

The RadiSys logo is displayed in white serif font within a dark blue rectangular box. A thin black line extends from the right side of this box, ending in a small white circle.

RadiSys®

Endura

GL815E

Product Manual

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Revision History

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1.0	First Release	December 2000

Notational Conventions

This manual uses the following conventions:

- Screen text and syntax strings appear in this font.
- All numbers are decimal unless otherwise stated ('h' indicates a hexadecimal number).
- Bit 0 is the least-significant bit. If a bit is set to 1, the associated description is true unless otherwise stated.



Warnings indicate situations that may result in physical harm to you or the hardware.



Notes indicate important information about the product.



Cautions indicate situations that may result in damage to data or the hardware.



The globe indicates a World Wide Web address.

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Safety & Approvals Notices

Battery

This product contains a lithium cell.



When removing or replacing the lithium cell, do not use a conductive instrument as a short-circuit may cause the cell to explode. Always replace the cell with one of the same type. This product uses a CR2032 cell. Dispose of a spent cell promptly – do not recharge, disassemble or incinerate. Keep cells away from children.



CAUTION! Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the manufacturer. Dispose of batteries according to the manufacturer's instructions.

LAN (Local Area Network) Connector



This product may include an RJ45 LAN connector (see installation guide). Do not connect to anything other than an Ethernet LAN.

Thermal Interface Material



This product may contain thermal interface material between devices and heatsinks. This can cause irritation and can stain clothing. Avoid prolonged or repeated contact with the skin and wash thoroughly with soap and water after handling. Avoid contact with eyes and inhalation of fumes. Do not ingest.

Anti-static Precautions



This product contains static-sensitive components and should be handled with care. It is recommended that the product be handled in a Special Handling Area (SHA) as defined in EN100015-1:1992. Such an area has working surfaces, floor coverings and chairs connected to a common earth reference point. An earthed wrist strap should be worn whilst handling. Other examples of static-sensitive devices are the memory modules and the processor. Failure to employ adequate anti-static measures can cause irreparable damage to components on the motherboard.

Safety

This product complies with the American Safety Standard UL1950.

Electromagnetic Compatibility

This product complies with the following EMC standards.

FCC Class B (Title 47 of Code of Federal Regulations, parts 2 & 15, subpart B)
EN55022:1998 Class B
EN55024:1998

FCC Compliance Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures.

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and the receiver
- Connect the equipment into an outlet on a different circuit to that of the receiver
- Consult the dealer or an experienced radio/TV technician for help.

Any change or modification to this product not expressly approved by RadiSys could void the approvals held by this product.

Legal Directives

This product complies with the relevant clauses of the following European Directives.

Low Voltage Directive	73/23/EEC
EMC Directive	89/336/EEC
CE Marking Directive	93/68/EEC

This product, when supplied, complies with the CE Marking Directive and its strict legal requirements. Use only parts tested and approved by RadiSys.

