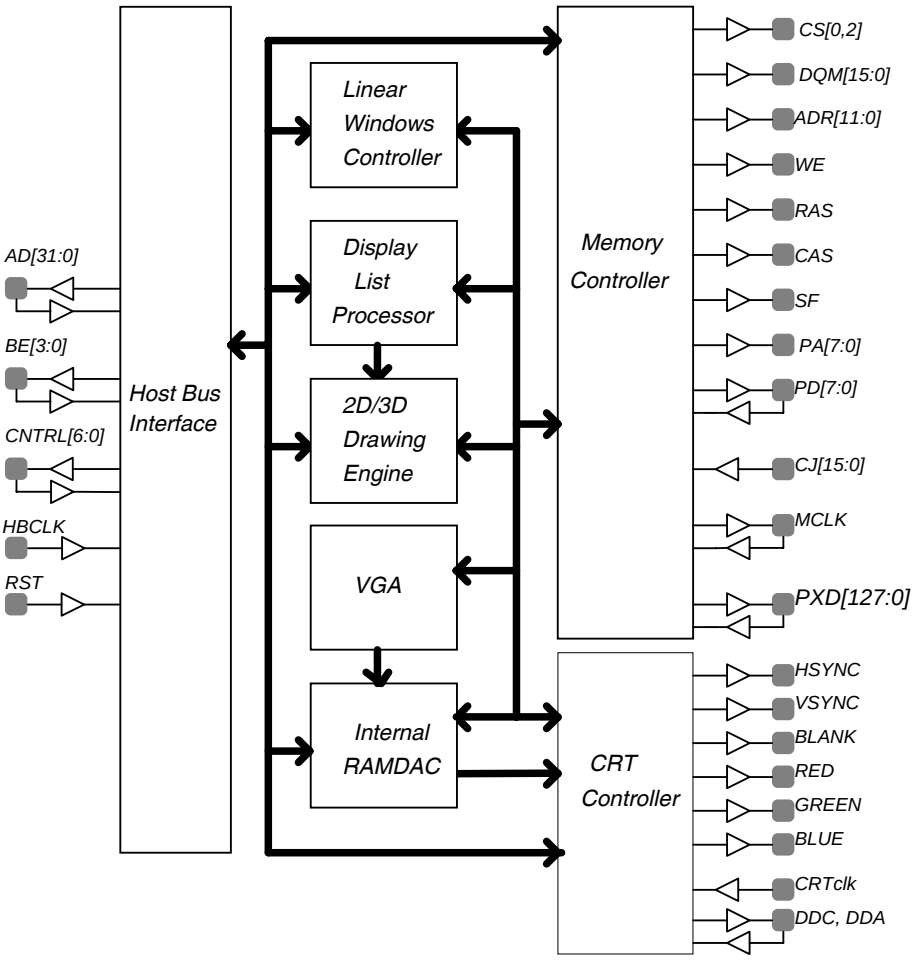


Figure 5-1 Borealis Block Diagram

5.2.5 Linear Windows Controller

The Linear Windows Controller provides address decoding, address translation, color space conversion between the host interface and the local memory system. It also provides a mechanism for caching reads and writes from the host bus to the local buffers. In write mode, up to eight 32-bit words may be written to the host bus cache. The cache continuously monitors the address of each word written to determine if they are in the same page. If the words are not in the same page, or if the cache word count reaches eight, the cache will request the required number of memory writes from the Memory Controller. At this time the cache controller swaps access to its second cache and continues to accept host writes. If another page fault is detected during the secondary cache fill, a system stall will occur. This situation can be avoided by testing the cache and by doing cache line fills. During reads latency will be incurred for initial accesses or any page fault conditions. Software should make an effort to maintain scan line coherency during any access to the local buffers for optimal performance.

5.2.6 Drawing Engine

The Drawing Engine provides all the required logic to implement BITBLT, LINE, LINE_3D, TRIAN_3D, and HOST XFER commands. The Drawing Engine, when triggered, transfers command and parameter information from the host accessible registers to its own local working registers where it begins its setup phase. When the Drawing Engine is done with its setup, it begins the execution of a specific algorithm for the associated command.

For non-rendering commands, after the setup phase, the Drawing Engine begins requesting memory access from the Memory Controller. For 2D and/or 3D rendering commands, the object is piped through the algorithmic rendering engine which begins requesting memory access from the Memory Controller as soon as the first pixel/texel is generated. Up to 2 rendering commands can be piped through the rendering engine at the same time.

If read data is requested, the memory controller will control the loading of the data into the Drawing Data path and will notify the Drawing Engine that the data is now available. If write data is requested, the data will have been previously setup in the drawing data path and the Memory Controller will control the output of that data to the selected memory buffer.

5.2.7 Display List Processor

The Display List Processor (DLP) is used to feed a set of commands to the Drawing Engine. The DLP uses a 128-bit instruction word. The instruction formats allow for each word to write up to three Drawing Engine registers or two text glyphs. There is a four register mode which only writes XY0, XY1, XY2, and XY3. This mode cannot be mixed with any other mode.

5.2.8 CRT Controller

The CRT Controller provides programmable CRT timing signals: horizontal, vertical blanks and syncs. It is also responsible for generating requests to the memory controller for screen refresh cycles. A free running frame counter which generates interrupts to the Host is also provided. This is useful for synchronizing bit map copies. CRT Controller also provides display refresh data for the internal RAMDAC.

5.2.9 Memory Controller

The Memory Controller arbitrates and controls all access to the local memory buffer by the Host Interface, the CRT controller, and the Drawing Engine. This unit provides support for SGRAM memory.

5.2.10 VGA Core

The Borealis incorporates an IBM-compatible VGA core. The VGA core implements the standard VGA register set for the various VGA components (CRT controller, sequencer, graphics controller, attribute controller, etc.) and is capable generating the standard VGA modes (00h - 07h, 00h - 13h). The control of memory and CRT signals can be switched between the VGA core and the Borealis. The VGA memory space is shared with the Borealis frame buffer and is sparsely mapped within it.

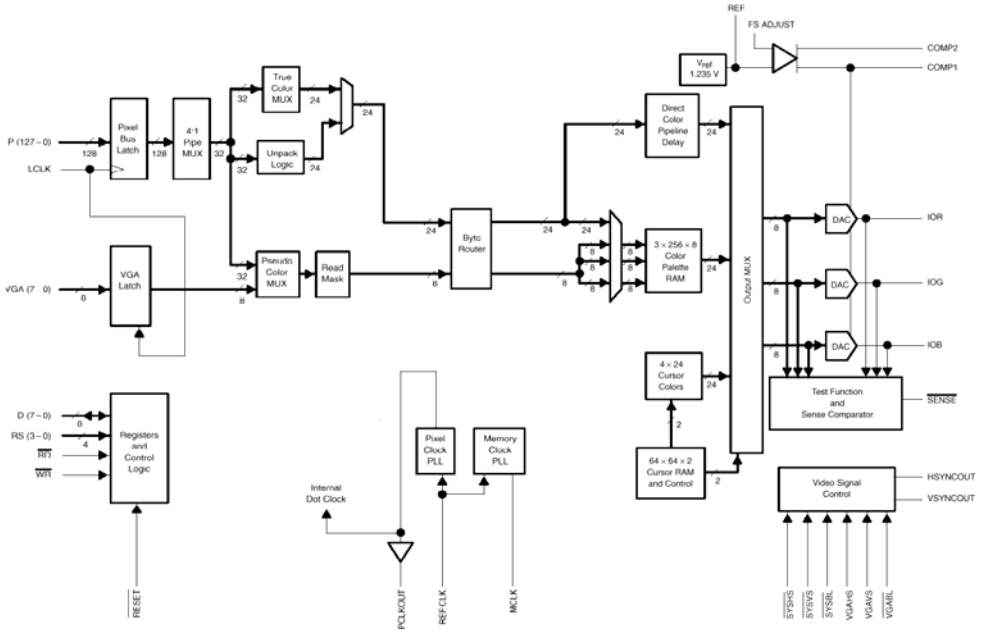
5.2.11 Internal RAMDAC and PLL Clock Generators

The RAMDAC transforms the raw data from the CRT controller into signals that an analog or digital monitor can understand. In the process, it can add gamma correction and a high-resolution cursor. The RAMDAC also provides two programmable clocks which can range from 25 MHz to 250 MHz: one for the memory controller, and the other for the pixel data.

