**hp** business pc technology

**hp** vectra xe310
**hp** vectra xe320
**hp** vectra vl400
**hp** vectra vl410
**hp** vectra vl420
**hp** e-pc c10/s10
**hp** e-pc 40
**hp** e-pc 42

# technical reference manual

**hp** business pcs

www.hp.com/go/vectrasupport
www.hp.com/go/e-pcsupport

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Business Desktop Division
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France

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# Information Roadmap

Use the icon in Acrobat Reader to search for information in this PDF.

The following types of information are available for HP Business PCs:

## Technical Reference

See the *HP Technical Reference Manuals*.

This *Technical Reference Manual* is a technical reference and BIOS document for personnel providing system level support. It is available in PDF format on the HP support web site (**www.hp.com/go/vectrasupport** or **www.hp.com/go/e-pcsupport**).
It is presented in modular form to provide quick and easy access to technical information on the HP Business PC. It is made up of the following components:

- The *Introduction & HP Business PC Overview* provides a quick reference guide to the hardware components and BIOS used in the latest HP Business PCs. It also lists some of the available accessories.
- *Product Description*. Provides technical information specific to a HP Business PC. This includes summary information on product hardware and detailed information on the BIOS. Read this manual to see which hardware components are in the PC.
- *HP Business PC Technology* (this document). Provides an in-depth guide to the hardware in all of the featured HP Business PCs. Subjects covered include chipsets, processors, graphics controllers, hard disk drives and optical drives.

## Installing, Configuring and Upgrading

See the *HP Upgrade Guide* (desktop PCs only) or the *HP Service Handbook Chapter*.

The *Upgrade Guide* will help you upgrade and replace components in your HP Business PC, including the hard drive, memory, battery, power supply, and optical drives. More information is available on the HP support web site (**www.hp.com/go/vectrasupport**).

The *Service Handbook Chapter*, available in PDF format on the HP support web site (**www.hp.com/go/vectrasupport** or **www.hp.com/go/e-pcsupport**), provides information on:

- HP Business PC configurations
- Replacement parts
- Available accessories.

## Troubleshooting

See the *HP Troubleshooting Guide*.

The *Troubleshooting Guide*, available in PDF format on the HP support web site (**www.hp.com/go/vectrasupport** or **www.hp.com/go/e-pcsupport**) will help you:

- Troubleshoot your HP Business PC
- Find out where to get more information.

## Discover and use your product

See the *HP Quick Start* card and *HP Quick User's Guide*.

The *Quick Start* card provided with your HP Business PC will help you:

- Set up and begin using your HP Business PC for the first time
- Upgrade and replace components in your HP Business PC, including the hard drive, processor memory, add-on cards and optical drives. More information is available on the HP support web site (**`www.hp.com/go/vectrasupport`** or **`www.hp.com/go/e-pcsupport`**).
- Find out where to get more information.

The *Quick User's Guide* provided with your HP Business PC includes basic troubleshooting information, technical specifications, warranty and legal information.

## Your computer's online information

Your computer may contain online help information on the hard disk. It includes information on:

- Troubleshooting and how to use HP Instant Support
- Linking to useful HP web sites.

## Information on the hp support web site

Refer to the HP support web site (**`www.hp.com/go/vectrasupport`** or **`www.hp.com/go/e-pcsupport`**) for a wide range of information, including:

- Downloadable documentation
- Service and support options
- The latest BIOS, drivers and utilities
- Answers to Frequently Asked Questions.

## System recovery cd-roms

Used for a full system recovery or alternative OS installation. Includes instructions on how to recover your preloaded software including operating system, drivers and utilities.

# Finding Information

Use the following table to determine where to locate particular types of information:

| Type of Information | Location |
|---|---|
| • Support phone numbers<br>• Technical support contact information<br>• Warranty information | *Quick User's Guide* |
| • How to set up your computer | *Quick Start Card* (details)<br>*Quick User's Guide* (general information) |
| • Operation of your computer | Operating system and application manuals |
| • Diagrams and detailed instructions on installing add-on devices<br>• Internal wire connections for adding hard drives, CD-ROM, etc.<br>• Memory expansion and replacing devices | *Upgrade Guide* (desktop PCs only) |
| • LAN configuration<br>• LAN controller | *LAN Card Ready Program* (when provided, is available on the HP support web site)<br>*Technical Reference Manual* (this document) |
| • Identifying the problem<br>• Information on errors<br>• Problem solving<br>• Troubleshooting | *Troubleshooting Guide* |
| • Parts list<br>• Accessories list | *Service Handbook Chapter* |
| • BIOS<br>• Connectors<br>• IRQ<br>• POST setup<br>• Specifications<br>• System board layout<br>• Technical diagrams | *Technical Reference Manual* (this document) |

# Bibliography

Manual, datasheets and other information can be obtained at:

- *Technical Reference Manuals*
  **www.hp.com/go/support**
- *HP Service Handbook* Chapters at:
  **www.hp.com/go/vectrasupport** or **www.hp.com/go/e-pcsupport**.
- *HP Product Data Sheets*
  **www.hp.com/go/library**
- *Intel Chipsets*
  **www.intel.com**
- *Intel Celeron, Pentium III & Pentium 4 Processors*
  **www.intel.com/design/celeron/datashts**
  **www.intel.com/design/pentiumIII/datashts**
  **www.intel.com/design/pentium4/datashts**
- *Adaptec SCSI Products*
  **www.adaptec.com**
- *Analog Devices AD1885*
  **www.analogdevices.com**
- *Matrox Millennium G400 and G450 AGP graphics controllers*
  **www.matrox.com/mga/products/home.htm**
- *NVIDIA graphics cards*
  **www.nvidia.com**
- *ATI graphics cards*
  **www.ati.com**
- *Intel Dynamic Video Memory Technology (used in chipsets 810E, 815 and 845)*
  **www.intel.com/products**
- *Creative Audio sound cards*
  **www.creative.com**
- *Crystal Audio integrated audio*
  **www.cirrus.com**
- *Intel LAN card*
  **www.intel.com/support/network**

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# 1

# Chipsets

This chapter describes chipsets and chipset technology.

# Chipset Usage

**NOTE** There are two versions of the HP XE310 PC: Series 1 and Series 2. To identify which model you have, look at the sticker located on the right side of your PC. Series 1 models are labelled 'XE310' and Series 2 models are labelled 'XE310 Series 2'. All information in the following table applies to both Series 1 and Series 2 PCs unless otherwise stated.

| | Intel i810E | Intel i815 | Intel i815EG | Intel i815E Step B | Intel i845 |
|---|---|---|---|---|---|
| VL400 | | ✓ | | | |
| VL410 | | | | ✓ | |
| VL420 | | | | | ✓ |
| XE310 (Series 1) | ✓ | | | | |
| XE310 (Series 2) | | | ✓ | | |
| XE320 | | | | | ✓ |
| e-pc 40 | | | | ✓ | |
| e-pc 42 | | | | | ✓ |
| e-pc c10/s10 | ✓ | | | | |

# Intel i815 Chipset (VL400)

## Processors supported

- Socket 370
- FSB 66, 100 and 133MHz for Intel processors
- Intel CuM-128k-FCPGA, FSB 66 and 100MHz (Celeron product line)
- Intel CuM-256k-FCPGA, FSB 100 and 133MHz (Pentium III product line).

## Chipset

- Intel 815 chipset
- North: 815 GMCH
- South: ICH-1.

## System Memory

- 2 SDRAM DIMM sockets
- Minimum configuration: 64MB
- Maximum configuration: 512MB

- Memory modules supported:
  - PC-133 CL-2/CL-3 technology capable of running at 100 or 133MHz (depending on FSB). PC-100 modules are not supported
  - 64MB, 128MB, 256MB and 512MB memory modules. Only one 512MB module supported
  - ECC and non-ECC modules supported but single/multiple bit-error processing not done by 815 chipset.
- DIMMs can be placed in any order and can be combinations of any size while respecting the above
- If one module is used, preferred slot is DIMM2 (DIMM1 and DIMM2 indicated on system board).

## FSB / System Memory Frequency Combinations

FSB / System Memory Frequency:

- 66 / 100MHz
- 100 / 100MHz
- 133 / 133MHz.

## LAN

- LAN controller 3Com 3C390
- Supports WOL (Wake On LAN)
- Possible to disable integrated LAN via BIOS Setup.

## Super IO

- SIO: National SemiConductor NS360
- Floppy port
- 2 Serial ports
- 1 Parallel port
- 1 Keyboard / 1 Mouse port
- Key-lock support (42i).

## IDE

- 2 IDE Channels
- ATA-33 (2nd IDE channel) and ATA-66 (1st IDE channel)
- ATA-66 device side detection: Master/Slave cable select.

## Floppy

- FDD write protection via BIOS Setup menu
- FDD disable via BIOS Setup
- 3 mode FDD support.

## Expansion Slots

- 3 PCI (PCI2.2 and #PME support) on system board (DT + MT only, cannot be used for accessory boards in Small Form Factor)
- 3.3V standby on all PCI slots, maximum total supported current: 2A

- Universal AGP 2X/4X slot. (In Small Form Factor, this slot cannot be used for AGP card but it can be used for an AIMM graphics memory extension card)
- ATX riser card with 3 PCI slots (Small Form Factor)
- Optional ATX riser card with 1 PCI slot and 1 combo PCI-ISA slot (Small Form Factor)
- Optional Two ISA Extension kit providing 2 ISA slots (MT + DT).

## External IO Ports

- 1 PS2 Mouse connector
- 1 PS2 Keyboard connector
- Microphone in, Line in, Line out
- 2 Serial ports
- 1 Parallel port
- 1 VGA port
- 2 USB ports on rear-side with stacked LAN connector
- Color coding for all connectors.

## System Board Connectors

- 1 Intrusion detection / Box-ID connector
- 2 IDE connectors, keyed
- 1 FDD connector, keyed
- 1 Front panel connector, keyed
- 1 PSU connector, keyed
- 1 CD-IN audio connector, keyed
- 1 Internal speaker connector
- 3-pin CPU fan connector
- 3-pin System fan connector
- 3-pin PSU fan connector
- 1 WOL (Wake On LAN) connector
- Power Protection Device (PPD) connector.

## Front Panel

- HDD Activity LED: Yellow
- ON-OFF / Suspend LED: solid green indicates ON, blinking indicates suspend/standby
- Lock LED: orange, indicates that PC has been locked by user
- Soft ON/OFF/Suspend button.

# Limitations and Additional Information

## Graphics Controllers

An AGP graphic card cannot be used simultaneously with the integrated graphics of the chipset. When the AGP slot is used for an AGP card, the Integrated Graphic controller of the chipset will be automatically disabled. This means that when dual VGA support is required, a PCI graphic card is mandatory. This PCI graphic card can then be used in combination with an AGP card in the AGP slot, or with the integrated graphic controller of the chipset.

Following the above, when two graphic systems are used on the system (e.g. PCI and AGP, or PCI and Integrated Graphics), the user needs to identify in the BIOS Setup program which graphics system should be used during startup.

The 2D and 3D performance of the integrated graphics controller can be improved by adding a 4MB memory extension module in the AGP slot. Alternatively, a high performance AGP dual head graphics card, such as the HP Matrox G450, can be used to greatly improve 2D and 3D performance.

## Connecting IDE Devices

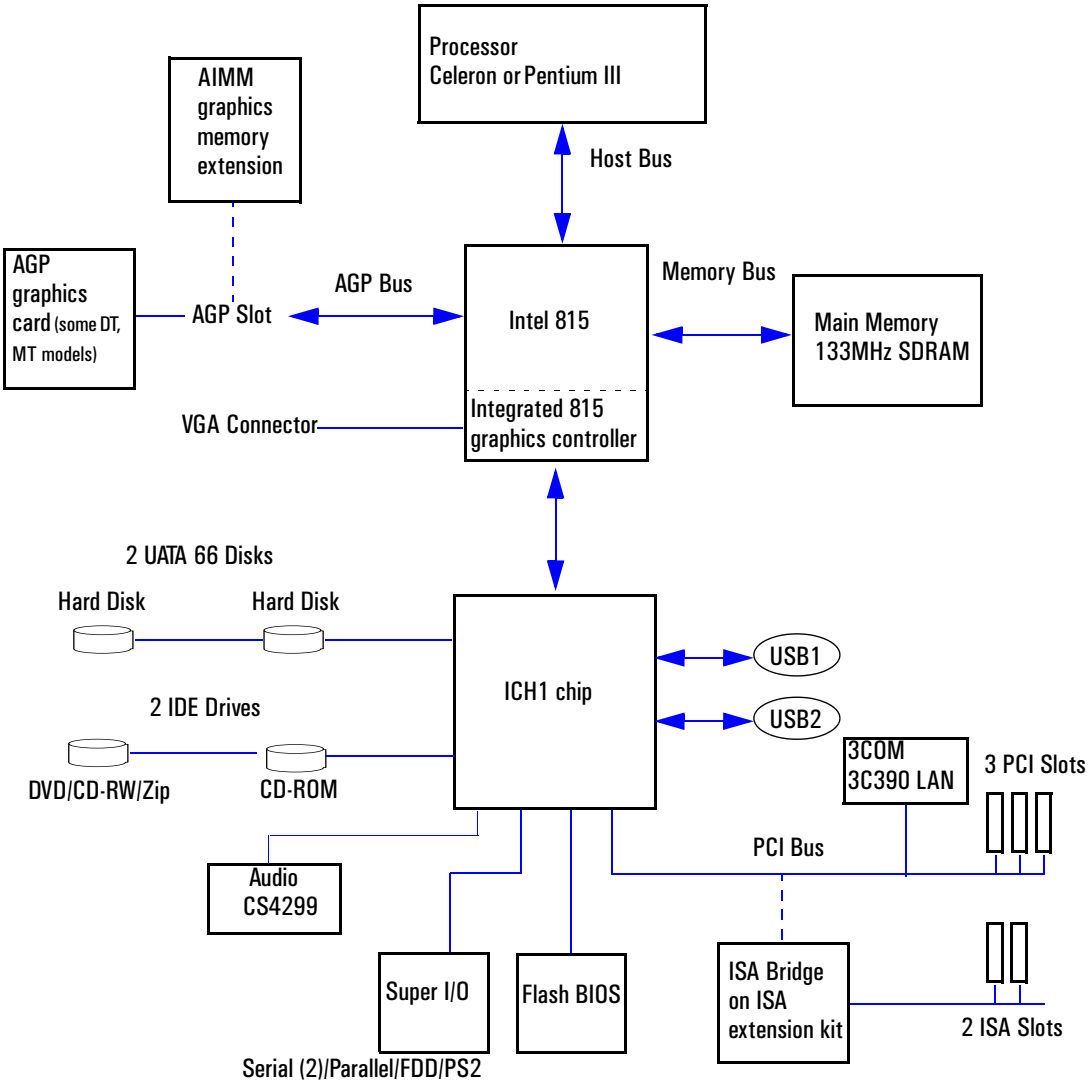
It is recommended that you connect hard drives to the primary IDE channel (master and slave HDD). Optical devices such as CD-ROM, DVD-ROM, and CD-RW drives should be connected to the secondary IDE channel. This ensures optimal hard drive performance.