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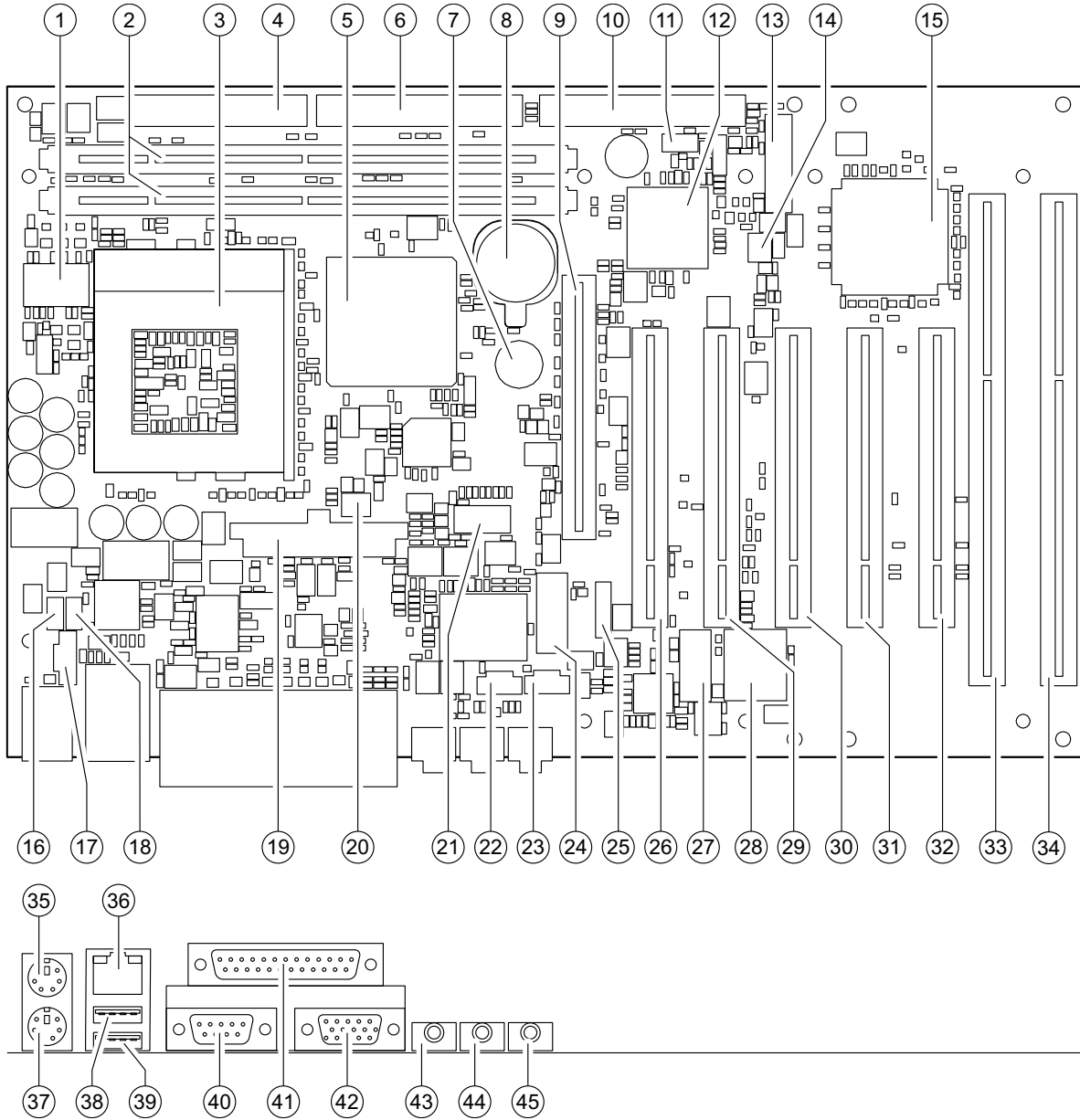
1 Overview

The GL815E is an ATX form factor motherboard based around an Intel Celeron or Pentium III processor and an Intel 815E family chipset. It integrates video, audio, system monitoring and Ethernet on a 12.0 x 7.5-inch board and is targeted at the embedded PC technology market.

Form Factor	ATX 2.03 compliant, 12.0 x 7.5 inches
Processor	370 pin PGA socket for Intel Celeron and Pentium III processors 66, 100 or 133 MHz bus speed
Chipset	Intel 815E with National Semiconductor PCI/ISA Bridge
Memory	Two DIMM sockets for PC100 & PC133 SDRAM modules without ECC or parity Min. 16MB, max. 512MB memory
Video	3D graphics controller integrated within chipset On-board PanelLink flat panel controller option Support for DDWG DVI & VESA DFP
Audio	AC97 v2.1 CODEC Digital audio controller integrated within chipset Line-in, Line-out and MIC jacks on rear panel ATAPI CD input and telephony connectors on motherboard
Power Management	APM, ACPI, PCI PME
System Management	Voltage, temperature and fan monitoring Fan control
BIOS	Based on Phoenix 4.0 release 6 4Mbit device Includes POST, Setup, ACPI, APM, PnP, video BIOS Customizable startup logo
I/O	Dual rear USB 1.1 Third USB channel on header, fourth channel on AGP connector Two serial ports (one on header) Bi-directional/EPP/ECP parallel port PS/2 keyboard and mouse (also available on headers) IrDA General Purpose I/O Lines (8)
Network	Integrated within chipset plus Intel 82562ET 10/100Mbps Ethernet transceiver
Disks	Dual UltraDMA/100 interfaces with ATAPI CD, LS120 and ZIP drive support 3-mode floppy interface with on-board connector
Expansion	1 AGP 4X slot 5 PCI 2.2 slots (one shared with an ISA slot) 2 ISA slots (one shared with an PCI slot)