Feature Summary

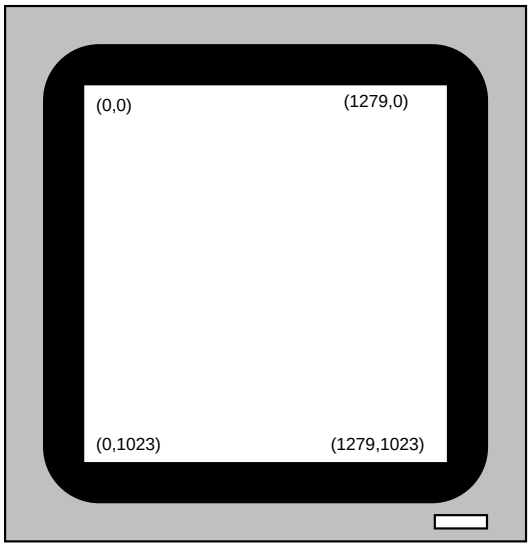
- 250 MHz operation
- 128-bit wide pixel data bus
- Fine-grained PLL programming optimizes display
- Pixel re-synchronization ensures integrity of all display modes
- Large Screen ISO-compliant refresh rates
- 8/15/16/32-bits per pixel
- 32 bpp Direct Color Gamma correction
- 256-shade gray scale
- Three 256x8 color palette RAMs
- Triple monotonic 8-bit DACs
- 64x64/32x32 translucent hardware cursor
- 100 MHz 8-bit VGA data input
- On-chip diagnostic functions
- Power-down modes

Figure 5-2 Internal RAMDAC Block Diagram



5.2.12 Coordinate System

The screen coordinate system has its origin at the upper left hand corner of the screen, with the X coordinates incrementing left to right and the Y coordinates incrementing top to bottom. The coordinate system for a 1280 by 1024 display is shown in below.



Everything performed in X-Y space is done using 16-bit 2's complement integers. This includes: destination X and Y coordinates, registers that are specified in XY format, and arithmetic operations.

Rendering commands use X and Y coordinates that are specified in IEEE Single Precision Floating Point (***ISPFP***) format and then converted to 16-bit 2's complement integers.

In all cases, no overflows will be detected or reported. Care must be taken for drawing operations not to exceed the 16 bit coordinate space.

The display buffer is accessed in this format by specifying the coordinate, the source and/or destination space origin, and the buffer pitch. From this organization it can be seen that the pitch of the display buffer can be changed on a command-by-command basis.

The Z buffer can be either 16bits in 16bpp mode or 24bits (packed into the lower 3 bytes of a 4byte DWORD) in 32bpp mode. As with the display buffer, the Z buffer can be accessed by specifying the Z buffer origin, Z buffer pitch and the (x,y) coordinate of the Z buffer. The Z values go through an ***ISPFP*** setup engine and are converted to the appropriate format (16 or 24 bits) before it is stored into the Z buffer.

5.2.13 Borealis Build Options and Power-up Settings

The Borealis is a "Plug and Pray" device, whose operation depends on the software. Except as documented in ***Section 4.3.3***, there are no user jumpers.

The Technical Manual documents a number of register preloads and functional settings that are determined by 0 ohm resistors installed during manufacturing and read by the Borealis on power up.

Note: Software cannot override the values set by the 0 ohm resistors. Please contact Rastergraf if it is necessary to change a value.

Table 5-1 Borealis Configuration Settings

CJ	In/Out	Function	Default
31	in	PCIBAR 0, 1 address size	16 MB video memory (Argus/Gemini) 32 MB video memory (Sirena)
30	out		
	in		
29	in	BIOS PROM enable	Enabled
JP201	out	PCI device sub class	VGA
	in		"Other Device"
27	in	SGRAM density	32 Mb x 32 bit wide
26	in		
25	in	Internal RAMDAC	Enabled
24	in	Enable SGRAM	Enabled
23	in	Enable PCI	Enabled
22-20	out	Subsystem ID	Subsystem ID Code
19	out/in		16/32 MB video memory
18	in		
17	in		
16	in	Enable Sub. Vendor ID	Enabled
15-13	in	Subsystem Vendor ID	Rastergraf PCI Vendor ID 0x10F0
12	out		
11-8	in		
7-4	out		
3-0	in		

5.3 Borealis Clocks

The Argus/Gemini boards have several clocks.

DECLK is the Borealis Drawing Engine clock and is generated by the CY2292 clock synthesizer. A two frequency select allows the DECLK to be set to 75, 80, 90, or 100 MHz, depending on the operating conditions of the system. The default is 75 MHz.

REFCLK is the Borealis PLL reference clock, and is generated by the CY2292 clock synthesizer. It is fixed at 37.5 MHz.

LDCLK is generated by the Borealis internal video clock PLL. It is an auxiliary clock output (from the Borealis) and is used as the pixel clock for the digital output. One pixel is output for ***each edge*** of LDCLK.

SECLK is the Borealis Setup Engine clock. Its source is selected under program control using a register in the Borealis. The choices include the PCI bus clock and MCLK/2.

VCLK is the Borealis video (pixel) clock and is generated by a PLL internal to the Borealis. It uses the REFCLK as its PLL reference. The pixel frequency can be set to between 25 MHz and 250 MHz.

MCLK is the Borealis memory clock for the Borealis memory controller and SGRAM interface. and is generated by an independent PLL internal to the Borealis. It uses the REFCLK as its PLL reference. The frequency can be set to between 25 MHz and 250 MHz, although the usable memory frequency limit is about 125 MHz.

When the Argus/Gemini powers up, MCLK is REFCLK and VCLK is undefined. Once the VGA BIOS (or, if in a non-PC environment, the Argus/Gemini graphics software) is executed, the MCLK and VCLK PLLs can be programmed to select higher frequencies in accordance to the desired display format and memory timing.

A consequence of the multi-clock nature of the Borealis is that if you read a register driven by the pixel clock (e.g. VCOUNT), you may get erratic results because the host bus interface uses a different clock. You have to read the register twice, read the comparison flag or use interrupts to get correct results. The reason for this is simple: the VCOUNT register can change state in the middle of a Borealis host read cycle. Its operations are totally asynchronous to the Borealis PCI bus interface clock.

5.4 Synchronous Graphics RAM (SGRAM)

The display memory chips are expressly designed for high-speed graphics applications. These devices are called Synchronous Graphics RAMs (SGRAMs).

The SGRAM replaces the previously used Video RAM, which had a two-port design with separate video output that drove an external RAMDAC. While the VRAM was potentially able to supply substantially better performance than the SGRAM, the price pressures of the PC market made it too expensive.