## Connecting Keyboard, Mouse and Other Devices to the PS/2 Ports

Keyboards attached to the PS/2 keyboard connector should not draw an excessive current. The keyboard port is designed for devices that draw a normal amount of current for standard keyboards. For this reason, you should connect any special devices that use a PS/2 port to the mouse port and not the keyboard port (for example, a parallel-to-LAN converter that uses a PS/2 port for power).

Special keyboards with two PS/2 connectors, such as those with a built-in track-ball mouse, are not supported.

# VL400 Intel i815 Chip Block Diagram (this block diagram applies primarily to Desktop configurations):



# Intel i815E Step B Chipset (VL410 and e-pc 40)

## Processors supported

- Socket 370
- FSB 66, 100 and 133MHz for Intel processors
- Intel 128k-FCPGA, FSB 66 and 100MHz (Celeron product line)

## Chipset

- Intel 815E Step B chipset
- North: 815B GMCH
- South: ICH-2.

## System Memory

- 2 SDRAM DIMM sockets
- Minimum configuration: 64MB
- Maximum configuration: 512MB (2 x 256MB)
- Memory modules supported:
  - PC-133 CL-2/CL-3 technology capable of running at 100 or 133MHz (depending on FSB). PC-100 modules are not supported
  - 64MB, 128MB and 256MB memory modules
  - Non-ECC modules supported.
- DIMMs can be placed in any order and can be combinations of any size while respecting the above

## FSB / System Memory Frequency Combinations

FSB / System Memory Frequency:

- 66 / 100MHz
- 100 / 100MHz
- 133 / 133MHz.

## LAN

- Intel LAN solution (82 562ET)
- Possible to disable integrated LAN via BIOS Setup (VL410 only)
- WOL (Wake On LAN) through PCI 2.2
- No support for Alert On Lan (AOL).

## Super IO

- SIO: National SemiConductor NS PC87360
- Floppy port (VL410 only)
- 1 Serial port (VL410 only: an additional connector on the system board allows a second serial port to be connected through an I/O bracket)
- 1 Parallel port
- 1 Keyboard / 1 Mouse port
- Key-lock support (42i).

## IDE

- 2 IDE Channels
- ATA-33, ATA-66 and ATA-100 (on both channels, however BIOS will only validate ATA-100 on channel 1 for compatibility reasons)
- ATA-100 device side detection
- Master/Slave cable select (relevant to VL410 only).

## Floppy (VL410 only)

- FDD write protection via BIOS Setup menu
- FDD disable via BIOS Setup
- 3 mode FDD support.

## Expansion Slots (VL410 only)

- 3 PCI (PCI2.2 and #PME support) on system board (Desktop only, cannot be used for accessory boards in Small Form Factor)
- 3.3V standby on all PCI slots, maximum total supported current: 2A
- Universal AGP 4X slot. (In Small Form Factor, this slot cannot be used for AGP card but it can be used for a GPA graphics memory extension card)
- ATX riser card with 3 PCI slots (Small Form Factor)

## External IO Ports

- 1 PS2 Mouse connector
- 1 PS2 Keyboard connector
- Microphone in, Line in, Line out
- 1 Serial port (VL410 only: an additional connector on the system board allows a second serial port to be connected through an I/O bracket)
- 1 Parallel port
- 1 VGA port
- 4 USB ports (VL410 has 4 on rear panel, e-pc has 2 on rear panel and 2 on front panel)
- 1 RJ45 LAN port
- Color coding for all connectors.

## System Board Connectors

- 1 Intrusion detection / Box-ID connector
- 2 IDE connectors, keyed
- 1 FDD connector, keyed (VL410 only)
- 1 connector for a second serial port on I/O bracket (serial kit) (VL410 only)
- 1 Front panel connector, keyed
- 1 PSU connector, keyed
- 1 CD-IN audio connector, keyed
- 1 Ventriloquist speaker connector
- 1 CPU fan connector
- 1 System fan connector
- 3-pin PSU fan connector (VL410 only)

## Switches

### VI410

- Clear configuration switch
- Clear password switch
- Boot block recovery switch
- Boot block protection switch (hardware or software protection)
- Reserved switch (currently not used).

### e-pc

- Clear configuration\password switch
- Boot block protection switch (hardware or software protection)
- Debug mode switch (when activated, it sends postcodes to the parallel port).

## Front Panel

### VI410

- HDD Activity LED: Yellow
- ON-OFF / Suspend LED: solid green indicates ON, blinking indicates suspend/standby
- Lock LED: orange, indicates that PC has been locked by user
- Soft ON/OFF/Suspend button.

### e-pc

- HDD Activity LED: Yellow
- ON-OFF / Suspend LED: solid green indicates ON, blinking indicates suspend/standby
- Soft ON/OFF/Suspend button.

# Limitations and Additional Information

## Graphics Controllers (VL410 only)

An AGP graphic card cannot be used simultaneously with the integrated graphics of the chipset. When the AGP slot is used for an AGP card, the Integrated Graphic controller of the chipset will be automatically disabled.

The 2D and 3D performance of the integrated graphics controller can be improved by adding a 4MB Graphics Performance Adapter (GPA) in the AGP slot. Alternatively, a high performance AGP graphics card, such as the Nvidia GeForce 2 MX, can be used to greatly improve 2D and 3D performance.

## Connecting IDE Devices (VL410 only)

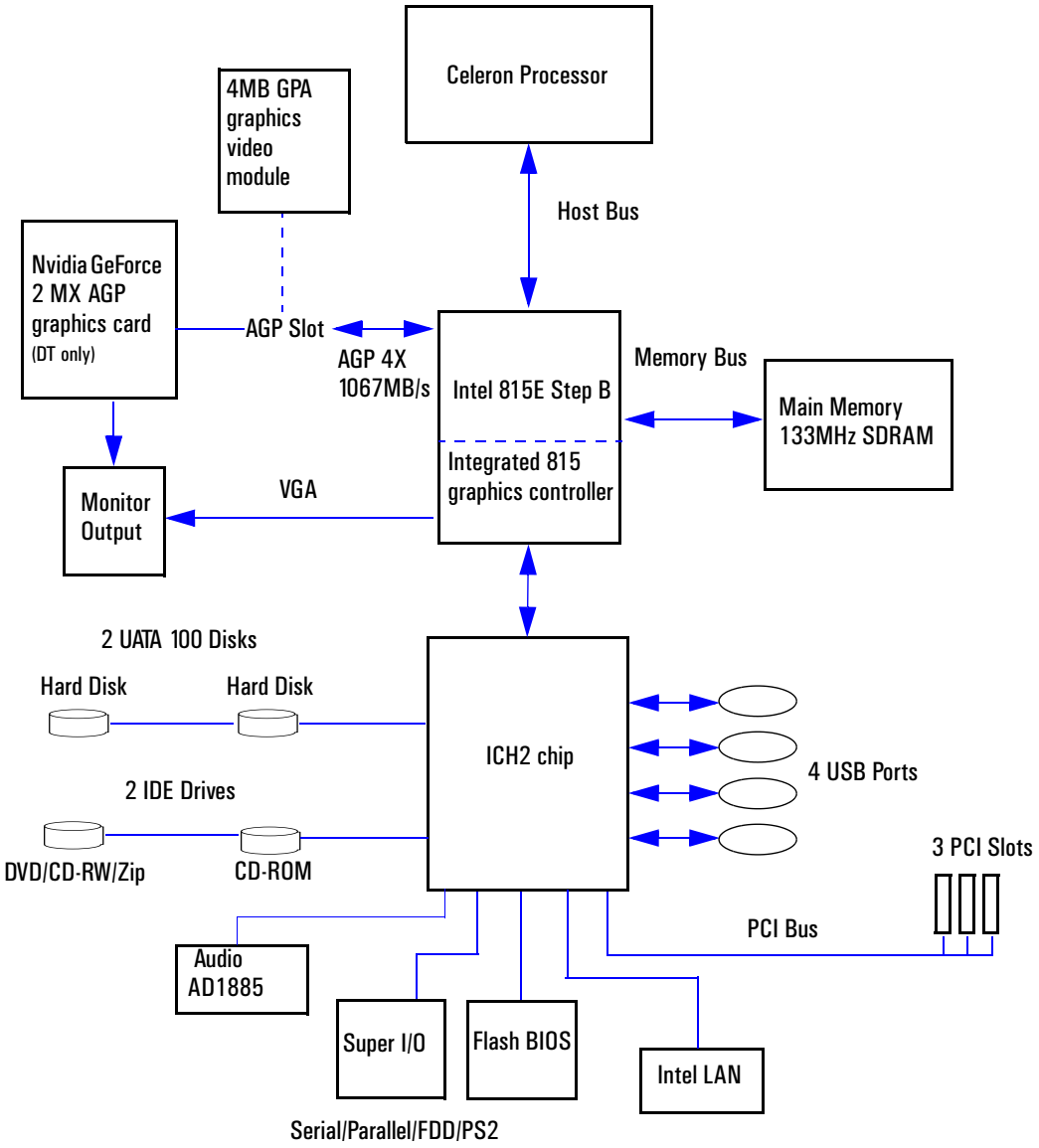
It is recommended that you connect hard drives to the primary IDE channel (master and slave HDD). Optical devices such as CD-ROM, DVD-ROM, and CD-RW drives should be connected to the secondary IDE channel. This ensures optimal hard drive performance.

## Connecting Keyboard, Mouse and Other Devices to the PS/2 Ports

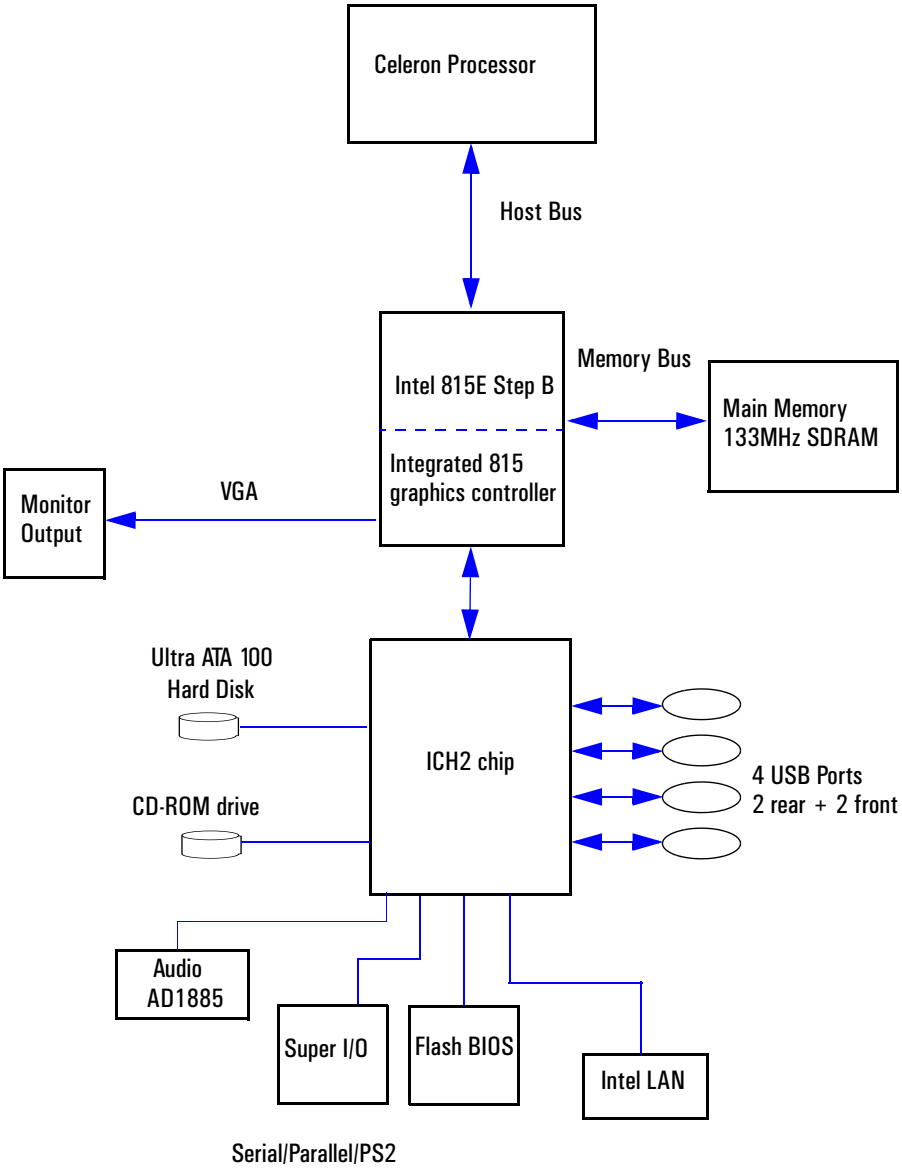
Keyboards attached to the PS/2 keyboard connector should not draw an excessive current. The keyboard port is designed for devices that draw a normal amount of current for standard keyboards. For this reason, you should connect any special devices that use a PS/2 port to the mouse port and not the keyboard port (for example, a parallel-to-LAN converter that uses a PS/2 port for power).

Special keyboards with two PS/2 connectors, such as those with a built-in track-ball mouse, are not supported.

# VL410 Intel i815E Step B Chip Block Diagram:



# e-pc 40 Intel i815E Step B Chip Block Diagram:



# Intel 815EG Chipset (XE310 Series 2)

## Processors supported

- Socket 370
- FSB 66, 100 and 133MHz for Intel processors
- Intel 128k-FCPGA, FSB 66 and 100MHz (Celeron product line)
- Intel 256k-FCP6A, FSB 100 Mhz (Celeron product line)
- Intel 256k-FCP6A, FSB 133 Mhz (Pentium III product line)

## Chipset

- Intel 815EG chipset
- North: 815EG GMCH
- South: ICH-2.