1.1 Motherboard Layout

The figure below shows the layout of the GL815E motherboard with the major components identified.

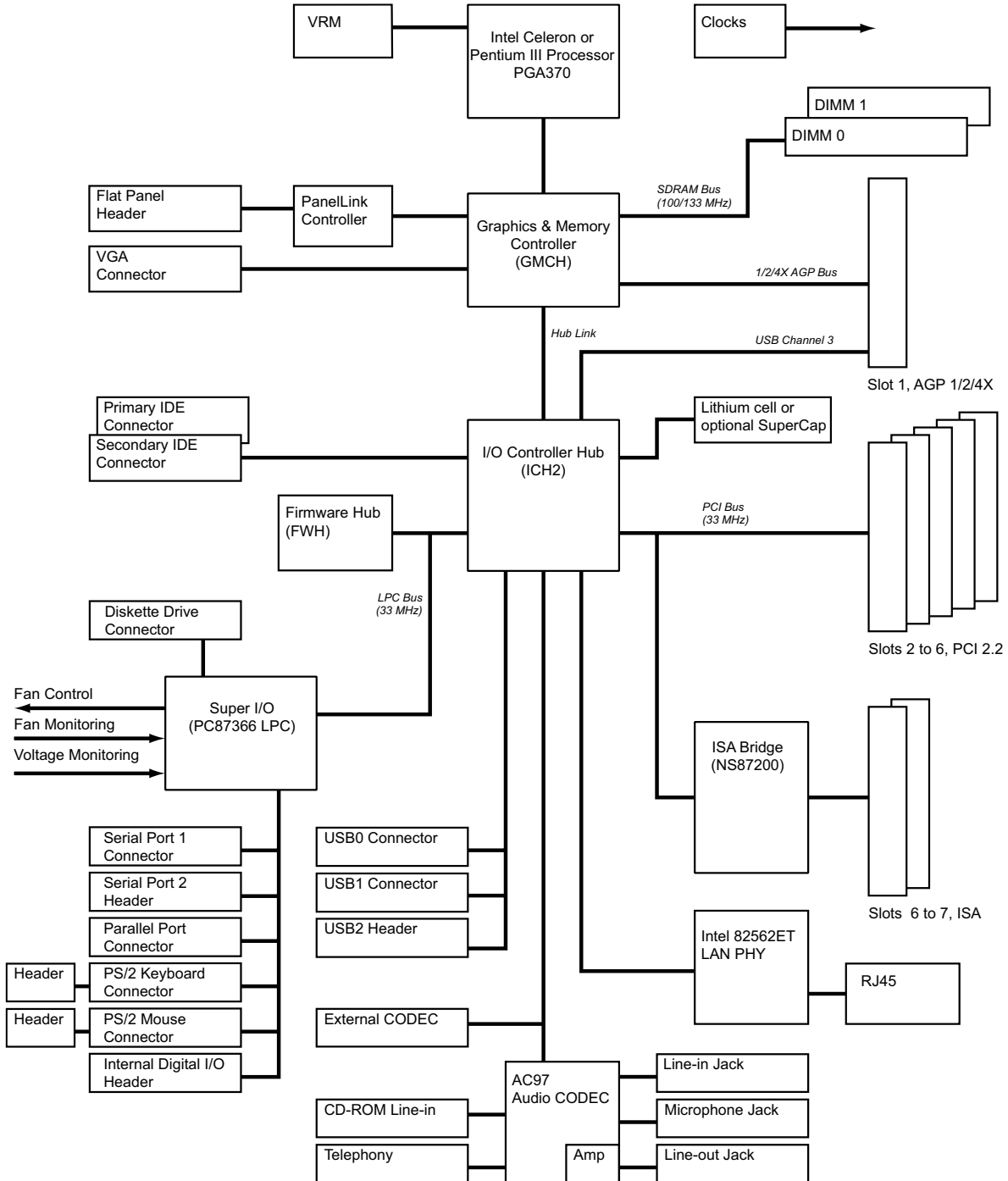


Motherboard Component Identification

1	Clock generator	24	GPIO header
2	PC100/PC133 DIMM sockets	25	External audio CODEC support
3	PGA370 socket for processor	26	Slot 2 – PCI 2.2
4	Diskette header	27	Serial port 2 header
5	Graphics & memory controller (GMCH)	28	Firmware hub (FWH)
6	Secondary IDE connector	29	Slot 3 – PCI 2.2
7	Optional Supercap	30	Slot 4 – PCI 2.2
8	3V Lithium cell – use CR2032	31	Slot 5 – PCI 2.2
9	Slot 1 – AGP 4X	32	Slot 6 – PCI 2.2 (shared slot)
10	Primary IDE connector	33	Slot 6 – ISA (shared slot)
11	Operating mode jumper	34	Slot 7 – ISA
12	I/O controller hub (ICH2)	35	PS/2 mouse
13	Front panel connector	36	10/100 Ethernet RJ45
14	System fan connector	37	PS/2 keyboard
15	ISA Bridge (NS87200)	38	USB 1.1 channel 1
16	Keyboard header	39	USB 1.1 channel 0
17	USB 1.1 channel 2 header	40	Serial port 1
18	Mouse header	41	Parallel port
19	Power supply connector	42	VGA monitor
20	Processor fan power connector	43	Stereo audio line output jack
21	Digital flat panel header	44	Stereo audio line input jack
22	ATAPI CD-ROM audio header	45	Mono microphone input jack
23	ATAPI telephony audio header		

1.2 Block Diagram

The figure below shows a block diagram of the GL815E motherboard.



1.3 Product Options

The table below lists the product options available.