The SGRAM is a single port device: the random access and video refresh access data all come out on the same data lines, and are routed through the graphics controller. The SGRAM can be built on the same fab line as SDRAM, and, by adding a few graphics-oriented features, combined with building the RAMDAC into the graphics controller, provides a more cost effective solution at a small performance penalty.

The video refresh reads a block of video data into a FIFO in the Borealis which eventually passes the data to the on-chip RAMDAC. Depending on the horizontal line pixel count, the video refresh transfer operation may have to be repeated several times during the raster line time to keep the FIFO filled. The SGRAM is available for random access operations at all other times. There is a small additional overhead time for memory refresh, which occurs about once every 15 us. The SGRAM availability for random access is about 75%. The Borealis uses 32 Mb Samsung K4G323222A-2x512K x 32 SGRAM.

Write-per-bit Registers

SGRAM has a write-per-bit feature that allows bit planes to be selectively write enabled. This feature allows the Borealis to perform write operations instead of read-modify-write operations, which can be a significant performance enhancement. When updated, the Borealis write-per-bit register contents are automatically stored in the SGRAM using the persistent write-per-bit function.

SGRAM Color Register and Block Fill Special Function

The Borealis can use the SGRAM block write and color register special functions. The color register is used in conjunction with the SGRAM block fill mode to enable up to 8 adjacent 32-bit locations in the SGRAM to be written in one cycle. In this way, one can quickly replicate 1-D and 2-D patterns in memory at many times the single pixel rate. Using block write, up to 128 (16 byte data bus * 8 locations/block) 8-bit pixels can be

written in each 10 ns page mode cycle, resulting in a 12.8 Gpix/sec FILL time.

Display Memory Size

The pixel size is programmable to 8, 15, 16, or 32 bpp. The SGRAM on the Argus/Gemini is constrained by available space to 16 MB (Sirena can have 32 MB), where a MB = 1024 * 1024 bytes. Calculate the possible display formats based on these values.

Note that you can render into SGRAM that is not being used in the active display, and by changing the starting address register in the Borealis pan to it so it is visible or BitBLT the Pixmap data to a static display window.

5.5 Video Timing Parameters

The Borealis must be programmed to generate the proper video timing for the hardware configuration and display format. The Rastergraf **SDL** Graphics Library Package accepts display format (e.g. 1600 x 1200, 32 bpp) and refresh requirements (e.g. 67 Hz vertical refresh) as parameters to a function call. The software then provides (and loads) a best-fit timing profile for the Borealis graphics chip.

Similar display format information is provided in a configuration file for the Rastergraf PX Windows server.

Does your Display have a Green Cast to it?

By default, the Argus, Gemini, and Sirena supply video in separate (five wire video RGBHV) video format. If you hook the graphics board up to a multiscan monitor with a regular VGA cable then you will be giving RGBHV to the monitor. Be sure to not select sync-on-green in the jumper setting (Section 4.3.3) or you will get a green cast to the image.

Table 5-2 Standard Graphics Display Formats

Format Name	Pixel Resolution	Aspect Ratio
QXGA	2048 x 1536	4:3
UXGA	1600 x 1200	4:3
SXGA+	1400 x 1050	4:3
SXGA	1280 x 1024	5:4
QVGA	1280 x 960	4:3
XGA	1024 x 768	4:3
SVGA	800 x 600	4:3
VGA	640 x 480	4:3

5.5.1 Application Note: Adjusting the Timing Parameters

Most monitors have adjustments for Horizontal Frequency, Horizontal Position, Horizontal Size, Vertical Frequency, Vertical Position and Vertical Size. It is recommended that the monitor adjustments be tried before trying monitor settings not in accord with the monitor data sheet.

Rastergraf SDL software allows you to define the timing parameters in one of two ways:

a) you tell SDL that you are using a multiscan monitor. You specify the display active width and height (e.g. 1600 x 1200) and the Vertical Frequency, and the program figures out the rest.

b) you tell SDL exactly what you want the timing to be. You specify:

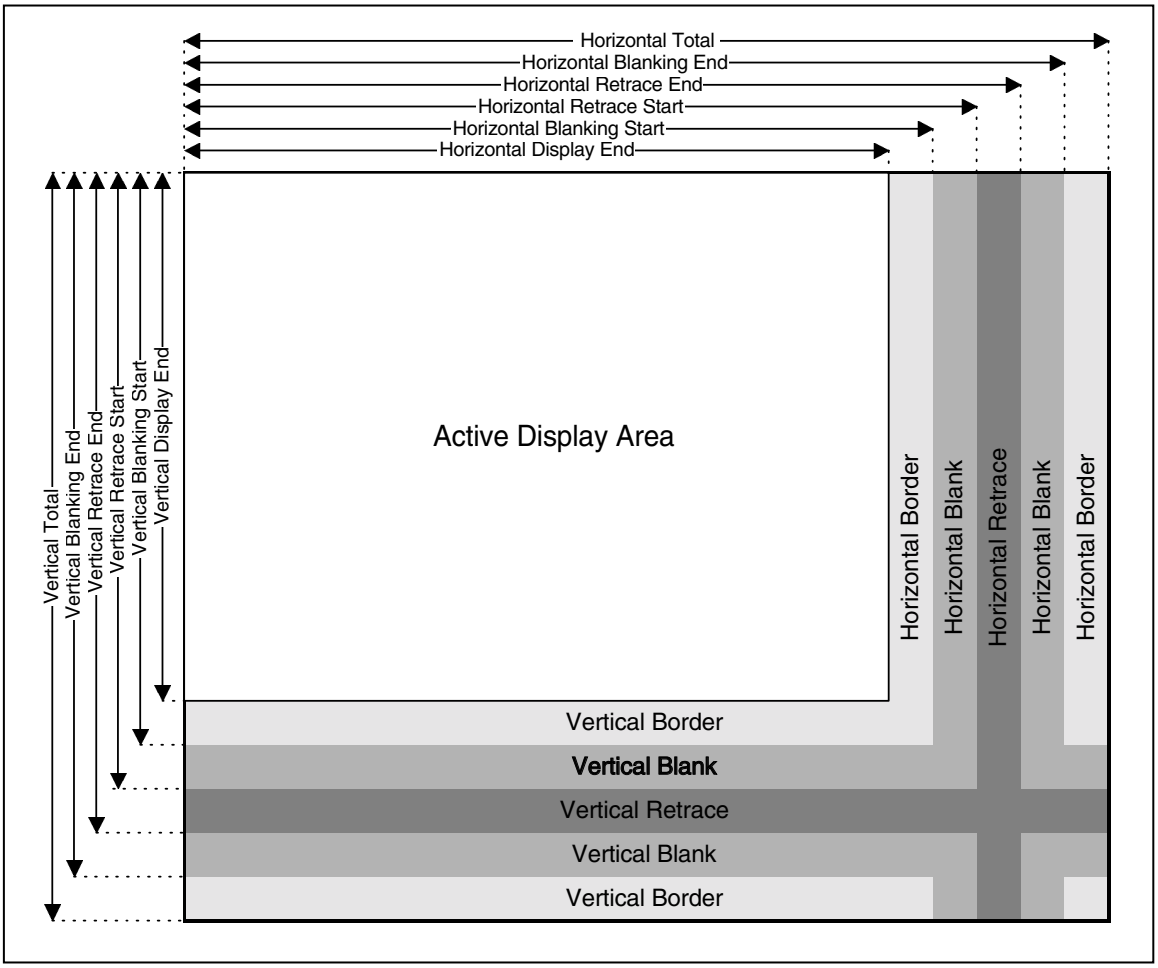
- vertical frequency in Hz
- vertical blanking in milliseconds (ms)
- vertical front porch in ms
- vertical sync width in ms
- horizontal blanking in microseconds (us)
- horizontal front porch in us
- horizontal sync width in us
- display width and height

The program derives the horizontal frequency from this information. Ordinarily, you should be able to use the monitor's data sheet to obtain a satisfactory display. However, it may be that adjustments are required. This section gives you some advice on how to do this. You can also send Rastergraf a filled-in copy of the parameters sheet which follows this section.