## System Memory

- 2 SDRAM DIMM sockets
- Minimum configuration: 64MB
- Maximum configuration: 512MB (2 x 256MB)
- Memory modules supported:
  - PC-133 CL-2/CL-3 technology capable of running at 100 or 133MHz depending on FSB (PC-100 modules are not supported)
  - 64MB, 128MB and 256MB memory modules
  - Non-ECC modules supported.
- DIMMs can be placed in any order and can be combinations of any size while respecting the above

## Processor Front Side Bus/System Memory Frequency Combinations

Processor Front Side Bus/ System Memory Frequency:

- 66 / 100MHz
- 100 / 100MHz
- 133 / 133MHz.

## LAN

- Intel LAN solution (82 562ET)
- Possible to disable integrated LAN via BIOS Setup
- WOL (Wake On LAN) through PCI 2.2
- No support for Alert On Lan (AOL).

## Super IO

- SIO: National SemiConductor NS PC87360
- Floppy port
- 1 Serial port
- 1 Parallel port
- 1 Keyboard / 1 Mouse port
- Key-lock support (42i).

## IDE

- 2 IDE Channels
- ATA-33, ATA-66 and ATA-100 (on both channels, however BIOS will only validate ATA-100 on channel 1 for compatibility reasons)
- ATA-100 device side detection
- Master/Slave cable select.

## Floppy

- FDD write protection via BIOS Setup menu
- FDD disable via BIOS Setup
- 3 mode FDD support.

## Expansion Slots

- 3 PCI (PCI2.2 and #PME support) on system board
- 3.3V standby on all PCI slots, maximum total supported current: 2A

## External IO Ports

- 1 PS2 Mouse connector
- 1 PS2 Keyboard connector
- Microphone in, Line in, Line out
- 1 Serial port
- 1 Parallel port
- 1 VGA port
- 4 USB ports
- 1 RJ45 LAN port
- Color coding for all connectors.

## System Board Connectors

- 2 IDE connectors, keyed
- 1 FDD connector, keyed
- 1 Front panel connector, keyed
- 1 PSU connector, keyed
- 1 CD-IN audio connector, keyed
- 1 CPU fan connector

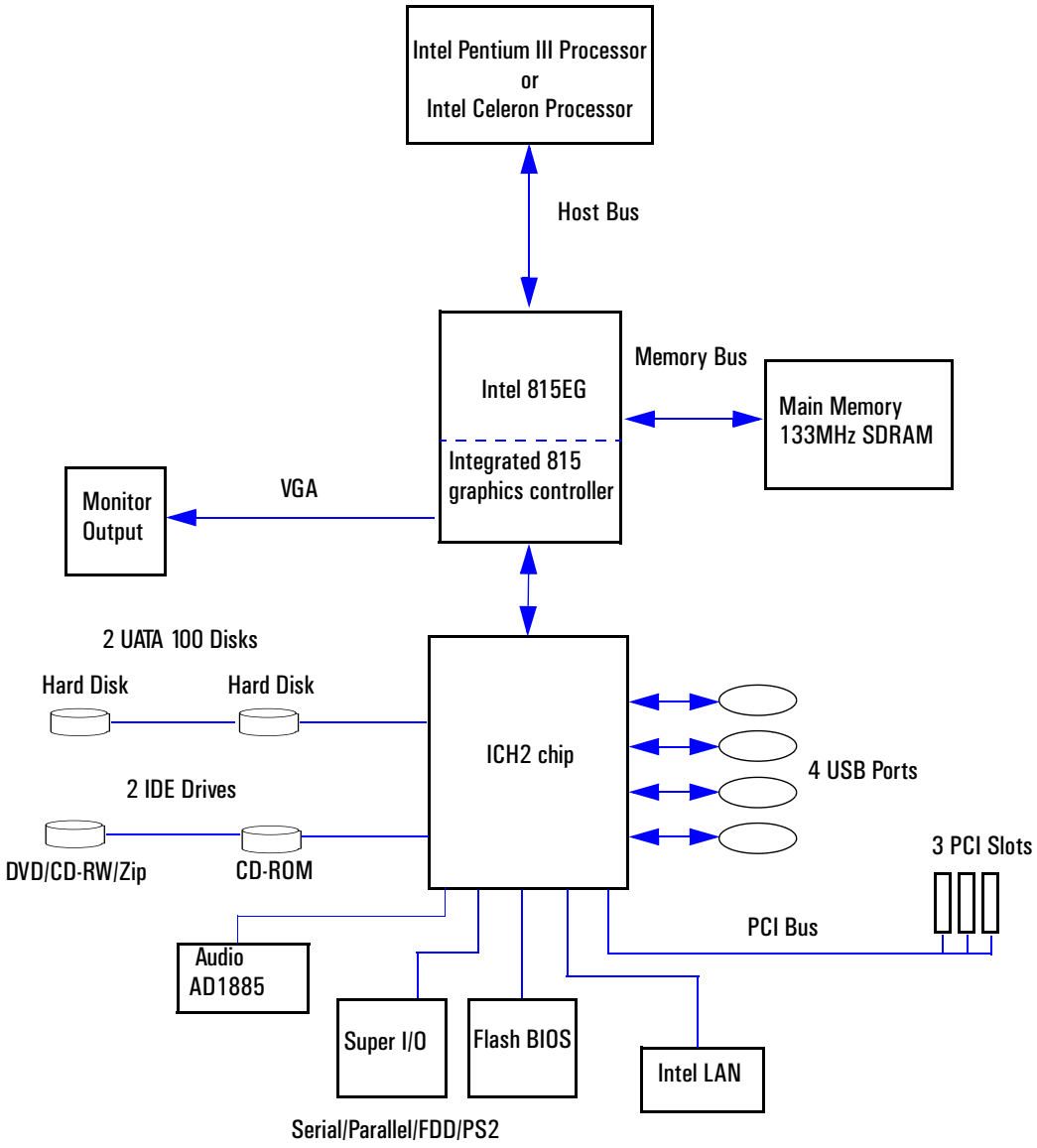
## Jumpers

- Clear configuration jumper
- Clear password jumper

## Front Panel

- HDD Activity LED: Yellow
- ON-OFF / Suspend LED: solid green indicates ON, blinking indicates suspend/standby
- Soft ON/OFF/Suspend button.

# Intel 815EG System Block Diagram



# Intel i845 Chipset (VL420, XE320 and e-pc 42)

## Memory Controller HUB (MCH) Intel 82845

The Intel i845 chipset is a high integration chipset designed for graphics/multimedia PC platforms.

### Host Interface

- Intel Pentium 4 Processor (478 pin package)

### System Memory Support

- Directly supports one SDR SDRAM channel, 64 bits wide (72 bits with ECC)
- 133 MHz SDRAM devices
- 64 Mb, 128 Mb, 256 Mb and 512 Mb technologies for x8 and x16 devices

### Accelerated Graphics Port (AGP) Interface

- Supports a single AGP device (either a connector or on the motherboard)
- Supports AGP 2.0 including 1x, 2x, and 4x AGP data transfers and 2x/4x Fast Write protocol
- Supports only 1.5 V AGP electrical characteristics

### System Interrupt Support

- System bus interrupt delivery mechanism
- Interrupts signalled as upstream memory writes from AGP/PCI
- Supports peer MSI between hub interface and AGP

### Power Management

- ACPI, Revision 1.0b compliant power management
- APM, Revision 1.2 compliant power management

## I/O Controller Hub (ICH) Intel 82801BA

### PCI Bus Interface

- Supports PCI at 33 MHz
- Supports PCI Rev 2.2 Specification
- 133 MB/sec maximum throughput

### Integrated LAN Controller

- Interface to discrete LAN Connect component
- 10/100 Mb/sec Ethernet support

## Integrated IDE Controller

- Independent timing of up to 4 drives
- Ultra ATA/100/66/33, BMIDE and PIO modes
- Read transfers up to 100 MB/s, Writes to 89 MB/s
- Separate IDE connections for Primary and Secondary cables
- Implements Write Ping-Pong Buffer for faster write performance

## USB

- 2 UHCI Host Controllers with a total of 4 ports
- USB 1.1 compliant
- Supports wake-up from sleeping states S1–S4
- Supports legacy Keyboard/Mouse software

## AC'97 Link for Audio and Telephony CODECs

- AC'97 2.1 compliant

## Interrupt Controller

- Support up to 8 PCI interrupt pins
- Supports PCI 2.2 Message-Based Interrupts
- Two cascaded 82C59
- Integrated I/O APIC capability
- 15 interrupts supported in 8259 mode, 24 supported in I/O APIC mode

## Power Management Logic

- ACPI 1.0b compliant
- ACPI Power Management Timer
- SMI# generation
- Support for APM-based legacy power management for non-ACPI implementations

## Firmware Hub (FWH)

- Interface supports BIOS memory size up to 8 MBs

## Enhanced DMA Controller

- Two cascaded 8237 DMA controllers
- PCI DMA: Supports PC/PCI, includes two PC/PCI REQ#/GNT# pairs
- Supports LPC DMA
- Supports DMA Collection Buffer to provide Type-F DMA performance for all DMA channels

## Real-Time Clock

- 256-byte battery-backed CMOS RAM
- Hardware implementation to indicate century rollover

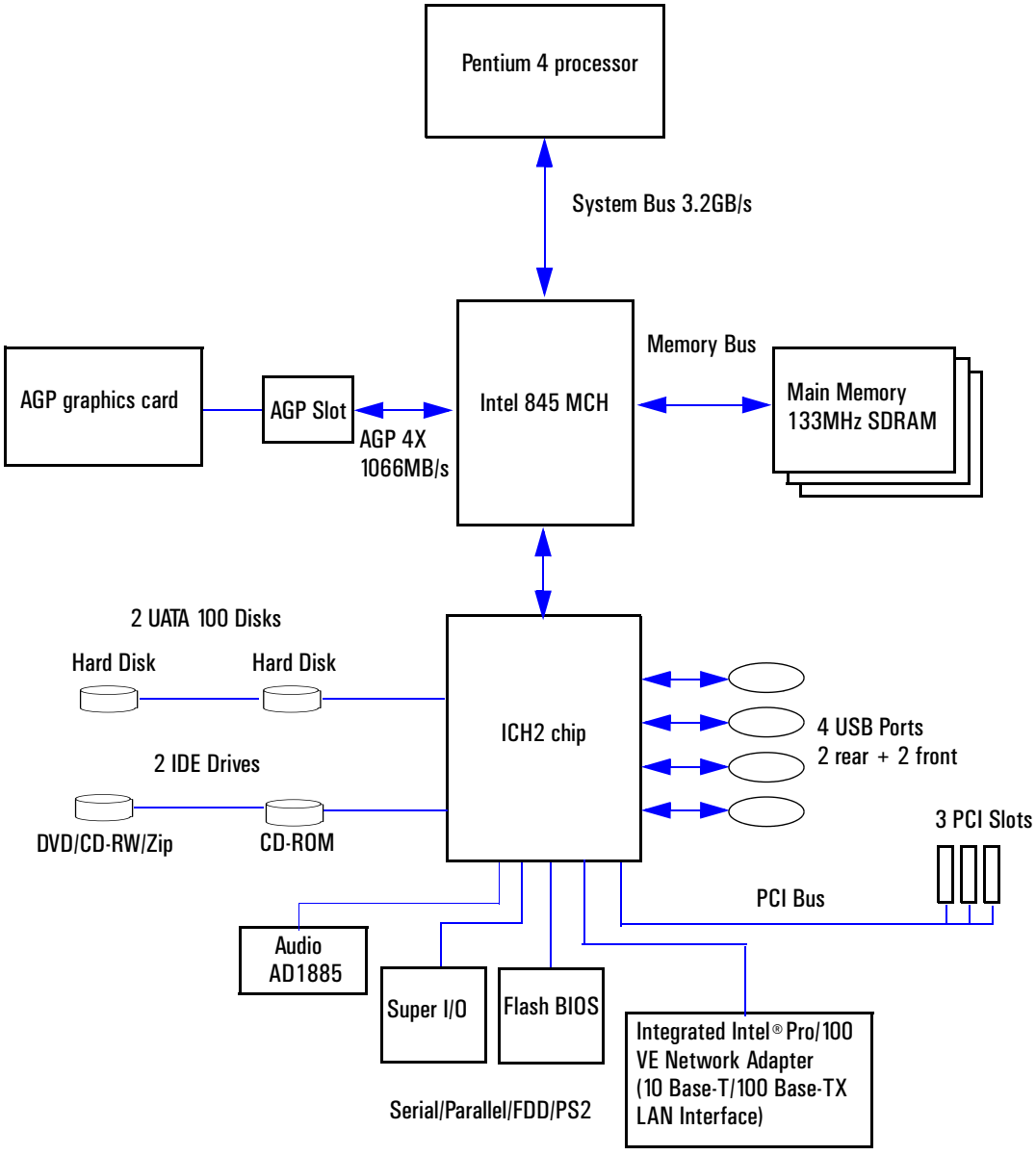
### System Reduction Circuits

- Timers to generate SMI# and Reset upon detection of system hang
- Timers to detect improper processor reset
- Integrated processor frequency strap logic