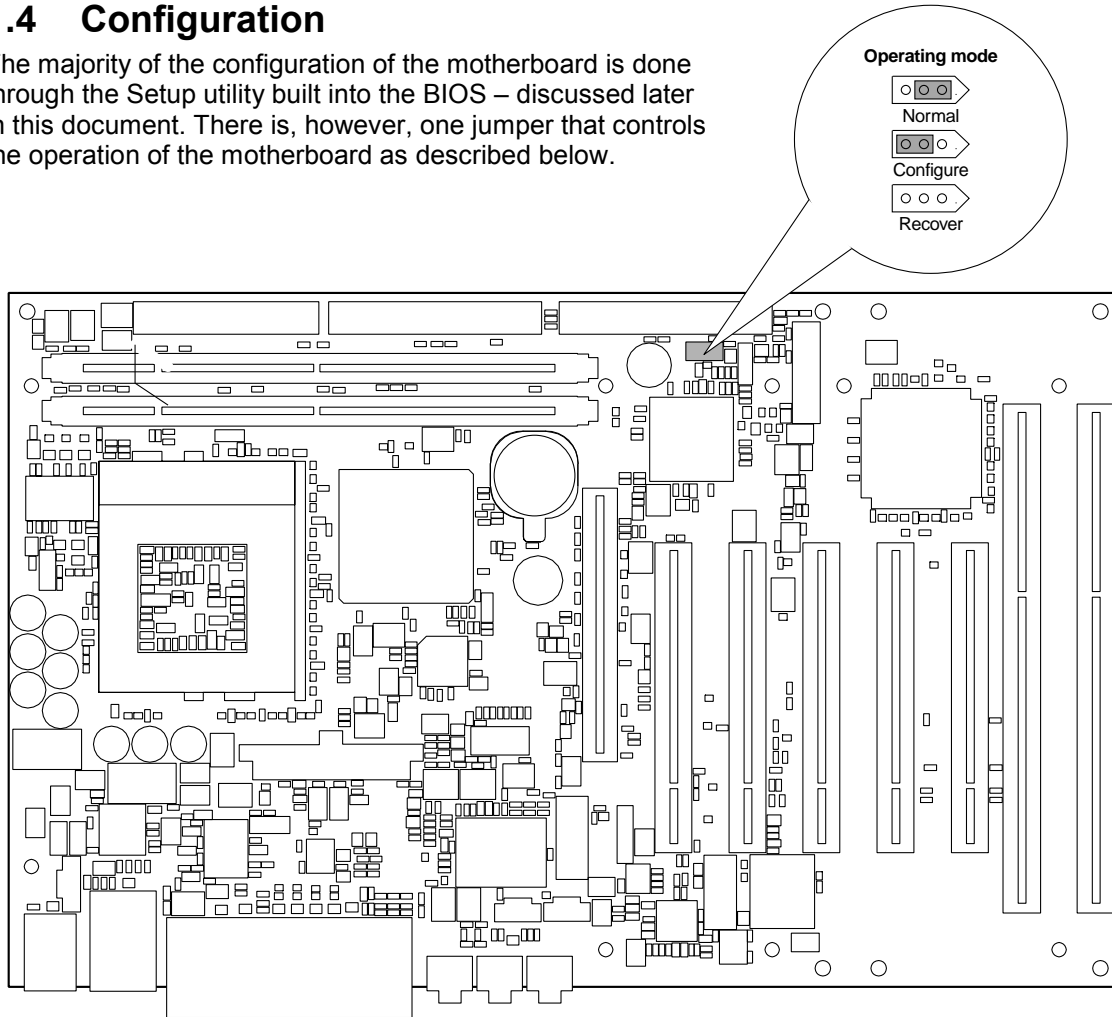
Functions	GL815E-V	GL815E-L	GL815E-FPL
Audio	Yes	Yes	Yes
Flat panel interface	No	No	Yes
Flat panel rear connector ¹	No	No	No
LAN	No	Yes	Yes
SuperCap	No	No	No

Each of the products is available with a choice of CPU speed. Consult the latest price list for the available options. Other product options are available to special order for high volume customers.

¹ The flat panel rear connector assembly is available as an accessory.

1.4 Configuration

The majority of the configuration of the motherboard is done through the Setup utility built into the BIOS – discussed later in this document. There is, however, one jumper that controls the operation of the motherboard as described below.



1.4.1 Operation Mode Selection

This jumper selects one of three operating modes for the motherboard – Normal, Configure and Recovery modes. The factory default position for this jumper selects 'Normal' mode.

Normal Mode

This is the position the jumper should be in for normal operation of the motherboard. If the motherboard detects corruption in the BIOS ROM, then recovery mode will be entered regardless of the state of the jumper.

Recovery Mode

If the jumper is in the recovery mode position or if the motherboard detects a corrupted BIOS ROM then recovery mode is entered. The motherboard will not boot and will wait until a valid recovery diskette is detected and will then copy a new BIOS into the ROM. The motherboard must be powered down and then re-powered with the jumper in the normal position before normal operation can resume.

Configure Mode

With the jumper in this position the motherboard will automatically run the BIOS Setup utility regardless of the state of the Setup disable flag that can be set in the BIOS defaults. Additional BIOS settings are also available within Setup in this mode.

1.4.2 Front Panel Connections

The primary controls and indicators for the motherboard are connected via the front panel connector using either a single ribbon cable to a 'front panel' assembly, or using a number of small PC-standard connectors. The functions are described below. See appendix B for the connector pin-out information.

Power LED

This can be used to connect either a single-color LED (usually green) or a two-terminal bi-color LED (usually green/yellow) to indicate the powered status of the motherboard. In both cases, the 'green' anode should be attached to pin 2 of the front panel connector. See the Indicators section later in this document for further information.