Declaration

Rastergraf is dedicated to making your application work. We can assist in determining special video timing parameters for specific monitors and other output devices. If you need help it would be very useful if you can gather the data requested in the following form before calling us.

Figure 5-3 Video Display Timing Fields



To change the horizontal frequency:

The horizontal frequency is also known as horizontal refresh rate or horizontal scan rate. Indications that the horizontal frequency needs to be changed are an unviewable picture with diagonal lines. Some monitors display no picture when the horizontal frequency is out of its bandwidth. The same symptoms can be caused by no sync at all, so make sure that the cables are connected correctly and that the monitor is configured correctly. When the picture is out of sync, the number of diagonal lines is an indication of how close to the correct horizontal frequency you are: fewer lines are closer, more lines are farther. Remember that changing the horizontal frequency will also affect the vertical frequency. Decreasing the horizontal frequency will generally result in a wider picture.

To change the horizontal position:

To shift the image *left* **increase** the horizontal front porch by the same amount. Perform the converse procedure to move the image to the *right*.

To change the width of the image:

The best way to change the width of the image is to change the pixel clock frequency. If you want to change the pixel clock but not any other timing parameters, then increasing the frequency will result in a narrower image and decreasing it will result in a wider image While there are ways to change the width (horizontal size) of the image without changing the pixel clock, they affect other timing parameters and can lead to complications.

> **Note:**
>
> To keep the timing intervals the same when changing the pixel clock you have to enter new horizontal timing parameters.

To change the vertical frequency:

The vertical frequency is also known as vertical refresh rate or vertical scan rate. Indications that the vertical frequency needs to be changed are a picture which rolls up or down. Sometimes the appearance is of multiple pictures, one on top of another, with multiple horizontal lines. A very slow vertical frequency will cause the image to flicker. Some monitors display no picture when the vertical frequency is out of its bandwidth. Since the same symptoms can be caused by no sync at all, make sure that the cable is connected correctly and that the monitor is configured correctly.

To change the vertical position:

To shift the image *up* **increase** the vertical front porch by the same amount. Perform the converse procedure to move the image *downward*.

To change the height of the image:

There are two ways to change the height (vertical size) of the image.

1) Change the number of lines. The image aspect ratio remains the same.

2) Change the vertical frequency. Increasing the vertical frequency will result in a shorter image, decreasing it will result in a taller image.

5.5.2 Pan and Scroll

Panning and scrolling (also called roaming) are techniques used to provide a window into a larger memory than can be displayed. The display X (pan) and Y (scroll) starting points are changed, allowing new data areas to be displayed. This function is appropriate when using a display format which doesn't use up all of memory. For example, a 16 MB board with a 1280 x 1024 x 8 bpp format gives you ***almost thirteen*** full screens to roam around in. Routines in the Rastergraf SDL software provide you with an easy way to pan and scroll in memory.

Table 5-3 Video Timing Parameter Request Form

Request for Assistance in Determining Video Timing Parameters

Submit to:
Rastergraf, Inc.
1804-P SE First St.
Redmond, OR 97756
(541) 923-5530
fax: (541) 923-6475
email: support@rastergraf.com

Company Information
Company Name_____
Contact_____
Phone Number_____
Fax Number_____
email_____

Monitor Information
Monitor Brand_____ Model Number_____

Argus/Gemini/Sirena Information
Model Number_____ Serial Number_____

Horizontal Timing Information
Note: Horizontal timings may be given in pixel units (if given) or time units.
Horizontal Pixels per Line Displayed_____
Pixel Time or Frequency (optional)_____
Horizontal Total Line Time or Frequency_____
Horizontal Front Porch_____
Horizontal Sync Width_____
Horizontal Back Porch_____

Vertical Timing Information
Note: Vertical timings may be given in line units or time units.
Vertical Lines Displayed_____
Vertical Lines Total or Frequency (Field Rate)_____
Vertical Front Porch_____
Vertical Sync Width_____
Vertical Back Porch_____

Sync Information
Sync Polarity (+ or -): Composite:_____ Horizontal:_____ Vertical:_____

Additional Notes
_____
_____

5.6 System Management Devices and Functions

The Argus, Gemini, and Sirena boards have devices that are specifically intended to assist in system management. These include:

- A National Semiconductor LM75 I^2C temperature sensor located near the center of the board chip provides local temperature measurements. You can obtain the data sheet and collateral information for the LM75 from the technical document section on the Rastergraf web site;
- A 2 Kb I^2C Serial EEPROM which can be used by system software to store data such as serial number and software revision. This is accessed through the PLX PCI6154 (Argus/Sirena) or PCI6520 PCI Bridge;
- In addition, there are features of the Borealis chip that are useful:
- Power management control registers allow various parts of the chip to be put powered down without making the chip entirely useless;
- Signature registers in the RAMDAC can be are used to confirm that a test pattern in display memory will pass correctly through the Borealis all the way to the DAC inputs. This is useful as a Built In Self Test (BIST) function;
- When the board is properly connected to a monitor and a test image is displayed on the monitor, a certain level voltage will be developed at the DAC outputs that drive the monitor. A simple A/D reads the voltage and confirms that the DAC output is above a certain threshold level;
- The I^2C-based DDC2B protocol is used to control the display monitor(s). DDC2B is a VESA standard (http://www.vesa.org/) which allows the frame buffer to read the Additional Display Identification Data (EDID) from the monitor. The EDID includes resolutions supported, maximum width and refresh, and sync type;

5.7 Talk To Me Through I^2C

The I^2C protocol is a 2 wire serial bus originated by Philips Semiconductor. As used on the Argus, Gemini, and Sirena, the I^2C devices are associated with a particular master such as a bridge. An I^2C device base address is determined by a combination of device internal bits (bits 4-7) and (usually) three pins that are wired by the board designer (bits 1-3) Bit 0 is used to denote a Read (1) or Write (0) operation. Since most vendors combine the R/W bit with the actual I^2C address (e.g. write @ 0x88, read @ 0x89), the table (below) uses that convention.

The graphics boards have several 2Kbit Serial EEPROMs which can store user data and Vital Product Data (VPD) code used by Windows.

An LM75 thermal sensor, placed near the center of the board on Side 1, has limit flags, interrupts, and real-time temperature read back. The LM75 must be read in 2 byte increments, otherwise it will hang the I^2C bus.