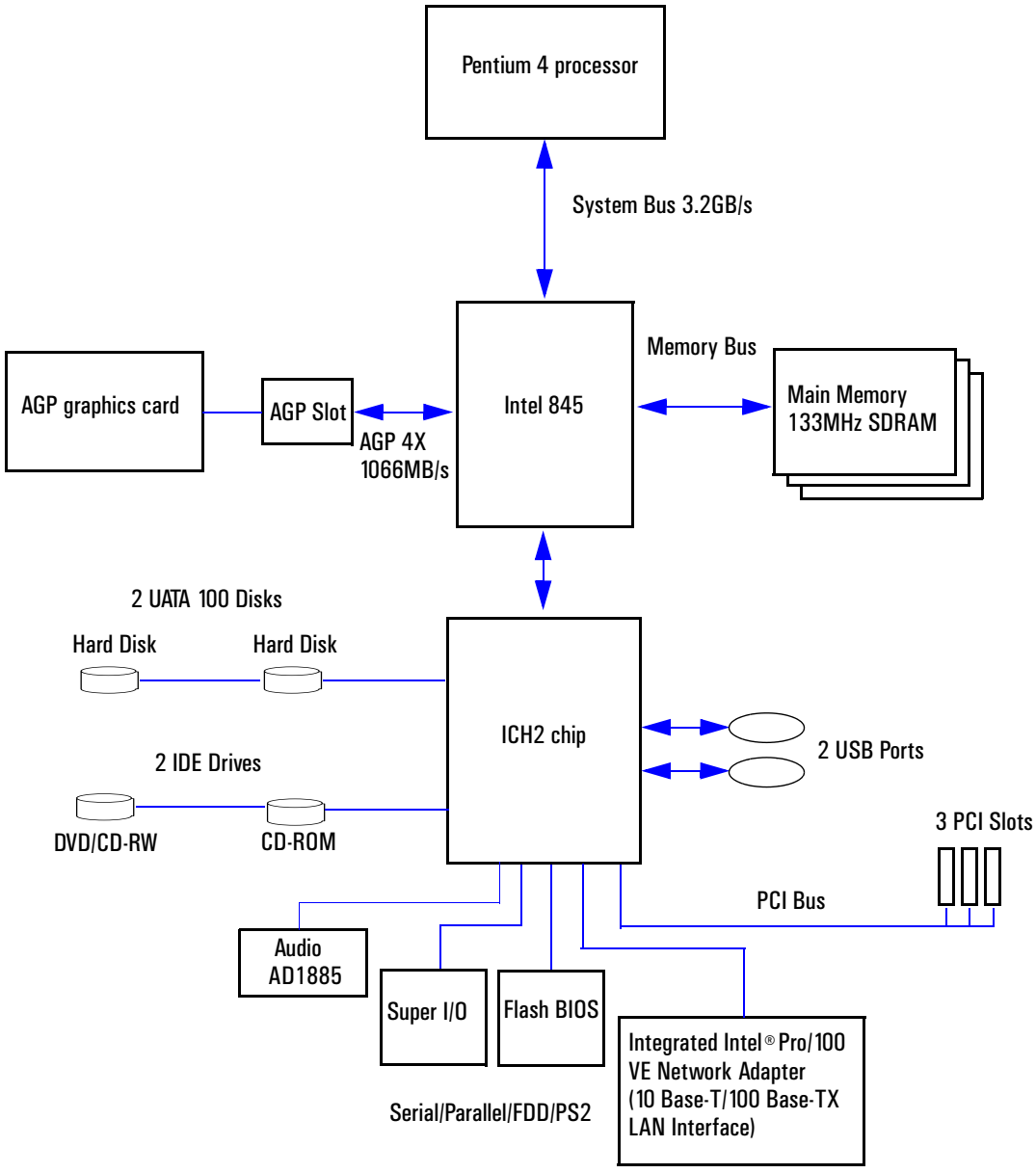
### SM Bus

- Host interface allows processor to communicate via SM Bus
- Slave interface allows an external Microcontroller to access system resources

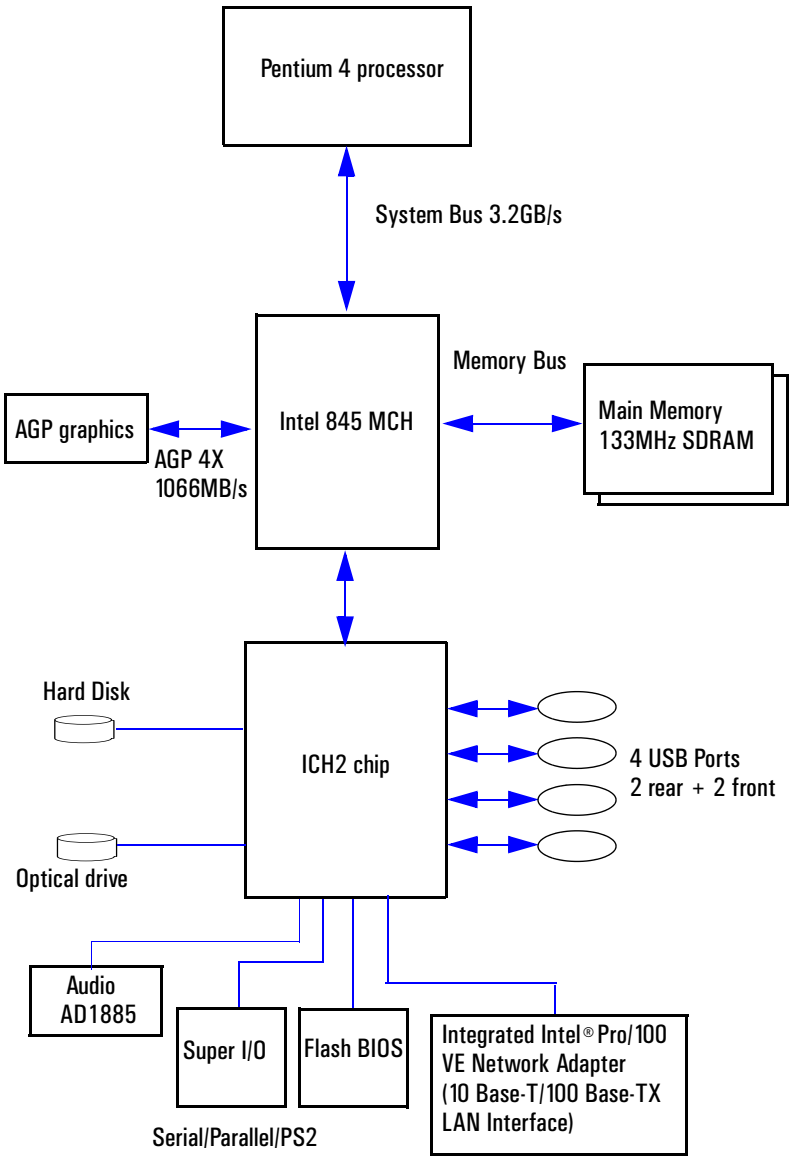
## VL420 Intel i845 Chip Block Diagram:



# XE320 Intel i845 Chip Block Diagram:



# e-pc 42 Intel i845 Chip Block Diagram:



# Intel 810E Chipset (XE310 Series 1 and e-pc c10/s10)

## Memory Controller HUB (MCH) Intel 82810E

The intel 810E chipset integrates the innovative features of the 810 chipset with performance enhancements and added flexibility.

### Host Interface

- Pentium III and Celeron on 370 Pin socket processor connector.

### Integrated DRAM Controller

- 8 MB to 256 MB using 16 Mb/64 Mb technology (512MB using 128Mb technology)
- 100 MHz system memory bus frequency
- 64-bit data interface.

### Power Management Functions

- ACPI Compliant power management
- APIC Buffer Management
- SMI, SCI and SERR error indication.

## I/O Controller Hub (ICH) Intel 82801AA

### PCI Bus Interface

- Supports PCI at 33 MHz
- Supports PCI Rev 2.2 Specification
- 133 MByte/sec maximum Throughput.

### Integrated IDE Controller

- Independent Timing of Up to 4 Drives
- Supports Ultra ATA/66 Mode (66 Mbytes/sec)
- PIO Mode 4 Transfers up to 14 Mbytes/s
- Implements Write Ping-Pong Buffer for faster write performance

### USB

- UHCI Implementation with 2 Ports
- Supports Legacy Keyboard/Mouse Software
- USB Revision 1.1 Complaint

### AC'97 Link for Audio CODEC's

- AC'97 2.1 Compliant

## Interrupt Controller

- Two Cascaded 82C59
- Integrated I/O APIC Capability
- 15 Interrupts Support in 8259 Mode, 24 Supported in I/O APIC Mode
- Timers Based on 82C54
- System Timer, Refresh Request, Speaker Tone Output
- GPIO

## Power Management Logic

- ACPI 1.0 Compliant
- Support for APM-Based Legacy Power Management for Non- ACPI Implementations
- ACPI Defined Power States (S1, S4, S5)
- ACPI Power Management Timer
- SMI# Generation
- All Registers Readable/Restorable for Proper
- Resume from 0V Suspend States
- PCI PME#

## Enhanced DMA Controller

- Two Cascaded 8237 DMA Controllers
- PCI DMA: Supports PC/PCI - Includes Two PC/PCI REQ#/GNT# Pairs
- Supports LPC DMA
- Supports DMA Collection Buffer to Provide

## Real- Time Clock

- 256-byte Battery-Backed CMOS RAM
- Hardware implementation to indicate Century Rollover

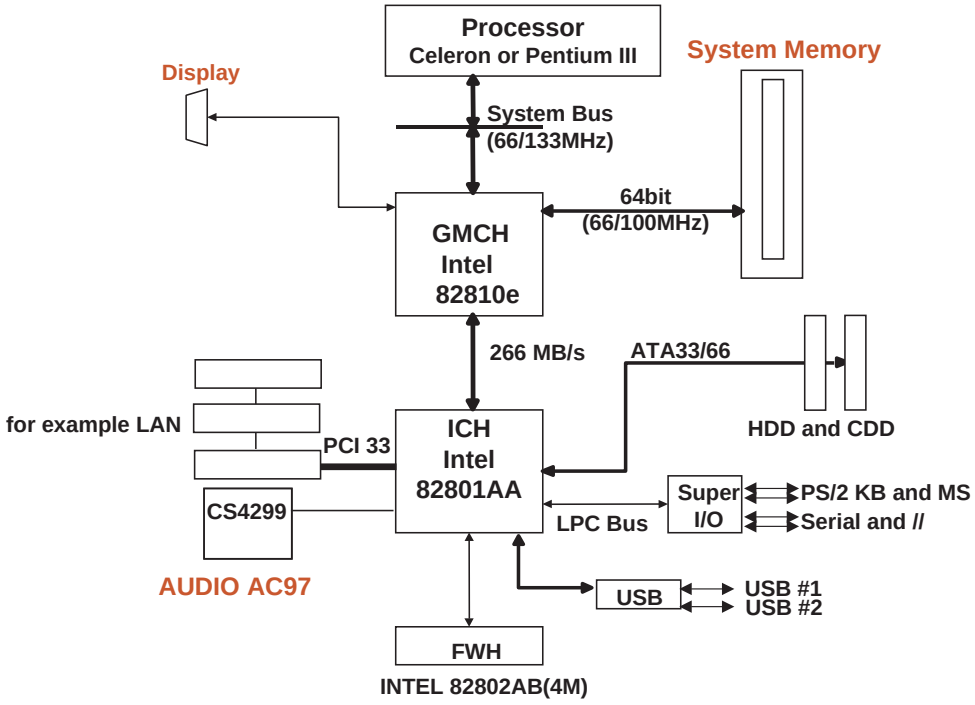
## System TCO Reduction Circuits

- Timers to Generate SMI# and Reset Upon Detection of locked system
- Timers to Detect Improper Processor Reset
- Integrated Processor Frequency Strap Logic

## SM Bus

- Host Interface Allows Processor to Communicate via SM Bus
- Compatible With Most 2-Wire Components that are Also $I^2C$ compatible

# Intel 810E System Block Diagram:



# 2

# Processors

This chapter describes the processors and processor technology used in the featured PCs.

# Processor Usage

| | Celeron Socket 370 | Pentium III Socket 370 | Pentium 4 Socket 478 |
|---|---|---|---|
| VL400 | ✓ | ✓ | |
| VL410 | ✓ | ✓ | |
| VL420 | | | ✓ |
| XE310 | ✓ | ✓ | |
| XE320 | | | ✓ |
| e-pc 40 | ✓ | ✓ | |
| e-pc 42 | | | ✓ |
| e-pc c10/s10 | ✓ | ✓ | |

Speed limitations for each processor are listed in the *Technical Reference Manual - Introduction & HP PC Product Line Overview*.

**NOTE** The Processor-Local (PL) bus of Socket 370 Celeron and Socket 370 Pentium III processors, also referred to as their FSB (Front Side Bus), is implemented in GTL+ technology. This technology features open-drain signal drivers that are pulled-up to 1.5 V through 56 ohm resistors on the bus, acting as bus terminators.
The supported operating frequencies of the GTL+ bus are 66, 100 or 133 MHz. The width of the data bus is 64 bits, the width of the address is 32 bits.
The control signals of the PL bus allows the implementation of a *"split -transaction"* bus protocol. This allows the processor to send its request (such as asking for the contents of a given memory address) and then to release the bus, rather than waiting for the result, thereby allowing the bus to accept another request. The target device (PCI AGP controller chip) then requests the bus again when it is ready to respond, and sends the requested data packet. Up to four transactions can be outstanding at any given time.

For Socket 478 Pentium 4 processors, the processor system bus uses a variant of GTL+ signalling technology called Assisted Gunning Transceiver Logic (AGTL+) signal technology.

# Intel Celeron (Socket 370)

The Socket 370 Intel Celeron processor has the following features:

- 128K on-die L2 cache up to 1.1Ghz
- 256K on-die L2 cache starting with 1.2GHz
- Intel MMX technology, which gives higher performance for media, communications and 3D applications.

Socket 370 is a conversion of Slot 1 (used by the Pentium II and Pentium III) to a socket. The Socket 370 Celeron shares the same P6 microarchitecture as the Pentium II. The reduction in size achieved by the Socket 370 Celeron is due to the integration of the L2 cache on the processor die.

The heatsink is supplied separately from the processor. The processor is locked in place in the plastic pin grid array (PPGA) by a lever. Thermal efficiency is further enhanced by a heat interface gum supplied with the heatsink.

# Intel Pentium III (Socket 370)

The Pentium III processor uses the same basic core and L2 cache as the Pentium II. In addition to this, however, it uses 70 new multimedia-oriented instructions known as SSE (streaming SIMD extensions). These SIMD (single instruction multiple data) instructions enable the CPU to perform simultaneous floating point calculations on multiple data. This brings substantial improvements to 3D graphics, video encoding and decoding and other floating point-intensive operations that operate on large sets of data such as voice recognition.

The Socket 370 Pentium III processor also includes:

- An integrated on-die, 256KB, 8-way set associative level-two (L2) cache. The L2 cache implements the new Advanced Transfer Cache (ATC) Architecture with a 256-bit wide bus.
- A 16KB level one (L1) instruction cache and 16KB L1 data cache. These cache arrays run at the full speed of the processor core.

# Intel Pentium 4 (Socket 478)

The Intel Pentium 4 processor has the following features:

- Data bus frequency of 400 MHz
- Dual Independent Bus architecture, which combines a dedicated 64-bit L2 cache bus (supporting 256KB or 512KB) plus a 64-bit system bus that enables multiple simultaneous transactions
- MMX2 technology, which gives higher performance for media, communications and 3D applications
- Dynamic execution to speed up software performance
- Internet Streaming SIMD Extensions 2 (SSE2) for enhanced floating point and 3D application performance
- Uses multiple low-power states, such as AutoHALT, Stop-Grant, Sleep and Deep Sleep to conserve power during idle times.