Power Switch

A momentary switch should be connected between pins 6 and 8 of the power connector if the motherboard is used with a soft-switch power supply. If the switch is closed for greater than approximately 4 seconds, the motherboard will power off immediately, regardless of the state of the operating system, losing any system context information. This switch is redundant when using a hard-switch power supply.

Reset Switch

If used, a momentary switch connected between pins 5 and 7 will cause the motherboard to restart when closed.

Hard Disk LED

A single color LED should be connected between pins 1 (anode) and 3 to indicate hard disk activity on either of the two ATA channels.

Speaker

Connect a speaker between pins 10 and 11 or 10 and 16. This is used only for the PC 'beep' functions - it cannot be used as an output of the audio CODEC.

Tamper Switch

Connect a momentary switch between pins 18 and 20 to make use of the tamper detection logic of the motherboard. The switch should be open when the chassis is closed.

Infra-red port

Pins 9, 11, 13 and 15 provide an interface to an infra-red receiver/transmitter module. Pins 9 and 13 provide the +5V module power and signal ground return.

2 Motherboard Description

2.1 Processor

The GL815E motherboard supports Intel Celeron and Pentium III processors in a PGA370 package (FC-PGA). The table below lists the supported processors. An on-board voltage regulator generates the voltage for the CPU. Both the processor voltage and the operating frequency are automatically adjusted by the motherboard to suit the installed processor.

Processor Type	Processor Speed	CPU bus speed	Cache size	Package
Intel Celeron	566 MHz	66 MHz	128kB	FC-PGA
Intel Celeron	733 MHz	66 MHz	128kB	FC-PGA
Intel Pentium III	600 MHz	100 MHz	256kB	FC-PGA
Intel Pentium III	700 MHz	100 MHz	256kB	FC-PGA
Intel Pentium III	733 MHz	133 MHz	256kB	FC-PGA
Intel Pentium III	850 MHz	100 MHz	256kB	FC-PGA
Intel Pentium III	866 MHz	133 MHz	256kB	FC-PGA

2.2 System Memory

The GL815E motherboard has two DIMM sockets to accept PC100 or PC133 modules. The product does not accept PC66 modules. The sockets may be populated in any order and each can accept either single or double-sided modules. The minimum total memory size is 16MB and the maximum is 512MB. The BIOS automatically configures the motherboard for the correct size, speed and type. For best performance, use PC133 modules with a 133MHz bus processor. When using a 100MHz bus processor, the module will always operate at 100MHz regardless of type. See the Manuals, Drivers & BIOS section on the RadiSys web site at www.radisys.com for a list of memory modules that have been tested with this product.



When using the on-board video controller, the frame buffer is held within system memory and thus less memory is available to the operating system.

Each memory module should meet the following requirements

- Compliance with the Intel PC100 or PC133 specification
- Inclusion of a serial presence detect (SPD) ROM
- The module type is 3.3V 168-pin unbuffered synchronous DRAM (SDRAM)
- Based on 16Mb, 64Mb, 128Mb or 256Mb devices
- Capacity of between 16MB and 512MB
- 64 bits wide. ECC or parity is not supported

2.3 Chipset

The GL815E motherboard is based around an Intel 815E chipset comprising two parts -

- Graphics and memory controller hub (GMCH). This includes the processor interface, a high-performance 3D graphics controller and the system memory controller.
- I/O controller hub (ICH2). This provides all the PCAT-compatible devices and the PCI bus interface. In addition, it integrates Ethernet, USB and SMBus controllers, a dual UltraATA/100 disk controller, an AC97 digital audio controller and power management functions.

In addition, a National Semiconductor NS87200 ISA bridge is used to support ISA devices and a firmware hub flash ROM contains the system BIOS, setup utility and video BIOS.

2.4 Video

The video controller is integrated within the 815E chipset GMCH and provides the features listed below.