Table 5-4 I^2C Device Addresses

Device	Channel	Master/Slave	Address R/W	Used On	I^2C Bus
PCI6154 Primary PCI Bridge	-	Master		Argus/Gemini	0
PCI6520 Primary PCI Bridge	-	Master		Sirena	0
AT24C02	-	Slave	0xA9/8	All	0
Borealis 2D/3D Graphics	A	Master		All	1
Display Monitor	A	Slave	0xA9/8	All	1
TH63DV164	A	Slave	0x71/0	All DVI	1
LM75	-	Slave	0x9D/C	All	1
CY22150 Reference Clock		Slave	0x69/8	All	1
Borealis 2D/3D Graphics	B	Master		Argus/Gemini	2
Display Monitor	B	Slave	0xA9/8	Argus/Gemini	2
TH63DV164	B	Slave	0x71/0	Argus/Gemini	2
CY22150 Reference Clock	B	Slave	0x69/8	All	2
PCI6150 Secondary PCI Bridge	-	Master		Argus/Gemini	3
AT24C02	-	Slave	0xA9/8	not used	3
Bt878A Video In	A	Master		Argus/Sirena	4
AT24C02	A	Slave	0xA9/8	Argus/Sirena	4
Bt878A Video In	B	Master		Argus	5
AT24C02	B	Slave	0xA9/8	Argus	5
uPD720101 USB 2.0 Host Ctrlr	-	Master		Argus	6
ISP1561 USB 2.0 Host Ctrlr	-	Master		Sirena	6
AT24C02	-	Slave	0xA9/8	Argus/Sirena	6
UAC3556B USB Audio Ctrlr	-	Master		Argus/Sirena	7
AT24C02	-	Slave	0xA9/8	not used	7

5.8 DVI Digital Video Output

5.8.1 General Description

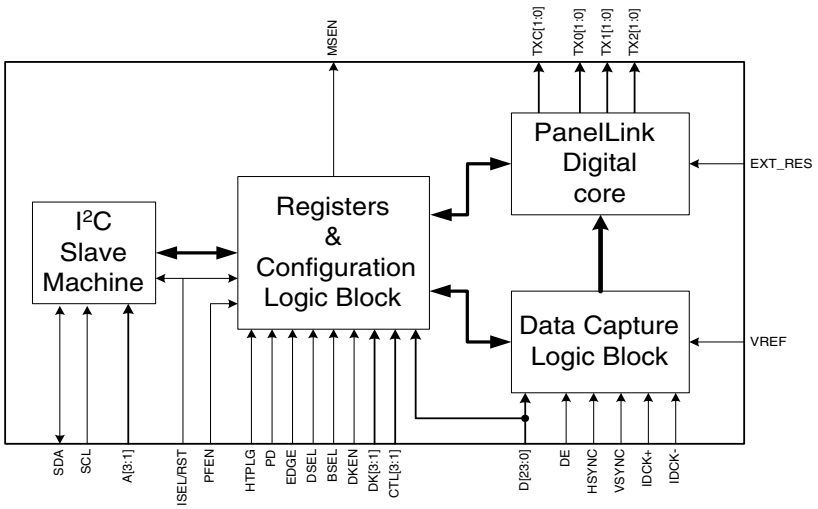
The THC63DV164 transmitter uses DVI technology to support displays ranging from VGA to UXGA resolutions (25-165Mpix/s) in a single link interface. As used on the Argus, Gemini, and Sirena, the THC63DV164 is connected to the Borealis graphics chip via 24-bit mode, one pixel per clock edge interface. The THC63DV164 is programmed though an I^2C slave interface, eliminating the requirement for external programming pins. The THC63DV164 supports Receiver Detection for a variety of power management options.

Features

- 25 - 165 Megapixels/sec (VGA to UXGA)
- Uses 24-bit single clock, dual edge (24-bit pixel data)
- I^2C Slave Programming Interface
- Receiver Detection reports good monitor connection
- De-skewing option: varies clock to data timing
- Supports cable length over 5m with twisted pair, fiber-optics ready
- DVI 1.0 compatible

You can obtain the data sheet and other information for the THC63DV164 from the technical document section on the Rastergraf web site.

Figure 5-4 THC63DV164 Block Diagram



5.8.2 CY22150 Reference Clock

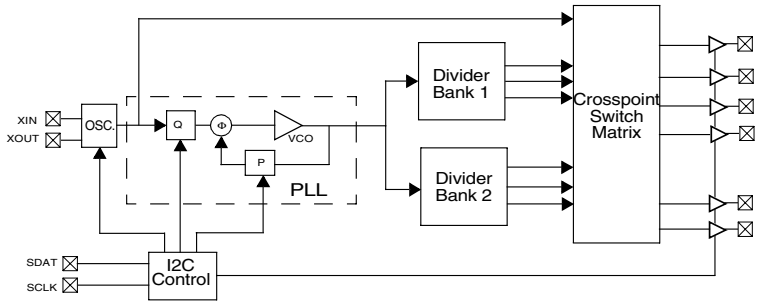
The PLL clock in the Borealis is susceptible to noise because it is laid out such that its control lines go through the RAMDAC section of the chip. This can cause video pixel jitter and it is most noticeable when running high-resolution DVI output.

It is possible to turn off the internal PLL clock or to run it at a straight integer multiple of an external clock, either of which can substantially eliminate the video jitter and increase usable DVI margins by 20-30 MHz.

On the Argus, Gemini, and Sirena boards, a combination of these strategies is used in conjunction with a low-noise programmable clock, the Cypress CY22150. Programmed via an I^2C port (see Section 5.7), the chip provides the pixel clock or an integer sub-multiple of it for the Borealis.

Rastergraf software knows to look for the CY22150(s) and program accordingly.

Figure 5-5 CY22150 Block Diagram



5.9 uPD720101 USB Host Controller (Argus)

The NEC uPD720101 PCI-to-USB Bus Bridge is a Universal Serial Bus (USB) 2.0 controller. It combines high performance features such as PCI bus mastership with compliance to OpenHCI 1.0 and USB 1.0 specifications. It is compatible with Microsoft and Solaris USB drivers.

You can obtain more information about the uPD720101 from the Rastergraf web page or see Section 1.3.

To aid software compatibility across multiple operating systems, the uPD720101 replaces the Philips ISP1561 which was used in earlier versions of the Argus.

The uPD720101's multiple-connections architecture supports concurrent operation of up to 127 physical USB devices while maintaining top speeds. Using the USB standard low-cost 4-wire cables and connectors, it supports such devices as keyboard, mouse, monitor, scanner, and printer. The uPD720101 permits "Hot", insertion and removal of devices.

The uPD720101's OpenHCI protocol imposes comparatively low PCI and CPU overhead, making it suitable for USB devices which require up to 12 Mb/s, the USB design limit. It supports isochronous, bulk, interrupt, and control transfer types over the same set of wires. Isochronous means all connections or circuits are synchronized using a common clocking reference. This ensures consistent delivery and minimizes jitter.

The chip also supports the transfer of multiple data and message streams between the host and devices, and provides compound device support (i.e., peripherals composed of many functions). Applications such as telephony and audio are guaranteed bandwidth and low latencies.

The uPD720101 isochronous data transfer mode can use most of the PCI bus bandwidth, thus maximizing performance and efficiency. A wide selection of packet buffer sizes and latencies allows the maximum range of device buffering options. Flow control for buffer handling as well as an error handling/fault recovery mechanism is built into the protocol architecture.

The uPD720101's USB power-switching allows external devices to be shut off as desired. The Micrel power control chip detects and will report overcurrent conditions, and the uPD720101 will correctly report them .The uPD720101 has five ports, but due to connector limitations, not all ports are used.

5.10 ISP1561 USB Host Controller (Sirena)

The Philips ISP1561 PCI-to-USB Bus Bridge is a Universal Serial Bus (USB) 2.0 controller. It combines high performance features such as PCI bus mastership with compliance to OpenHCI 1.0 and USB 1.0 specifications. It is compatible with Microsoft and Solaris 8 USB drivers.

You can obtain more information about the ISP1561 from the Philips web page: http://www.Philips.com/html/usbsolutions.html.

The ISP1561's multiple-connections architecture supports concurrent operation of up to 127 physical USB devices while maintaining top speeds. Using the USB standard low-cost 4-wire cables and connectors, it supports such devices as keyboard, mouse, monitor, scanner, and printer. The ISP1561 permits "Hot", insertion and removal of devices.