The Pentium 4 processor is packaged in a pin grid array (PGA) that fits into a PGA478B socket. The Pentium 4 integrates the following cache memories on the same die as the processor cache:

- A trace instruction and L1 data cache. The trace cache is 4-way set associative
- A 256KB or 512KB L2 cache. The L2 cache is 8-way associative.

# 3

# Mass Storage Devices

This chapter describes Ultra-ATA hard disks, DVD and CD-RW technology.

# Ultra-ATA Hard Disk Drives

ATA (AT Attachment) is a disk drive implementation designed to integrate the controller into the drive itself, thereby reducing interface costs. Ultra-ATA has three high performance modes: DMA/33 with 33MB/s bandwidth, twice that of DMA mode 2, DMA/66 with 66MB/s bandwidth and DMA/100 with 100MB/s bandwidth.

## Ultra ATA/33

Ultra-ATA 33 provides higher levels of disk throughput (with a burst transfer rate of 33MB/s) yet also enhancing data integrity. A checksum is added to the data sent over the ATA interface. That way, data corruption can be detected and the data retransmitted.

Ultra-ATA 33 improves timing margins by eliminating propagation and data turnaround delays. During a read under Fast ATA, the drive must wait for the strobe from the host (propagation delay) before taking some time to respond by putting data on the bus (data turnaround delay) - for which the host must then wait (more propagation delay). All these events must occur with a fixed time window between the falling edge of the strobe and the rising edge, when data is latched in the host.

The Ultra-ATA protocol eliminates these delays by having the drive be the source of both the strobe and the data during a read. Since the strobe and data signal travel in the same direction down the cable simultaneously, propagation delay in the opposite direction is eliminated. And since the drive controls both strobe and data, there is no data turnaround delay. With the time window remaining constant, less delay means improved timing margins during reads.

On top of improved timing margins, the protocol of Ultra-ATA also implements Cyclical Redundancy Check (CRC) to provide data protection verification. CRC is calculated on a per-burst basis by both the host and the drive, and is stored in their respective CRC registers. At the termination of each burst, the host sends the contents of its CRC register to the drive, which compares it against its own register's contents.

For even greater integrity, the protocol can be used at speeds slower than its maximum 33MB/s. In these cases, signal and data integrity will still surpass that of Fast ATA and earlier protocols at a given burst transfer rate. In fact, the slower the Ultra-ATA transfer speeds, the greater the integrity margins.

To access HP's white paper on the Ultra ATA/33 protocol, refer to **`www.hp.com/go/library`**.

## Ultra ATA/66

Ultra ATA/66 is an extension of the Ultra ATA/33 hard drive interface that doubles its burst data rate. Also known as Ultra DMA/66 and Fast ATA-2, Ultra ATA/66 allows host computers to send and receive data at 66.6MB/s, which is twice the data transfer speeds of 33.3MB/s of Ultra DMA/33. The result is maximum disk performance under PCI local bus environments.

At its fast burst data rates, Ultra ATA/66 will go farther than Ultra ATA/33 in removing bottlenecks associated with data transfers, especially during sequential operations. Ultra ATA/66 also delivers heightened data integrity to the EIDE interface through use of a 40-pin 80-conductor cable, and CRC (Cyclical Redundancy Check) error detection code. The 80-conductor cable reduces crosstalk and improves signal integrity by providing 40 additional ground lines between the 40-pin IDE signal and ground lines. The connector is plug-compatible with existing 40-pin headers, and the incremental cost for the cable should be minimal. As with Ultra ATA/33, CRC ensures the integrity of transferred data.

By having the hard drive as the source of both the strobe and the data during a read, Ultra ATA/33 eliminated both propagation and data turnaround delays. The elimination of these delays improved the timing margins. Ultra ATA/66 retains the same strobe frequency but doubles the burst transfer rate once again.

Ultra ATA/66 is available on HP PCs and e-pcs running Windows 98, Windows NT4 and Windows 2000. Ultra ATA/66 is not available with Windows 95.

The progressive advantage of Ultra ATA/66 is to double the transfer rate once again, this time by reducing setup times. Timing signals are made twice as fast. However, a new 80-conductor cable is needed to ensure data integrity. The 40-pin interface cable of the earlier Ultra ATA/33 and multi-word DMA interfaces cannot handle the shorter cycle times for a 44.4MB/s or 66.6MB/s burst rate. The 80-conductor cable retains the same connector configuration as the standard 40-pin interface cable but has ground lines interleaved between all signal lines. In other words, the 40 new lines are all ground (which act as shields) and no new signals are transferred.

Ultra ATA/33 introduced CRC, a feature new to IDE that provides data protection verification. Ultra ATA/66 uses the same process. The CRC is calculated on a per-burst basis by both the host and the hard drive, and is stored in their respective CRC registers. At the end of each burst, the host sends the contents of its CRC register to the hard drive, which then compares it against its own register's contents. If the hard drive reports errors to the host, then the host retries the command containing the CRC error.

## Ultra ATA/100

Ultra ATA/100 is an extension of the Ultra ATA/66 hard drive interface. Ultra ATA/100 increases burst data rates significantly over previous versions of the protocol. Also known as Ultra DMA/100 and Feature ATA, Ultra ATA/100 allows host computers to send and receive data at 100MB/s. This is considerably faster than the 66.6MB/s data transfer speeds of Ultra ATA/66. The result is maximum disk performance under PCI local bus environments.

At its fast burst data rates, Ultra ATA/100 will go farther than Ultra ATA/66 in removing bottlenecks associated with data transfers, especially during sequential operations. Ultra ATA/100 also delivers heightened data integrity to the EIDE interface through use of a 40-pin 80-conductor cable, and CRC (Cyclic Redundancy Check) error detection code. The 80-conductor cable reduces crosstalk and improves signal integrity by providing 40 additional ground lines between the 40-pin IDE signal and ground lines. The connector is plug-compatible with existing 40-pin headers, and the incremental cost for the cable should be minimal. As with Ultra ATA/66, CRC ensures the integrity of transferred data

By increasing the burst transfer rates of IDE drives, UltraATA/100 brings the effective transfer rate of the system's bus and a drive's internal data rate that much closer into balance. Ultra ATA/100 allows greater system throughput, particularly for long sequential transfers required by audio/visual applications.

Ultra ATA/100 hard drives are 100 percent backwards compatible with Ultra ATA/66, Ultra ATA/33, and DMA, as well as with existing EIDE/IDE hard drives, CD-ROM drives, and host systems.

**NOTE** S.M.A.R.T. or Self Monitoring Analysis and Reporting Technology allows the hard disk drive to report certain types of degradation or impending failure. This allows the operating system to take the necessary precautions and warn the user. The system is comprised of software that resides both on the disk drive and on the host computer. The disk drive software monitors the internal performance of the motors, media, heads, and electronics of the drive, while the host software monitors the overall reliability status of the drive. The reliability status is determined through the analysis of the drive's internal performance level and the comparison of internal performance levels to predetermined threshold limits.

# DVD-ROM Drives

## Digital Versatile Disk (DVD) Technology

Digital Versatile Disc (DVD) is a medium for the distribution of from 4.7 to 17GB of digital data on a 120-mm (4.75 inch) disc. This huge volume of data (CD-ROMs can store 680MB) can be used to store up to nine hours of studio quality video and multi-channel surround-sound audio, highly interactive multimedia computer programs, 30 hours of CD-quality audio, or anything else that can be represented as digital data.

A DVD looks like a CD-ROM: it is a silvery disc, 4.75 inches in diameter, with a hole in the center. Like a CD, data is recorded on the disc in a spiral trail of tiny pits, and the discs are read using a laser beam. The DVD's larger capacity is achieved by making the pits smaller and the spiral tighter, and by recording the data in as many as four layers, two on each side of the disc.

To read these tightly packed discs, lasers that produce a shorter wavelength beam of light are required, as are more accurate aiming and focusing mechanisms. In fact, the focusing mechanism is the technology that allows data to be recorded on two layers. To read the second layer, the reader simply focuses the laser a little deeper into the disc, where the second layer of data is recorded.

Not only are two layer discs possible, but so are double-sided discs. The availability of four layers is what gives DVD its 17GB capacity.

| | DVD | CD |
|---|---|---|
| **Diameter** | 120mm | 120mm |
| **Thickness** | 0.6mm | 1.2mm |
| **Track Pitch** | 0.74nm | 1.6nm |
| **Minimum Pit Length** | 0.40nm | 0.834nm |
| **Laser Wavelength** | 640nm | 780nm |
| **Data Capacity (per layer)** | 4.7GB | 0.68GB |
| **Layers** | 1,2,4 | 1 |

## Audio features of DVD-Video

A DVD-Video disc can have up to 8 audio tracks (streams). Each track can be in one of three formats:

- Dolby Digital (Dolby AC-3): 1 to 5.1 channels
- MPEG-2 audio: 1 to 5.1 or 7.1 channels
- LPCM: 1 to 8 channels.

Dolby Digital is multi-channel digital audio, using lossy AC-3 coding technology from original PCM with a sample rate of 48 kHz at up to 24 bits. The bitrate is 64 kbps to 448 kbps, with 384 being the normal rate for 5.1 channels and 192 being the normal rate for stereo (with or without surround encoding).

MPEG audio is multi-channel digital audio, using lossy compression from original PCM format with sample rate of 48 kHz at 16 bits. Both MPEG-1 and MPEG-2 formats are supported. The variable bitrate is 32 kbps to 912 kbps, with 384 being the normal average rate. MPEG-1 is limited to 384 kbps.

Linear PCM is uncompressed (lossless) digital audio, the same format used on CDs and most studio masters. It can be sampled at 48 or 96 kHz with 16, 20, or 24 bits/sample. (Audio CD is limited to 44.1 kHz at 16 bits.) There can be from 1 to 8 channels. The maximum bitrate is 6.144MBps.

## DVD Region Codes

After setting the DVD region (by playing a DVD video for the first time), the DVD region can be changed a further four times; after that the DVD drive will only play DVD videos from the last DVD region that was set.

| Regional Codes | Region |
|---|---|
| 1 | USA & Canada |
| 2 | Europe (excluding former USSR countries), Japan, Near East (including Iran and Egypt), South Africa |
| 3 | South East Asia, South Korea |
| 4 | Latin America & Oceania (Australia, New Zealand) |
| 5 | Africa (excluding Egypt and South Africa), Eastern European countries, Sub-Indian continent |
| 6 | China |

# CD-RW Drives

## CD-RW Technology

CD-RW drives use a technology known as optical phase-change. It does not use magnetic fields like the phase-change technology used with magneto-optical technology. The media are generally distinguishable from CD-R discs by their metallic grey color. The basic structure of the discs, however, is the same as a CD-R disc but with significant detail differences. A CD-RW disc's phase-change medium consists of a polycarbonate substrate, moulded with a spiral groove for servo guidance, absolute time information and other data, on to which a stack (usually five layers) is deposited. The recording layer is sandwiched between dielectric layers that draw excess heat from the phase-change layer during the writing process. In place of the dye-based recording layer on a CD-R disc, CD-RW commonly uses a crystalline compound made up of a mix of silver, indium, antimony and tellurium. This mix, when heated to a certain temperature and then cooled becomes crystalline, but if heated to a higher temperature it becomes amorphous when it cools down again. The crystalline areas allow the metallized layer to reflect the laser light better while the non-crystalline portion absorbs the laser beam, and is therefore not reflected.

CD-RW devices use three different laser powers to achieve these effects in the recording layer:

- the highest, called 'Write Power', creates a non-crystalline (absorptive) state on the recording layer
- the medium, 'Erase Power', melts the recording layer and converts it to a reflective crystalline state
- the lowest, 'Read Power', does not alter the state of the recording layer, so it can be used for reading the data.

During writing, a focused 'Write Power' laser beam selectively heats areas of the phase-change material above the melting temperature (500-700$^{o}$ C), so all the atoms in this area can move rapidly in the liquid state. Then, if cooled sufficiently quickly, the random liquid state is 'frozen-in' and the so-called amorphous state is obtained. The amorphous version of the material shrinks, leaving a pit where the laser dot was written, resulting in a recognizable CD surface. When an 'Erase Power' laser beam heats the phase-change layer to below the melting temperature but above the crystallization temperature (200$^{o}$ C) for a sufficient time (at least longer than the minimum crystallization time), the atoms revert back to an ordered state (the crystalline state). Writing takes place in a single pass of the focused laser beam, sometimes referred to as 'direct overwriting' and the process can be repeated several thousand times per disc.

Once the data has been burned the amorphous areas reflect less light, enabling a 'Read Power' laser beam to detect the difference between the lands and the pits on the disc. One compromise here is that the disc reflects less light than CD-ROMs or CD-Rs and consequently CD-RW discs can only be read on CD players that support the new MultiRead specification.

CD-RW drives are dual-function, offering both CD-R and CD-RW recording, so the user can choose the best media for a particular job.

Although UDF (Universal Disc Format) allows users to drag and drop files to discs, CD-RW is still not as easy to use as a hard disk. Initially limitations in the UDF standard and associated driver software meant that when data was deleted from a CD-RW, those areas of the disc were merely marked for deletion and were not immediately accessible. A disc could be used until all its capacity was used, but then the entire disc had to be erased to reclaim its storage space using a 'sequential erase' function. In hardware terms erasing a disk is accomplished by heating up the surface to a lower temperature, but for a longer time, which returns it to the crystalline state.

Evolution of the UDF standard and developments in associated driver software have improved things considerably, making CD-RW more like hard drives or floppy disks.

# 4

# AGP Graphics Controllers

This chapter describes graphics controllers and the technology they use. AGP technology was developed as a means of accessing system memory as a viable alternative to augmenting the memory of the graphics subsystem needed for high quality 3D graphics applications.

# Graphics Controller Usage

| | Matrox Millennium G400 | Matrox Millennium G450 | Nvidia GeForce2 MX | Nvidia GeForce3 Ti200 | Nvidia TNT2 Vanta | ATI Rage 128 | Intel Integrated Graphics |
|---|---|---|---|---|---|---|---|
| VL400 | ✓ | ✓ | ✓ | | | | ✓ |
| VL410 | | | | | | | ✓ |
| VL420 | | | ✓ | ✓ | ✓ | ✓ | |
| XE310 | | | | | | | ✓ |
| XE320 | | | | | ✓ | ✓ | |
| e-pc 40 | | | | | | | ✓ |
| e-pc 42 | | | | | | ✓ | |
| e-pc c10/s10 | | | | | | | ✓ |

# Matrox Millennium G400 AGP Graphics Card (On Selected VL400 PCs)

The Matrox Millennium G400 is an AGP 4X graphics controller designed to make maximal use of the AGP 4X's 1GB/s bandwidth. As graphics applications become more demanding, data transfer rates must increase in order to support the growing bandwidth requirements of these applications.