The ISP1561's OpenHCI protocol imposes comparatively low PCI and CPU overhead, making it suitable for USB devices which require up to 12 Mb/s, the USB design limit. It supports isochronous, bulk, interrupt, and control transfer types over the same set of wires.

Isochronous (or, in non-computer-speak, isosynchronous) means all connections or circuits are synchronized using a common clocking reference. This ensures consistent delivery and minimizes jitter.

The chip also supports the transfer of multiple data and message streams between the host and devices, and provides compound device support (i.e., peripherals composed of many functions). Applications such as telephony and audio are guaranteed bandwidth and low latencies.

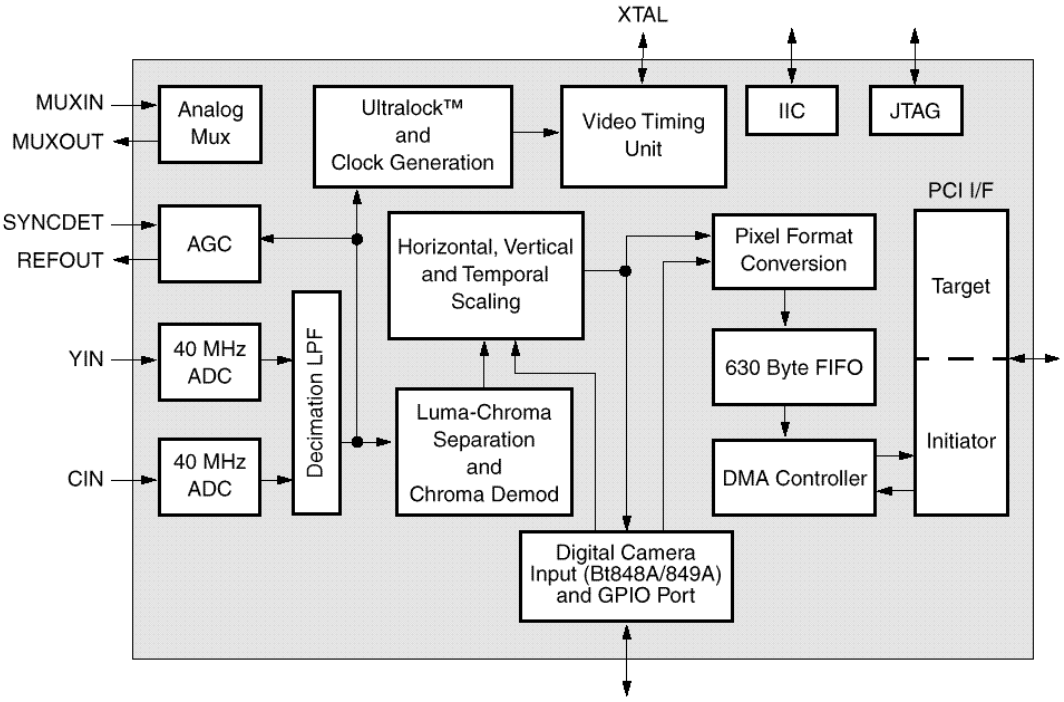
The ISP1561 isochronous data transfer mode can use most of the PCI bus bandwidth, thus maximizing performance and efficiency. A wide selection of packet buffer sizes and latencies allows the maximum range of device buffering options. Flow control for buffer handling as well as an error handling/fault recovery mechanism is built into the protocol architecture.

The Gemini implements the ISP1561's USB power-switching, allowing external devices to be shut off as desired. Due to a bug in the ISP1561, the power indication must be hard-wired on, so you can't tell if power is actually good. But, the Micrel power control chip detects and will report overcurrent conditions, and the ISP1561 will correctly report them.

5.11 Bt878A Video Digitizer (Argus/Sirena)

Conexant's Bt878A is a complete, low-cost, single-chip solution for analog NTSC/PAL/SECAM video capture on the PCI bus. As a bus master, the Bt878A does not require any local memory buffers to store video pixel data, which significantly minimizes the hardware cost for this architecture. Bt878A takes advantage of the PCI-based system's high bandwidth and inherent multimedia capability. It is designed to be interoperable with any other PCI multimedia device at the component or board level, enabling video capture and overlay capability to be added to PCI systems in a modular fashion at low cost. The Bt878A solution is independent of the PCI system bus topology and may be used directly on a motherboard planar bus, on a card for a planar, or on a secondary bus.

Figure 5-6 Bt878A Block Diagram



5.11.1 Bt878A Features and Specifications:

Product Features

- Fully PCI Rev 2.1 compliant
- Auxiliary GPIO data port and video data port
- Supports image resolutions up to 768 x 576 (full PAL resolution)
- Supports complex clipping of video source
- Zero wait state PCI burst writes
- Field/frame masking support to throttle bandwidth to target
- Multiple YCrCb and RGB pixel formats supported on output
- Supports NTSC/SECAM/PAL analog input
- Image size scalable down to icon using vertical and horizontal
- interpolation filtering
- Multiple composite and S-video inputs
- Supports different destinations for even and odd fields
- Supports different color space/scaling factors for even and odd fields
- Support for mapping of video to 225 color palette
- VBI data capture for closed captioning teletext and Intercast data decoding

Applications

- PC TV
- Intercast receiver
- Desktop video phone
- Motion video capture
- Still frame capture
- VBI data services capture

5.11.2 Implementation

The Bt878A is packaged in a 160-pin Plastic Quad Flat Pack (PQFP) with a 28 mm x 28 mm body size. It requires only a minimum of discrete support components and no local frame buffer. It is ideal for low-cost, graphics -independent video capture solutions.

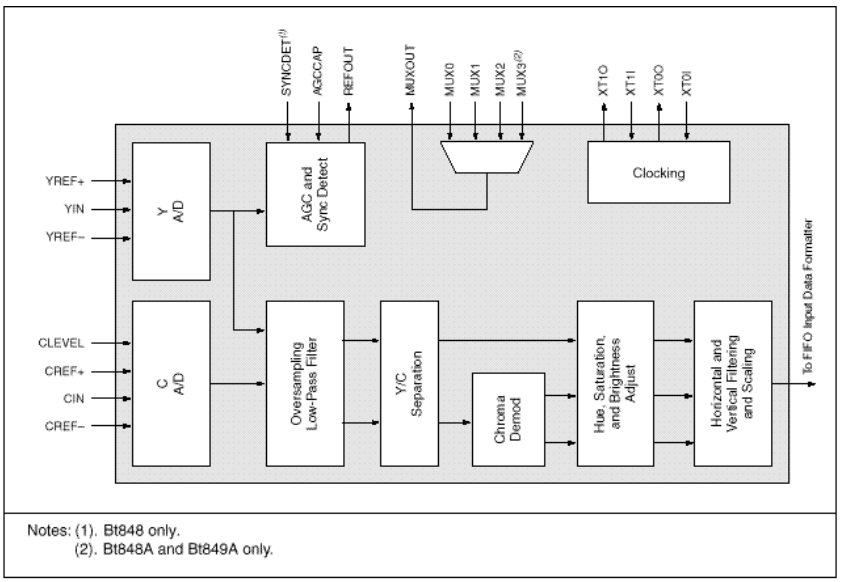
5.11.3 Video Capture Over PCI Bus

On a single device, the Bt878A integrates an NTSC/PAL/SECAM composite and S-Video decoder, scaler, DMA controller, and PCI bus master. The Bt878A can place video data directly into host memory for video capture applications and into a target video display frame buffer for video overlay applications. As a PCI initiator, the Bt878A can take control of the PCI bus as soon as it is available, thereby avoiding the need for on-board frame buffers. The Bt878A contains a small pixel data FIFO to decouple the high-speed PCI bus from the continuous video data stream.