The Matrox G400 acts as a unique multi-threaded AGP 4X bus master that is capable of using Direct Memory Access (DMA) to fetch commands and data from multiple locations in memory. This feature balances the needs of next generation 3D applications to send command data, vertex data and texture data from different areas in memory across the AGP bus to the graphics engine. In addition, the Matrox G400 is able to avoid long latencies in data fetching across the AGP bus. Large buffers inside the Matrox G400 allow it to initiate Extended Burst Transactions on the AGP 4X bus for highly optimized data flow. The combination of these features allows the Matrox G400 to sustain high, effective bandwidth on the AGP bus for high performance in real-life applications. The Matrox G400 also supports AGP texturing, pipelining, side band signaling, and AGP 4X transactions.

## 256-bit DualBus Architecture

Building on the success of the MGA-G200's 128-bit DualBus architecture, the Matrox G400 doubles the engine bandwidth by moving to a full 256-bit DualBus architecture, composed of two independent unidirectional 128-bit buses working in parallel inside the chip. Coupled with a high-speed 128-bit bus to external memory, the Matrox G400 256-bit DualBus architecture delivers very high 2D performance, surpassing the performance of traditional 128-bit architectures. While the 256-bit DualBus provides the largest direct gain in 2D performance, it is also used to accelerate all other data types, including 3D and video.

One of the benefits of the DualBus architecture is dual command pipelining, a feature that delivers fast and efficient data transfer by preventing empty, or wasted, cycles between commands. Dual command pipelining avoids the latency experienced with the traditional 128-bit bus by allowing the Data In buffer to begin sending the next command to the engine while the Data Out buffer finishes reading the results from the current command. Since the next piece of data to be processed by the engine is always available in the Data In buffer, it can be sent to the engine right away. This ensures a continuous, uninterrupted flow of instructions/commands to the engine.

## Vibrant Color Quality (VCQ) Rendering

The VCQ rendering engine in the Matrox G400 was designed to ensure that multi-textured applications are rendered with the same Vibrant Color Quality achieved with single texturing on the MGA-G200. Multi-texturing requires the combination or blending of many textures onto a single polygon. Without proper care, precision can be lost on each texture pass and the resulting image suffers from cumulative rounding errors and ugly dither patterns. The VCQ engine addresses this issue with increased precision and buffering throughout all of the internal 3D pipelines.

## Symmetric Rendering Architecture (SRA)

Similar to the MGA-G200, the Matrox G400 uses a Symmetric Rendering Architecture (SRA) to take advantage of the high bandwidth made available by the AGP 4X bus. Within the SRA, the Matrox G400 treats AGP memory exactly as if it were local video memory, meaning that in a fully bus mastered fashion, the Matrox G400 can draw to, render to and read from AGP memory at AGP 4X transfer rates. By using the SRA as a key component of 3D, 2D and video operations, the Matrox G400 benefits from the 1GB/s bandwidth provided by the AGP 4X bus in parallel with local video memory to achieve an optimal performance level in all application areas. To alleviate some of the drain on local memory, the SRA uses a hierarchical texturing system which stores textured and bitmapped surfaces across three levels: the large on-chip cache, local video memory of 32MB (16MB on dual head models) and AGP memory. Within the hierarchical texturing system, small and frequently used textures are usually mapped from local memory while large and infrequently used textures are mapped using AGP texturing from AGP memory. Supported by the chip's intelligent memory controller and the driver's intelligent memory management and allocation scheme, the hierarchical texturing system ensures that available memory resources are maximized and used with utmost efficiency. In addition, the SRA is designed to take advantage of the local video memory pool of 32MB, meaning that users benefit from high resolution triple buffering and extra texture storage. Two-dimensional bitmaps benefit from the SRA in the same way that 3D textures do. In addition, the Matrox G400 expands the amount of fast access memory available for bandwidth-intensive video compression and decompression operations by writing to AGP memory at AGP 4X speeds.

## DualHead Display

DualHead Display is a new technology in the Matrox G400 which allows a single chip to ouput two physically separate images simultaneously to two different output devices. The DualHead Display is quite versatile in its ability to support simultaneous output either to two RGB monitors, to an RGB monitor and a television set, to an RGB monitor and a Digital Flat Panel or to two analog Flat Panels. DualHead Display takes advantage of a new Windows 98 feature which allows a single board to support a Windows desktop spanning multiple monitors. In addition, DualHead Display offers enhanced performance for DVD viewing, design applications, video editing, and web browsing.

The dual head version with 16MB of memory is used on some VL400 PCs.

# Matrox Millennium G450 AGP Graphics Card (On Selected VL400 PCs)

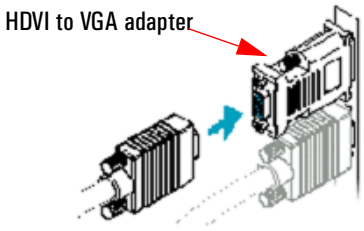
The Matrox Millennium G450 is a dual head AGP 4X graphics controller. Based on the powerful Millennium G400 (described on page 44), it extends the G400's capabilities. The G450's features include:

## Key Features

- Dual Monitors
  Two monitors can be connected for high-end and performance PC users and applications.
- TV-out encoder
  A TV can be connected to the second connector for use multimedia, TV and video applications.
- Second RAMDAC
  Separate RAMDAC for each graphics output, so that two displays can be run simultaneously. The primary RAMDAC runs at 360MHz and the secondary at 200MHz.
- 64-bit Double Data Rate (DDR) memory interface
- Maximum resolution
  On main display, 2048 × 1536, true color at 85Hz.
  On second display, 1600 × 1200, true color at 85Hz.
- Environment-Mapped Bump Mapping
  This is a Matrox DirectX feature that gives greater 3D realism. Using hardware, "bumps" are added to 3D graphics to make them appear more realistic.
- VCQ2 rendering
  This gives more vibrant, lush colors and clearer text. VCQ rendering is described in more detail on page 45.
- 3D Rendering Array Processor
  For fast, advanced 3D graphics.
- The Matrox Millennium G450 AGP card also exists in a PCI version, which is used on some VL400 Small Form Factor models.

# Nvidia GeForce2 MX Graphics Card (On Selected VL400 and VL420 PCs)

The Nvidia GeForce2 MX dual head graphics card brings the power of a Graphics Processing Unit (GPU) to the mainstream computer.




The standard version of the GeForce2 MX has a TwinView dual-display architecture and is capable of driving two digital displays independently, while fully supporting analog RGB (VGA) and TV-out. Its dual head provides one VGA output (analog) and one HDVI output (Digital for Flat panel). The HDVI connector can be converted to a classical VGA by adding an external converter.

A low profile version of the Nvidia GeForce2 MX is also available. The low-profile version does not have the same functionality as the standard version, it has a single VGA output, compared to the dualhead VGA and HDVI output on the standard card.

GeForce2 MX incorporates Digital Vibrance Control (DVC), which makes all images including 2D, 3D, and video more colorful. Its integrated High-Definition Video Processor (HDVP) supports ATSC 720p high-definition resolution at 60fps. GeForce2 MX also enables new applications like hardware timeshifting and digital VCR capabilities.

## Key Features

- Standard version: Dual-monitor support (VGA and HDVI), DVI to VGA converter provided
- Low profile version: Single VGA output
- 2nd generation transform & lighting engines
- 32MB DDR memory (not upgradeable)
- High definition video processor
- Full quality DVD and HDTV capability
- 350MHz ramdac, 2048x1536x32bpp on primary display, 150MHz, 1600x1200x32bpp at 60Hz on the secondary display
- 700 million texel fill rate
- 2.7GB/s memory bandwidth
- NVIDIA Unified Driver Architecture
- Digital Vibrance Control
- 8-64MB frame buffer size
- High-Definition Video Processor
- 256-bit graphics architecture.

## Supported Resolutions

The following resolutions are supported:

| Resolution on Primary Head | 256 colors (8-bit) | 64K Colors (16-bit) | 16.7M Colors (32-bit) |
|---|---|---|---|
| 640 x 480 | 60-240 Hz | 60-240 Hz | 60-240 Hz |
| 800 x 600 | 60-240 Hz | 60-240 Hz | 60-240 Hz |
| 1024 x 768 | 60-240 Hz | 60-240 Hz | 60-200 Hz |
| 1152 x 864 | 60-200 Hz | 60-200 Hz | 60-170 Hz |
| 1280 x 1024 | 60-170 Hz | 60-170 Hz | 60-150 Hz |
| 1600 x 1200 | 60-120 Hz | 60-120 Hz | 60-100 Hz |
| 1920 x 1080 | 60-100 Hz | 60-100 Hz | 60-85 Hz |
| 1920 x 1200 | 60-100 Hz | 60-100 Hz | 60-85 Hz |
| 1920 x 1440 | 60-85 Hz | 60-85 Hz | 60-75 Hz |
| 2048 x 1536 | 60-75 Hz | 60-75 Hz | 60 Hz |

# Nvidia GeForce3 Ti200 Graphics Card (On Selected VL420 Minitower PCs)

Some VL420 Minitower PC models are supplied with an Nvidia GeForce3 Ti200 64MB graphics card.

The Nvidia GeForce3 Ti200 card has 2 outputs, VGA and DVI. Either the VGA or the DVI output can be used. The outputs cannot be used for dual-monitor displays (unlike the GeForce 2 MX).

## Key Features

- NV20 ASIC + 64MB DDR SDRAM
- 175 MHz GPU clock
- 128 bit/200 MHz memory interface
- AGP 4x with Fast Writes
- 256 bit graphics accelerator
- VGA, DB15, VESA DDC2B
- DVI-D digital output connector
- Digital output cannot be used at the same time as the analog output
- 350MHz internal RAMDAC
- 2048x1536x32bpp @ 60 Hz maximum resolution
- Single link external TMDS
- 1600x1200 maximum resolution
- DirectX 8.1 API
- OpenGL1.3 ICD
- DVD and HDTV-ready for motion compensation for MPEG2 decoding
- 2800 million AA Samples/Sec fill rate
- T&L: 700 billion operations per second
- 6.4 GB/sec memory bandwidth.

## Supported Resolutions

The following display modes are supported up to the listed maximum refresh rates:

| Resolution | 256 colors (8-bit) | 64K Colors (16-bit) | 16.7M Colors (32-bit) |
|---|---|---|---|
| 640x480 | 240 Hz | 240 Hz | 240 Hz |
| 800x600 | 240 Hz | 240 Hz | 240 Hz |
| 1024x768 | 240 Hz | 240 Hz | 200 Hz |
| 1152x864 | 200 Hz | 200 Hz | 170 Hz |
| 1280x960 | 170 Hz | 170 Hz | 150 Hz |
| 1280x1024 | 170 Hz | 170 Hz | 150 Hz |
| 1600x900 | 150 Hz | 150 Hz | 120 Hz |
| 1600x1200 | 120 Hz | 120 Hz | 100 Hz |
| 1920x1080 | 100 Hz | 100 Hz | 85 Hz |
| 1920x1200 | 100 Hz | 100 Hz | 85 Hz |
| 1920x1440 | 85 Hz | 85 Hz | 75 Hz |
| 2048x1536 | 75 Hz | 75 Hz | 60 Hz |

# Nvidia TNT2 Vanta Graphics Card (On Selected VL420 and XE320 PCs)

Some VL420 and XE320 PC models are supplied with an Nvidia TNT2 Vanta graphics card.

A low-profile version of this card is also available for the VL420 small form factor. The low profile version has the same functionality as the standard version.

The Nvidia TNT2 Vanta graphics card provides powerful video and 2D/3D graphics features.

## Key Features

- 16MB 7ns 64-bit SDRAM memory (125MHz clock, 1.0GB/sec bandwidth)
- 300MHz RAMDAC built-in
- AGP 2X
- PC 99 DB-15 analog monitor connector (VESA DDC2B + DPMS)
- Cooled by heat sink only
- Full hardware triangle setup
- 200 Million pixels per second
- 5 Million triangles per second.

## 3D Features

- Single pass multi-texturing support
- 32-bit Z-buffer
- Environment mapping
- Per-pixel lighting and shading
- Procedural textures
- Texture modulation
- Light and reflection maps
- Bump mapping
- Per pixel perspective correct texture mapping
- Full scene, order independent anti-aliasing

## 2D and Video Features

- Windows GDI acceleration
- Fast 32-bit VGA/SVGA support
- Multi-buffering (double, triple, quad)
- Video acceleration (DirectShow, MPEG-1, MPEG-2, Indeo)
- Back-end hardware video scaling for video conferencing and playback
- Multiple video windows
- Hardware color space conversion/filtering
- Motion compensation for MPEG-2 decoding

## Supported Resolutions

The following 2D and 3D resolutions are supported:

| Resolution | 256 colors (8-bit) | 64K Colors (16-bit) | 16.7M Colors (32-bit) |
|---|---|---|---|
| 640 x 480 | 240 Hz | 240 Hz | 240 Hz |
| 800 x 600 | 240 Hz | 240 Hz | 240 Hz |
| 1024 x 768 | 170 Hz | 170 Hz | 170 Hz |
| 1152 x 864 | 150 Hz | 140 Hz | 140 Hz |
| 1280 x 1024 | 120 Hz | 100 Hz | 100 Hz |
| 1600 x 1024 | 85 Hz | 75 Hz | 75 Hz |
| 1600 x 1200 | 85 Hz | 75 Hz | 75 Hz |
| 1920 x 1080 | 85 Hz | 72 Hz | 72 Hz |
| 1920 x 1200 | 75 Hz | 60 Hz | 60 Hz |

# ATI Rage 128 Pro (On Selected VL420 and XE320 PCs) ATI Rage 128 Ultra (On Selected VL420 PCs)

Some VL420 PC models are supplied with an ATI Rage 128 Pro 16MB or ATI Rage 128 Ultra 32MB graphics card.

Some XE320 PCs are supplied with an ATI Rage 128 Pro 16/32MB graphics card.

A low profile version of both the ATI Rage 128 Pro and Ultra cards is also available for the VL420 small form factor the only difference between the standard and low profile version being the height of the bracket.

The ATI Rage 128 family is a speed enhanced, fully integrated, 128-bit graphics and multimedia accelerator.

## Key Features

- Powered by the ATI Rage 128 Pro chip
- Full AGP 2X/AGP 4X support (up to 1GB/s bandwidth)
- 128bit 2D engine
- Floating-point 3D setup engine with complete 3D primitive support
- High Quality DVD/MPEG2 playback with iDCT and motion compensation support
- DirectX 8 and OpenGL hardware acceleration
- Integrated triple 8-bit palette 250MHz RAMDAC with video gamma adjustment
- DDC2B support for Plug-&-Play detection of monitor
- 16/10 monitor support
- Support for 32-bit true color (16.7 million colors) at resolutions up to 1920x1440
- Twin-Cache architecture to maximize texture and pixel throughput.

## Supported Resolutions

The following 2D and 3D resolutions are supported:

| Color Palette | Maximum 2D display area | Maximum 3D display area | Double-buffered+ 32-bit |
|---|---|---|---|
| 8-bit | 1920 x 1440 | — | — |
| 16-bit | 1920 x 1440 | 1600 x 1200 | 1600 x 1200 |
| 24-bit | 1920 x 1440 | — | — |
| 32-bit | 1920 x 1440 | 1280 x 1024 | 1280 x 1024 |

## Refresh Rates

This following refresh rates/resolutions are supported:

| aspect ratio | Resolution | Refresh Rates (8-/16-/24-/32-bit) |
|---|---|---|
| 4:3/5:4 | 640 x 480 | 200 Hz |
| | 800 x 600 | 200 Hz |
| | 1024 x 768 | 180 Hz |
| | 1152 x 864 | 150 Hz |
| | 1280 x 1024 | 100 Hz |
| | 1600 x 1200 | 85 Hz |
| | 1920 x 1440 | 60 Hz |
| 16:9 / 16:10 | 1920 x 1080 | 80 Hz |
| | 1920 x 1200 | 76 Hz |

# ATI Rage 128 Pro Integrated Graphics (e-pc 42)

The e-pc 42 has an integrated ATI Rage 128 Pro graphics solution. The ATI Rage 128 Pro family is a speed enhanced, fully integrated, 128-bit graphics and multimedia accelerator.

## Key Features

- Powered by ATI Rage 128 Pro chip
- Full AGP 2X/AGP 4X support (up to 1GB/s bandwidth)
- 128bit 2D engine
- Floating-point 3D setup engine with complete 3D primitive support
- High Quality DVD/MPEG2 playback with iDCT and motion compensation support
- DirectX 8 and OpenGL hardware acceleration
- Integrated triple 8-bit palette 250MHz RAMDAC with video gamma adjustment
- DDC1 and DDC2B+ support for Plug-&-Play detection of monitor
- 16/10 monitor support
- Support for 32-bit true color (16.7 million colors) at resolutions up to 1920x1440
- Twin-Cache architecture to maximize texture and pixel throughput.

## Supported Resolutions and Refresh Rates

| Resolution | Max. Colors (bit depth) | Max. Refresh Rate |
|---|---|---|
| 640 x 480 | 32 | 200 Hz |
| 800 x 600 | 32 | 200 Hz |
| 848 x 480 | 32 | 88 Hz |
| 1024 x 768 | 32 | 100 Hz |
| 1152 x 864 | 32 | 100 Hz |
| 1280 x 1024 | 32 | 100 Hz |
| 1600 x 1200 | 32 | 85 Hz |
| 1792 x 1344 | 16 | 60 Hz |
| 1800 x 1440 | 16 | 70 Hz |
| 1856 x 1392 | 16 | 72 Hz |
| 1920 x 1080 | 16 | 75 Hz |
| 1920 x 1200 | 16 | 85 Hz |
| 2048 x 1536 | 16 | 75 Hz |

# Intel Integrated Graphics (VL400, VL410, XE310, e-pc 40 and e-pc s10/c10)

The Intel 815 and 810 chipset product families offer integrated graphics with Direct AGP and Dynamic Video Memory Technology (DVMT). Video memory is dynamically allocated from main memory.

## Key Features

- Integration of memory controller and graphics capability (Direct AGP).
- Advanced dynamic memory utilization (DVMT).

## Direct AGP

Rather than simply combining two semiconductor cell libraries for component reduction, both the Intel 810E and Intel 815 chipsets graphics controller combine the 2D and 3D video capabilities with the memory control unit. This functional overlap within the Graphics and Memory Controller enables Direct AGP.

Direct AGP provides an integrated graphics part with the capability to make direct memory set-up calls (similar to those associated with the standard AGP protocol) to system memory. Direct AGP calls can allocate and de-allocate system memory dynamically for complex 3D textures, preserving the benefits of standard AGP add-in solutions.

## Dynamic Video Memory Technology

Dynamic Video Memory Technology (DVMT) enables high graphics and memory performance through Direct AGP and highly efficient memory use. DVMT ensures the most efficient use of all available memory – regardless the size of the main memory– for maximum 3D graphics performance. During startup, memory is allocated for graphics dynamically depending on the PC's configuration.

DVMT only uses 1MB from the system's physical memory. This 1MB is required for legacy VGA graphics support and compatibility. Upon boot the BIOS allocates 1MB out of main memory for VGA graphics. An example of when VGA graphics memory is needed would be running under DOS when there is no driver loaded. Once the operating system boots this 1MB is not seen and is not visible by the operating system.

DVMT is highly scalable — as additional memory is added to the system, more memory will be available to enhance 3D applications. DVMT works dynamically and modulates the bandwidth available to the CPU, graphics and I/O interface, through the intelligent arbitration built into the Intel 815 family. This hard-coded logic evaluates the operating environment and prioritizes traffic to maximize bandwidth for memory intense multimedia applications.

## Memory Usage with Dynamic Video Memory Technology

The operating system requires allocation of up to 1MB of system memory to support legacy VGA. System properties will display up to 1MB less than physical system memory available to the operating system.

The graphics driver for both the Intel 810E and Intel 815 chipsets request up to 4MB of memory from the OS to implement a maximum 1024 x768 screen resolution, 2MB for a command buffer and 4MB used for z-buffering. For high-end 3D applications, the driver requests allocation of system memory from the OS for graphics textures. When the 3D application is closed, the OS will reallocate system memory back for generic use.

The graphics driver provides the address of an external SDRAM display cache to store z-buffering. SDRAM runs at 4MB of 100MHZ using the Intel 810E and 4MB of 133MHz using the Intel 815E or 815EG chipset. Storing the z buffering in the external 4MB display cache provides increased 3D performance. A maximum of 6 MB of system memory is allocated for the frame buffer and the remaining graphics data structures.

# 5

# Audio, Network, Input Devices, Connectors and Sockets

This chapter describes the audio controllers, network features, input devices and the connectors and sockets.

# Audio Controllers

**NOTE** There are two versions of the HP XE310 PC: Series 1 and Series 2. To identify which model you have, look at the sticker located on the right side of your PC. Series 1 models are labelled 'XE310' and Series 2 models are labelled 'XE310 Series 2'. All information in the following table applies to both Series 1 and Series 2 PCs unless otherwise stated.

## Usage

| | CrystalClear CS4299 | Analog Devices AD1885 | Sound Blaster Live Audio Card |
|---|---|---|---|
| **VL400** | ✓ | | |
| **VL410** | | ✓ | |
| **VL420** | | ✓ | ✓ |
| **XE310 (Series 1)** | ✓ | | |
| **XE310 (Series 2)** | | ✓ | |
| **XE320** | | ✓ | |
| **e-pc 40** | | ✓ | |
| **e-pc 42** | | ✓ | |
| **e-pc c10/s10** | ✓ | | |

## Crystal CS4299 Integrated PCI Audio (VL400, XE310 Series 1 and e-pc c10/s10)

Based on the earlier Crystal audio controller, the CS4299 extends these features to include, among many other enhancements, PC'98 and PC'99 compliancy for multimedia desktops requiring high quality audio.

Coupling the CS4299 with a PCI audio accelerator or core logic supporting the AC '97 interface, implements a cost-effective, superior quality, audio solution.

Features of the CS4299 include:

- AC'97 2.1 compatibility
- Industry leading mixed signal technology
- 20-bit stereo digital-to-analog converter and 18-bit analog-to-digital converter
- Sample rate converters
- Dual microphone inputs
- An analog line-level stereo inputs for LINE IN
- Stereo line level output
- High quality, pseudo differential CD input
- 3D stereo enhancement
- Meets or exceeds Microsoft's PC'98, PC'99 audio performance requirements
- Extensive power management support.

## Analog Devices AD1885 Integrated AC'97 Audio (VL410, VL420, XE310 Series 2, XE320, e-pc 40 and e-pc 42)

Analog Devices AD1885 AC'97 provides stereo analog I/O on the PC motherboard and peripheral devices, as part of the signal chain for delivery of high quality audio to PC-connected speakers, headphones, and microphone devices. AD1885 includes high-fidelity analog/digital, digital/analog, and sample rate converters, as well as power amplifier and programmable gain blocks.

AD1885 uses the same architecture as the Crystal CS4299 solution described in the previous section.

Other features of the Analog Devices AD1885 include:

- AC'97 2.1 compatibility
- Greater than 90dB dynamic range
- Industry leading mixed signal technology
- 16-bit stereo full-duplex codec
- High quality pseudo differential CD input
- Mono microphone input with built-in 20dB pre-amplifier
- An analog line-level stereo input for LINE IN
- Stereo line level output
- Meets or exceeds Microsoft's PC'98, PC'99, PC'2001, Windows Logo Program 2.0 audio performance requirements.

# Sound Blaster Live 5.1 Audio Card (VL420 minitower)

The Sound Blaster Live audio card is available as an alternative audio solution for VL420 minitower PCs. It is capable of producing a virtually limitless variety of professional quality digital sound effects. It allows multiple audio sources to playback on the same speaker system and delivers a realistic 3D positional audio effect.

## Main Features

- Low noise, low distortion, better SNR and frequency response with a high performance AC'97 codec
- SoundFont technology enables users to create their own set of sound libraries
- 64 hardware, 1024 PCI Wavetable
- Digital audio Multiple wave file playback
- Stereo wave file recording
- 64 Voice 2 Port hardware wavetable MIDI playback
- Playback of 64 audio channels, each audio channel can play back either 8 bit or 16 bit data from host memory
- Full duplex recording and playback.

## Effects Engine

- Supports real-time digital effects like reverb, chorus, echo, flanger, pitch shifting, vocal morpher, ring modulator, auto-wah or distortion across any audio source
- Capable of processing, mixing and positioning audio streams using up to 131 available hardware channels
- Full bass, treble, and effects controls available for all audio.

## 32-Bit Digital Audio Engine

- User selectable bit rates from 8-bit to 16-bit
- User selectable sample rates from 8kHz to 48kHz
- All sound sources are handled with 32-bit precision for highest quality output
- Analog and Digital I/O modes supported
- Hardware full-duplex support enables simultaneous record and playback at 8 standard sample rates.

## Specifications

The following table provides some typical performance values for the Sound Blaster Live audio card:

| | | |
|---|---|---|
| **Supported Recording Sampling Rates** | 8.0kHz, 11.025kHz, 16.0kHz, 22.05kHz, 24.0kHz, 32.0kHz, 44.1kHz, 48.0kHz | |
| **Supported Playback Sampling Rates** | Any arbitrary sampling rate ≤ 48kHz | |
| **Power Consumption** | $V_{cc}$ nominal current | 400mA |
| | +12V, nominal current | 160mA |
| | -12V, nominal current | 50mA |
| **Temperature Range** | Operating | 10°C to 50°C |
| | Non-Operating | -40°C to 125°C |

# Integrated Network Controllers

**NOTE** There are two versions of the HP XE310 PC: Series 1 and Series 2. To identify which model you have, look at the sticker located on the right side of your PC. Series 1 models are labelled 'XE310' and Series 2 models are labelled 'XE310 Series 2'. All information in the following table applies to both Series 1 and Series 2 PCs unless otherwise stated.

## Usage

| | 3COM | Intel Pro 100 VE |
|---|---|---|
| **VL400** | ✓ | |
| **VL410** | | ✓ |
| **VL420** | | ✓ |
| **XE310 (Series 2)** | | ✓ |
| **XE320** | | ✓ |
| **e-pc 40** | | ✓ |
| **e-pc 42** | | ✓ |

## Integrated 3COM LAN Controller (VL400)

The VL400 has an integrated LAN controller, the 3COM 3C920. This is a full duplex LAN controller with automatic 10 Base-T/100 Base-TX port selection.

| 3C920 Features | |
|---|---|
| **LAN Interface** | • 32 bits PCI 10 Base-T/100 Base-TX<br>• RJ 45 LAN port |
| **Power Management** | • RPO (Remote Power-On) and RWU (Remote Wake-Up) for APM Windows 95 and Windows 98 (SR # 1 only), Windows NT 4.0; RWU for ACPI Windows 98SE and Windows 2000<br>• On Now 1.0; APM 1.2; ACPI 1.0<br>• PCI Power Management 1.1, PCI 2.2 |
| **Manageability** | • DMI 2.0 Component Code<br>• WfM 2.0 Bootrom |
| **Diagnostics** | • Production Diag<br>• MAC address DOS report tool<br>• User Diag for MS-DOS, Windows 95, Windows 98 and Windows NT 4.0 |
| **Drivers** | Windows 2000, Windows 95, Windows 98, Windows NT 4.0, Novell support |
| **Specifications** | |
| **Network Interface** | • 10 Mbps Ethernet 10BASE-T: Ethernet IEEE 802.3 industry standard for a 10 Mbps baseband CSMA/CD local area network.<br>• 100 Mbps Ethernet 100BASE-TX: Ethernet IEEE 802.3u industry standard for a 100 Mbps base-band CSMA/CD local area network. |

The integrated 3COM 3C920 is functionally equivalent to the HP 10/100 3Com 3C905C-TX Network Interface Card.