The video data input may be scaled, color translated, and burst transferred to a target location on a field basis. This allows for simultaneous preview of one field and capture of the other field. Alternatively, the Bt878A is able to capture or preview both fields simultaneously. The fields may be interlaced into memory or sent to separate field buffers.

Figure 5-7 Bt878A Input Section Block Diagram

5.11.4 DMA Channels



The Bt878A provides two DMA channels for the odd and even fields, each controlled by a pixel instruction list. This instruction list is created by the Bt878A device driver and placed in the host memory. Instructions control the transfer of pixels to target memory locations on a byte resolution basis. Complex clipping can be accomplished by the instruction list blocking the generation of PCI bus cycles for pixels that are not to be seen on the display.

The DMA channels can be programmed on a field basis to deliver the video data in packed or planar format. In packed format, YCrCb data is stored in a single continuous block of memory. In planar format, the YCrCb data is separated into three streams that are burst to different target memory blocks. Having the video data in planar format is useful for applications where the data compression is accomplished via software and the CPU.

5.11.5 PCI Bus Interface

The Bt878A is designed to efficiently utilize the available 132 MB/sec PCI bus. The 32-bit DWORDs are output on the PCI bus with the appropriate image data under the control of the DMA channels. The video stream can easily consume bus bandwidth with average data rates varying from 44 MB/s for full size 768 x 576 PAL RGB32, to 4.6 MB/s for NTSC CIF 320 x 240 RGB16, to 0.14 MB/s for NTSC ICON 80 x 60 8-bit mode.

The pixel instruction stream for the DMA channels consumes a minimum of 0.1 MB/s. Achieving high performance throughput on PCI may be a problem with slow targets and long bus access latencies. The Bt878A provides the means for handling the bandwidth bottlenecks that sometimes occur depending on a particular system configuration. The Bt878A's ability to gracefully degrade and to recover from FIFO overruns to the nearest pixel in real-time is the best possible solution to these system bottlenecks.

The Bt878A register set is accessed through the PCI bus. Registers can be programmed by the host using the Bt878A as a PCI target.

5.11.6 Ultralock™ and Scaling Support

The Bt878A supports Conexant's proprietary Ultralock technique that locks to an incoming analog video signal. The Bt878A will always generate the required number of pixels per line regardless of the analog video source. Ultralock is able to recognize unstable video signals caused by VCR headswitches or any other deviation and adapt the locking mechanism to accommodate the source.

The Bt878A is able to reduce the video image size both vertically and horizontally independent of arbitrarily selected scaling ratios. The X and Y dimensions can be scaled to one-sixteenth of full resolution. Vertical scaling is implemented with Conexant's industry leading 5-tap vertical filter. High quality filtering ensures applications such as Internet videoconferencing (H.323) provide the highest quality video transmissions.

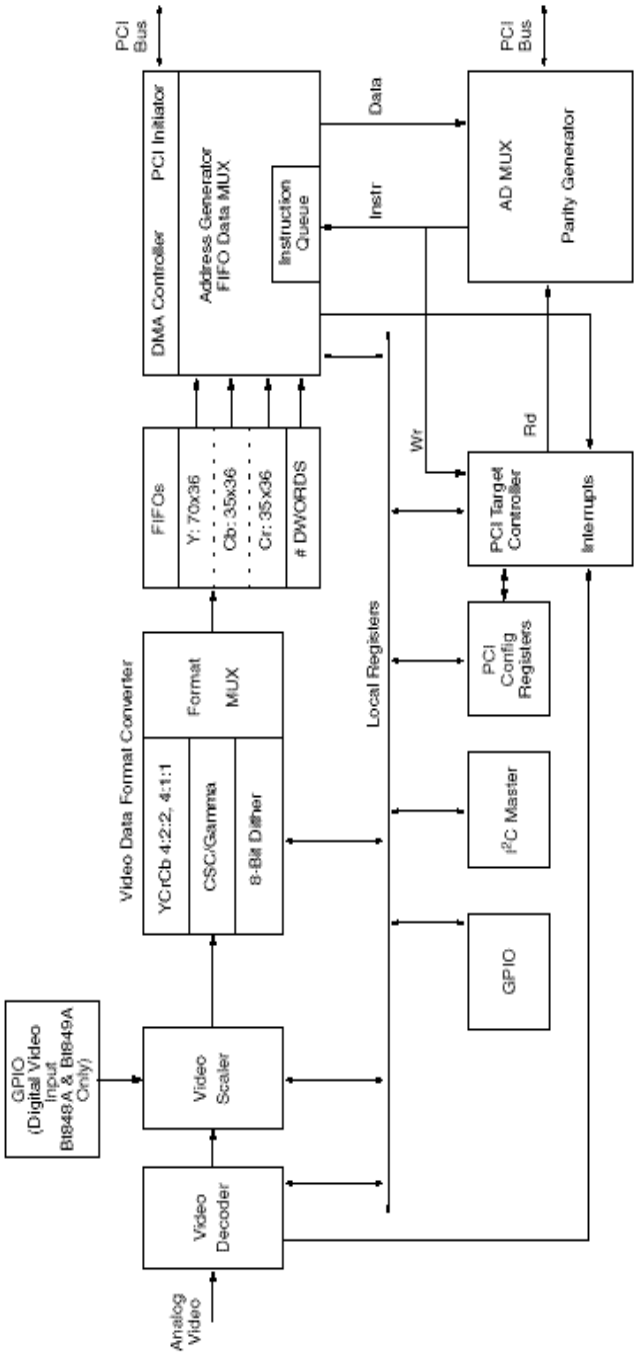


Figure 5-8 Detailed Bt878A Block Diagram

5.11.7 GPIO

The Bt878A provides a 24-bit general purpose I/O bus. This interface can be used to input or output any number of general purpose I/O, up to 24 signals. Alternatively, the GPIO port can be used as a means to input or output video decoder data. For example, the Bt878A can input the video data from an external video decoder and bypass the Bt878A's internal video decoder block. Another application is to output the video decoder data from Bt878A over the GPIO bus for use by external circuitry. The GPIO port's support for burst write transfers makes the port ideal for high-speed data transmission. This port is not used on the Argus or Sirena.

5.11.8 Vertical Blanking Interval Data Capture

The Bt878A provides a complete solution for capturing and decoding Vertical Blanking Interval (VBI) data. The Bt878A can operate in a VBI line output mode, in which the VBI data is only captured during select lines. This mode of operation enables concurrent capture of VBI lines containing ancillary data and the processing of normal video image data. In addition, the Bt878A supports a VBI frame output mode, in which every line in the video frame is treated as if it were VBI line data. This mode of operation is designed for use with still frame capture/processing applications.

5.12 Flash EEPROM

The Argus, Gemini, and Sirena have a 128 KB Flash EEPROM. It can be updated in the field using a special updater program. The code in the PROM cannot be directly executed by the CPU. It must be read by the host CPU into its memory and executed from there. The Borealis accesses the PROM data through the Flash EPROM data port. The multiplexed address bits contain both the high and low order address lines for the PROM. The high order lines appear first and so must be latched externally.

Although in most cases the standard BIOS PROM would be 64 KB, a 128 KB is used in order to accommodate both Windows VGA BIOS and SPARC FCode. See ***Section 4.3.3*** for more information.