# Integrated Intel PRO 100 VE Network Adapter (VL410, VL420, XE310 Series 2, XE320, e-pc 40 and e-pc 42)

This is a full duplex LAN controller with automatic 10 Base-T/100 Base-TX port selection.

| Intel PRO 100 VE Network Adapter Features | |
|---|---|
| **LAN Interface** | • 32 bits PCI 10 Base-T/100 Base-TX<br>• RJ 45 LAN port |
| **Power Management** | • RPO (Remote Power-On) for Windows 98SE, Windows NT 4.0, Windows 2000, Windows XP. Not available for XE310 Series 2<br>• RWU (Remote Wake-Up) for Windows 98SE, Windows 2000, Windows XP<br>• On Now ACPI 1.0b<br>• PCI Power Management 1.1, PCI 2.2 |
| **Manageability** | • DMI 2.0 Component Code<br>• WfM 2.0, PXE 2.1 and RPL2.73 boot on LAN |
| **Diagnostics** | • Production Diag<br>• MAC address DOS report tool<br>• User Diag for MS-DOS and Windows NT 4.0 |
| **Drivers** | Windows XP, Windows 2000, Windows 98, Windows NT 4.0, Novell support |
| **Specifications** | |
| **Network Interface** | • 10 Mbps Ethernet 10BASE-T: Ethernet IEEE 802.3 industry standard for a 10 Mbps baseband CSMA/CD local area network.<br>• 100 Mbps Ethernet 100BASE-TX: Ethernet IEEE 802.3u industry standard for a 100 Mbps baseband CSMA/CD local area network. |

# LAN Card Ready Program (VL400, VL410 and VL420)

The HP LAN Card Ready (LCR) Program provides drivers and installation information for LAN cards by third-party manufacturers that have been tested on your PC.

By using the exact configuration tested by HP, you will be able to install the LAN card more quickly and avoid many of the problems that can occur due to resource conflicts and incompatible driver revisions.

Follow the **LAN Card Ready** link from HP's Support Web site at: **`www.hp.com/go/vectrasupport`** to access LAN information and drivers tested on your PC.

# Input Devices

## Standard HP PS2 Keyboard

The standard HP keyboard has the following features:

- Euro symbol available on selected localizations if supported by the operating system (Windows 98, Windows 98 SE, Windows 2000, Windows NT4). See Microsoft's Web site for more details
- 6-pin Mini-Din style Keyboard with Windows keys
- Available in 30 languages
- Power on function from the space bar supported on some PC models
- Includes 12 function keys, numeric keypad and cursor keys.

## HP USB Internet Keyboard

The HP USB Internet keyboard has the following features:

- Connection via USB port
- User-configurable hotkeys for launching applications, opening documents, connecting to web sites
- Sleep key
- Audio volume mute key
- Power on function from the space bar supported on some PC models.

## HP PS2 Scrolling Mouse

The HP PS2 Scrolling Mouse provides the following benefits:

- Quicker and smoother scrolling through screens of information
- Immediate zooming on data without having to action scrollbars, menus or buttons
- Full functionality on supporting applications, including Microsoft Office 97.

You can easily configure the scrolling wheel to take full advantage of the functionality provided by an increasing number of applications or simply use it as a third button.

The scrolling mouse kit includes 1 scrolling mouse and 2 driver floppies.

### Specifications

- PS/2 compatible mouse with rubber scrolling wheel, including mini-DIN connector
- Allows scrolling in Windows 95, 98, NT applications (not only Office 97-compatible applications)
- Allows configuration of the wheel as a 3rd button.

## HP USB Scrolling Mouse

This has the similar benefits and specifications to the HP PS2 scrolling mouse described above. However, it can be connected to the computer's USB port and, with the adapter usually provided with the mouse, it can also be connected to the standard PS2 mouse connector.

# Connectors and Sockets

## Power Supply Connector

| 20-pin Power Supply Connector for System Board | | | |
|---|---|---|---|
| **Pin** | **Signal** | **Pin** | **Signal** |
| 1 | + 3.3 Volt supply | 2 | + 3.3 Volt supply |
| 3 | Ground | 4 | +5 Volt supply |
| 5 | Ground | 6 | +5 Volt supply |
| 7 | Ground | 8 | PwrGood |
| 9 | 5V STDBY | 10 | +12 Volt supply |
| 11 | + 3.3 Volt supply | 12 | -12 Volt supply |
| 13 | Ground | 14 | Remote On |
| 15 | Ground | 16 | Ground |
| 17 | Ground | 18 | N.C. |
| 19 | +5 Volt supply | 20 | +5 Volt supply |

## USB Stacked Connector (except VL420 and XE320)

| USB Stacked Connector | | | |
|---|---|---|---|
| **Pin** | **Signal** | **Pin** | **Signal** |
| 1 | USB0 Power | 2 | USB0 Neg. |
| 3 | USB0 Pos. | 4 | Chassis Ground |
| 5 | USB1 Power | 6 | USB1 Neg. |
| 7 | USB1 Pos. | 8 | Chassis Ground |
| 9 | Chassis Ground | 10 | Chassis Ground |
| 11 | Chassis Ground | 12 | Chassis Ground |

## USB Stacked Connector (VL420)

| USB Stacked Connector | | | |
|---|---|---|---|
| **Pin** | **Signal** | **Pin** | **Signal** |
| 1 | USB0 Power 0 | 2 | USB0 Neg. |
| 3 | USB0 Pos. | 4 | Ground |
| 5 | Key (no pin) | 6 | USB0 Power 1 |
| 7 | USB1 Neg. | 8 | USB1 Pos. |
| 9 | Ground | 10 | Cable Detect |

# IDE and Floppy Disk Drive Connectors

| IDE Connector | | | |
|---|---|---|---|
| **Pin** | **Signal** | **Pin** | **Signal** |
| 1 | Reset# | 2 | Ground |
| 3 | HD7 | 4 | HD8 |
| 5 | HD6 | 6 | HD9 |
| 7 | HD5 | 8 | HD10 |
| 9 | HD4 | 10 | HD11 |
| 11 | HD3 | 12 | HD12 |
| 13 | HD2 | 14 | HD13 |
| 15 | HD1 | 16 | HD14 |
| 17 | HD0 | 18 | HD15 |
| 19 | Ground 7 | 20 | orientation key |
| 21 | DMARQ | 22 | Ground 2 |
| 23 | DIOW# | 24 | Ground 3 |
| 25 | DIOR# | 26 | Ground 4 |
| 27 | IORDY | 28 | CSEL |
| 29 | DMACK# | 30 | Ground 5 |
| 31 | INTRQ | 32 | IOCS16# |
| 33 | DA1 | 34 | PDIAG# |
| 35 | DA0 | 36 | DA2 |
| 37 | CS1FX | 38 | CS3FX |
| 39 | DASP# | 40 | Ground 6 |

| Floppy Disk Drive Data Connector | | | |
|---|---|---|---|
| **Pin** | **Signal** | **Pin** | **Signal** |
| 1 | Ground | 2 | LDENSEL# |
| 3 | Ground | 4 | Microfloppy |
| 5 | Ground | 6 | EDENSEL |
| 7 | Ground | 8 | INDX# |
| 9 | Ground | 10 | MTEN1# |
| 11 | Ground | 12 | DRSEL0# |
| 13 | Ground | 14 | DRSEL1# |
| 15 | Ground | 16 | DTEN0# |
| 17 | Ground | 18 | DIR# |
| 19 | Ground | 20 | STP# |
| 21 | Ground | 22 | WRDATA# |
| 23 | Ground | 24 | WREN# |
| 25 | Ground | 26 | TRK0# |
| 27 | Ground | 28 | WRPRDT# |
| 29 | Ground | 30 | RDDATA# |
| 31 | Ground | 32 | HDSEL1# |
| 33 | Ground | 34 | DSKCHG# |

# IDE Connector for Slim Optical Drives

This connector is used for connecting slim optical drives, such as the slim CD drive used in the e-pc 42 and VL420 small form factor.

| IDE Connector | | | |
|---|---|---|---|
| **Pin** | **Signal** | **Pin** | **Signal** |
| 1 | LOUT | 2 | ROUT |
| 3 | A. GND | 4 | GND |
| 5 | HRST | 6 | HD08 |
| 7 | HD07 | 8 | HD09 |
| 9 | HD06 | 10 | HD10 |
| 11 | HD05 | 12 | HD11 |
| 13 | HD04 | 14 | HD12 |
| 15 | HD03 | 16 | HD13 |
| 17 | HD02 | 18 | HD14 |
| 19 | HD01 | 20 | HD15 |
| 21 | HD00 | 22 | DMARQ |
| 23 | GND | 24 | /HIOR |
| 25 | /HIOW | 26 | GND |
| 27 | HIORDY | 28 | /DMACK |
| 29 | HIRQ | 30 | /HIOCS16 |
| 31 | HA01 | 32 | /PDIAG |
| 33 | HA00 | 34 | HA02 |
| 35 | /HCSO | 36 | /HSCI |
| 37 | /DSAP | 38 | +5V |
| 39 | +5V | 40 | +5V |
| 41 | +5V | 42 | +5V |
| 43 | GND | 44 | GND |
| 45 | GND | 46 | GND |
| 47 | CSEL | 48 | GND |
| 49 | Reserved | 50 | Reserved |

## Status Panel Connector (except Vectra XE310, Vectra XE320 and Vectra VL420)

| Status Panel Connector | | | |
|---|---|---|---|
| **Pin** | **Signal** | **Pin** | **Signal** |
| 1 | Power LED (green) - standby | 2 | Ground |
| 3 | Power LED (green) - on | 4 | Key |
| 5 | $V_{CC}$ (power) | 6 | HDD LED (yellow) |
| 7 | Power button return path | 8 | Ground |
| 9 | Lock Led (amber) | 10 | Ground |

## Status Panel Connector (Vectra XE310 Series 1)

| Status Panel Connector | | | |
|---|---|---|---|
| **Pin** | **Signal** | **Pin** | **Signal** |
| 1 | Power LED - standby | 2 | Ground |
| 3 | Power LED - blinking | 4 | Key |
| 5 | $V_{CC}$ (power) | 6 | HDD LED |
| 7 | Ground | 8 | Power Button |

## Status Panel Connector (Vectra XE310 Series 2)

| Status Panel Connector | | | |
|---|---|---|---|
| **Pin** | **Signal** | **Pin** | **Signal** |
| 1 | Power LED (green) - standby | 2 | Ground |
| 3 | Power LED (green) - on | 4 | Key |
| 5 | $V_{CC}$ (power) | 6 | HDD LED (yellow) |
| 7 | Power button return path | 8 | Ground |

## Status Panel Connector (Vectra VL420 and Vectra XE320)

| Status Panel Connector | | | |
|---|---|---|---|
| **Pin** | **Signal** | **Pin** | **Signal** |
| 1 | Power LED pos. - standby | 2 | Power LED neg. |
| 3 | Power LED - pos. on | 4 | Key |
| 5 | HDD LED pos. | 6 | HDD LED neg. |
| 7 | Power Button - return | 8 | Power Button - input |

## PCI Wakeup Connector (Vectra VL400 only)

| PCI Wakeup | |
|---|---|
| **Pin** | **Signal** |
| 1 | Ground |
| 2 | PCI Wakeup |
| 3 | Ground |

## Power Supply 3V3 and Fan Connector (where available)

| Power Supply 3V3 on Backplane (where appropriate) | | | |
|---|---|---|---|
| **Pin** | **Signal** | **Pin** | **Signal** |
| 1 | + 3V3 Volt supply | 2 | + 3V3 Volt supply |
| 3 | Ground | 4 | Ground |

| Fan Connector | |
|---|---|
| **Pin** | **Signal** |
| 1 | Ground |
| 2 | 12V Power |
| 3 | Control Signal |

## External Audio Connectors

A Line In jack, Line Out jack and Mic In jack connector are located on the PCs' rear panel. These external jacks are standard connectors.

## Internal Speaker Connector and Package Intrusion Connector (where available)

| Internal Speaker | |
|---|---|
| **Pin** | **Signal** |
| 1 | + 5 Volt |
| 2 | Speaker Signal |
| 3 | Analog Ground |
| 4 | Test Pin |

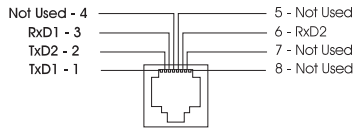
| Package Intrusion | |
|---|---|
| **Pin** | **Signal** |
| 1 | Open detect |
| 2 | Ground |

# External VGA DB15 Connector

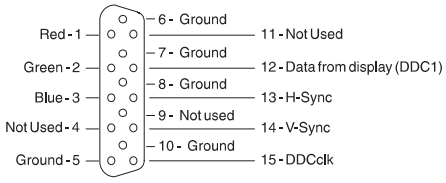
| VGA DB Connector Pins | | |
|---|---|---|
| **Pin** | **Standard VGA** | **DDC2B** |
| 1 | Analog RED | Analog RED |
| 2 | Analog GREEN | Analog GREEN |
| 3 | Analog BLUE | Analog BLUE |
| 4 | Monitor ID2 | Monitor ID2 |
| 5 | n/c | DDC return |
| 6 | Analog RED return | Analog RED |
| 7 | Analog GREEN return | Analog GREEN |
| 8 | Analog BLUE return | Analog BLUE |
| 9 | n/c | $V_{CC}$ supply (optional) |
| 10 | Digital ground | Digital ground |
| 11 | Monitor ID 0 | Monitor ID 0 |
| 12 | Monitor ID 1 | Data:SDA |
| 13 | HSYNC | HSYNC |
| 14 | VSYNC | VSYNC |
| 15 | n/c | Clock:SCL |

# External Socket Pin Layouts

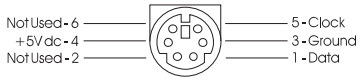
## Ethernet UTP Connector



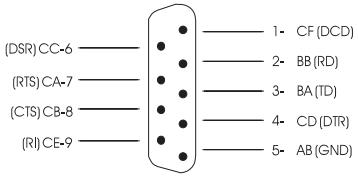

## VGA Connector



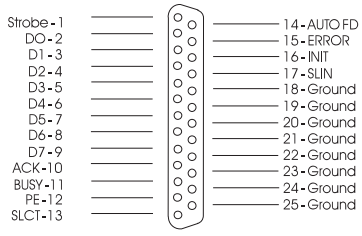

## Keyboard and Mouse Connector




## Serial Port Connector




## Parallel Port Connector



The Technical Reference Manual contains the following documents downloadable from the web site **www.hp.com/go/support** in PDF format:

- Introduction & HP Business PC Overview
  Describes how to use the Technical Reference Manual and provides a brief overview of the most recent HP Business PCs.
- Product Description
  One manual is provided for each HP Business PC. Each manual provides detailed BIOS information and summary information on the hardware components in the HP PC.
- HP Business PC Technology
  The document you are reading. A detailed look at the hardware components in the latest HP Business PCs. Includes information on processors, chip-sets, graphic controllers, network interfaces, connectors and sockets.

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