5.13 Serial EEPROMs

The graphics board includes several Atmel AT24C02 (or equivalent) 2 Kb (256 bytes) I^2C Serial EEPROMs. The programming of the Serial EEPROM is done through control lines on relevant device. EEPROMs are connected to the PCI6154 and PCI6150 bridges, the Bt878A digitizers, and the uPD720101 USB 2.0 controller. The use of the serial EEPROMs does not currently have formal Rastergraf software support.

Chapter 6
Troubleshooting

6.1 General Procedures

The Argus, Gemini, and Sirena boards were designed with reliability and durability in mind. Nevertheless, it may happen that a problem will occur. This section is devoted to aiding the user in tracking down the problem efficiently and quickly.

You may be able to locate minor problems without technical assistance. If the problem cannot be remedied, Rastergraf can then issue a Return Material Authorization (RMA) so that the board can be returned to the factory for quick repair.

It can happen that installing a new board will overload the computer's power supply if the power supply margins are exceeded. The first step in ascertaining if this is the problem is to calculate a power supply budget. This involves adding up the power requirements of each board in the system to see if you are within specification. Consult your computer's technical manual for information on how to correctly determine this. A typical Argus, Gemini, and Sirena will draw a total of less than 3 amps at +5 and +3.3 Volts.

When attempting to verify that the power supply is working properly, it is not unusual to unplug everything and measure the supply without a load. While this practice is acceptable for linear supplies, switching supplies (which are very commonly used in computers) require a certain load before proper regulation is achieved. Typically, at least 5 Amps must be drawn from the +5 Volt supply before the +12 volt supplies will give the proper readings.

It can also happen that if you build your own cables and you short +5 to ground on the Argus, Gemini, and Sirena front panel connector you may trigger the auto-resetting fuse which protects power supply pins when an overload occurs. The fuse resets automatically when an overload is removed.

Note

If the board is not functioning, check that +3.3V is supplied on the host side connectors. The Argus, Gemini, and Sirena boards **REQUIRE** both +3.3V and +5V. Please contact Rastergraf if you need to do this.

6.2 Dealing with the PCI Bus

Because of the nature of the PCI protocol and the way support has been implemented in the Operating Systems for PCI bus devices such as the Argus, Gemini, or Sirena, it is not possible to follow the same debugging strategies.

In fact, there are no address jumpers for these boards. Everything is configured in software through a set of on-board registers, which control the characteristics of the board as required by the Specification.

The information used to program these registers is supplied to Operating System (OS) specific functions by Rastergraf software. Ordinarily, several address map translations occur, including the CPU physical and virtual address maps and the CPU to PCI bridge address map.

While x86 systems generally follow the standards required to meet PC compatibility and mask these details, PowerPC systems do not. Among PowerPC vendors, there are no standards which ensure interoperability among CPU boards, even when they use the same CPU and PCI bridge.

Therefore, if you plan to use an Argus, Gemini, or Sirena graphics board in a PowerPC based system, it is vital to ensure that Rastergraf can vouch for the board's operation before you order the board. Otherwise, you may go crazy trying to figure out why it doesn't work. Please contact us (support@rastergraf.com or at 541-923-5530) if you have problems.

6.3 Maintenance, Warranty, and Service

Maintenance

The Argus, Gemini, and Sirena require no regular service, but if used in a particularly dirty environment, periodic cleaning with dry compressed air is recommended.

Because of the heat generated by normal operation of the graphics board and other boards in the system, forced crossflow ventilation ***is required***. If forced ventilation is not used, IC temperatures can rise to 60 degrees C or higher, which can cause premature product failure. With proper forced air-cooling IC temperatures will be less than 35 degrees C.

Warranty

The Argus, Gemini, and Sirena graphics boards are warranted to be free from defects in material or manufacture for a period of 12 months from date of shipment from the factory. The Rastergraf obligation under this warranty is limited to replacing or repairing (at its option) any board which is returned to the factory within this warranty period and is found by Rastergraf to be defective in proper usage. This warranty does not apply to modules which have been subjected to mechanical and/or electrical abuse, overheating, or other improper usage. This warranty is made in lieu of all other warranties expressed or implied. **All warranty repair work will be done at the Rastergraf factory.**

Return Policy

Before returning a module the customer must first request a Return Material Authorization (RMA) number from the factory. The RMA number must be enclosed with the module when it is packed for shipment. A written description of the trouble should also be included.

Customer should prepay shipping charges to the factory. Rastergraf will prepay return shipping charges to the customer. Repair work is normally done within ten working days from receipt of module.

Out of Warranty Service

Factory service is available for modules which are out of warranty or which have sustained damage making them ineligible for warranty repair. A flat fee will be charged for normal repairs and must be covered by a valid purchase order. If extensive repairs are required, Rastergraf will request authorization for an estimated time and materials charge. If replacement is required, additional authorization will be requested.

All repair work will be done at the Rastergraf factory in Redmond, Oregon, unless otherwise designated by Rastergraf.

6.4 Board Revision History

This manual covers Rev 2 of the PCBs for Argus, Gemini, and Sirena. Some changes have been made over previous revisions to address design errors and some usability problems. The following subsections discuss the changes. Most will, in fact, be transparent to the typical user, but some changes have been important to some.

6.4.1 Argus and Gemini Revisions

PCB Rev 1

1) Fix INT connections for Borealis and Bt878 – they were wrong out of order.

2) Reorganize the IDSELs and INTs to anticipate a potential compatibility problem using PCIADR16

3) Add in a CY22150 programmable clock reference to provide cleaner DVI because of the noisy Borealis PLL.

4) Add in Micronas UAC3556B audio controller. Bt878 audio-in had no real software support. Small changes to the 68 pin connector assignments to support audio in and out.

5) Update clock generator to CY22392.

6) Put in partial rear panel I/O support.

7) Remove 3.3V local regulator. Needed space for Micronas and no one was interested in it anyway.

PCB Rev 2

1) Reorganize the IDSELs again. There was really no problem with PCIADR16 and having big holes in the IDSEL ranges caused problems with some Windows BIOSs. (Rev 2 looks like a good fix).

2) Add in a second CY22150 programmable clock reference. Having just one for both channels caused lots of programmer confusion and broke the symmetry of two identical Borealis channels.

3) Add MIC and MIC Bias support to UAC3556B audio

4) Replace Philips ISP1561 USB controller with NEC uPD720101. The Philips Linux s/w could not be made to work and Audio under Windows 2K was unreliable. NEC was known to work.

5) Fix CY22392 startup/stability problem (done by ECO in Rev 1) by adding reset circuit.

6) Fix UAC3556B clock stability problem (done by ECO in Rev 1) by adding a cap to the oscillator.

7) Fix BOM problem that kept S-Video from working.

8) Change some r-packs to ones more available

9) Fix UAC3556B power. It runs better on 5V than 3.3V (done by ECO in Rev 1)

10) Add I2C mux to DDC ports so that local parts and monitor address conflicts can't happen (usually don't, but can). Same circuit as E3/CPCI.

6.4.2 Sirena Revisions

PCB Rev 1

1) Fix numerous PLX PCI6520 problems. PLX ref info that we used to design the board was misleading and/or wrong.

2) Add MIC and MIC Bias support to UAC3556B audio

3) Fix CY22392 startup/stability problem (done by ECO in Rev 0) by adding reset circuit.

4) Fix UAC3556B clock stability problem (done by ECO in Rev 0) by adding a cap to the oscillator.

5) Fix UAC3556B power. It runs better on 5V than 3.3V (done by ECO in Rev 0).

6) Added parts to fix PCI-X mode startup problem.

7) Removed muxes from front/rear switching. They were too slow. Use r-packs instead.

8) Add dual footprint BIOS PROM location.

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