- 2D graphics with full 2D acceleration
- 3D graphics with extensive rendering capabilities
- Hardware motion compensation for software MPEG2 decode
- System memory is used as frame buffer storage
- 15-way D-type for analog RGB output with VESA DDC2B capability
- Optional on-board Silicon Image SII164 PanelLink flat panel video controller
- Optional Vesa DFP or DDWG DVI connector on rear panel

The motherboard has two output connectors – a standard analog VGA connector and a header for the optional digital flat panel controller. A Vesa DFP or a DDWG DVI connector on the rear panel is available as an option. Whilst it is possible to connect a monitor to both the VGA and flat panel connectors at the same time, the displays will be identical since there is only one video controller. The BIOS supports multiple independent displays via PCI (or ISA) video cards.

The Intel 815E chipset supports a wide variety of video modes. The drivers for specific operating systems support a subset of these modes. The table below lists the video modes supported by the Windows and Linux drivers.

Resolution	Color Depth (bpp) **	Windows 2D Refresh Rates (Hz)	Windows 3D Refresh Rates (Hz)	Linux 2D Refresh Rates (Hz)	Flat Panel Refresh Rates (Hz)
640 x 480	4	60, 70, 72, 75, 85			
	8, 24	60, 70, 72, 75, 85		60, 75, 85	60 *
	16	60, 70, 72, 75, 85	60, 70, 72, 75, 85	60, 75, 85	60 *
720 x 480	8, 24	75, 85			60 *
	16	75, 85	75, 85		60 *
720 x 576	8, 24	60, 75, 85			60 *
	16	60, 75, 85	75, 85		60 *
800 x 600	8, 24	60, 70, 72, 75, 85		60, 75, 85	60 *
	16	60, 70, 72, 75, 85	60, 70, 72, 75, 85	60, 75, 85	60 *
1024 x 768	8, 24	60, 70, 72, 75, 85		60, 75, 85	60
	16	60, 70, 72, 75, 85	60, 70, 75, 85	60, 75, 85	60
1152 x 864	8, 16, 24	60, 70, 72, 75, 85		60, 75, 85	
1280 x 960	8, 16	60, 75, 85			
1280 x 1024	8, 16	60, 70, 72, 75, 85		60, 75, 85	
	24	60, 70, 75, 85		60, 75, 85	
1600 x 1200	8	60, 70, 72, 75, 85		60, 75, 85	
	16			60, 75, 85	

* These resolutions are supported via centering.

** Bits per pixel. 4bpp=16 colors, 8bpp=256 colors, 16bpp=64k colors, 24bpp=16M colors.

2.4.1 System Memory Allocation

The video controller does not have dedicated frame buffer memory but instead makes use of system memory for all its needs. This must be taken into account when the amount of system memory is chosen. When the on-board video controller is not used, it should be disabled completely via BIOS Setup to prevent system memory being allocated to the controller.

The motherboard BIOS allocates 1MB of system memory to the video controller to support legacy VGA graphics. The amount of system memory reported by the BIOS will reflect this reduction when the on-board video controller is enabled. Once the operating system loads, the video drivers allocate further system memory dependant on availability as described in the table below for Intel PV 4.x video drivers. Systems using Windows NT 4.0, Windows 2000 or those that require 16M colors at a resolution greater than 1024 x 768 must have at least 64MB of system memory.

Total Allocation of System Memory for On-board Video (including 1MB legacy support)			
Operating System	Total System Memory Size		
	32MB	64MB	128MB or greater
Windows 98	7MB	11MB	11MB
Windows NT 4.0	Not valid	10MB	10MB
Windows 2000	Not valid	10MB	11MB

2.5 Audio

The chipset ICH2 contains a digital audio controller that is supported on the motherboard by an Analog Devices AD1885 audio CODEC. The motherboard has an on-board ATAPI CD-ROM stereo audio line-input connector and a mono ATAPI telephony connector. The rear panel has three 3.5mm audio jacks for stereo Line output (driven by an amplifier and suitable for driving headphones), stereo Line input and a monaural microphone input with phantom power suitable for electret microphones.

2.6 Network

The GL815E supports an optional 10/100 Ethernet controller based around the controller integrated within the chipset and an Intel GD82562ET transceiver. An RJ45 connector located on the rear panel integrates two LED indicators to provide link status information. The list below describes the features provided.

- IEEE 802.3 10Base-T and 100Base-TX compatible
- 32-bit bus-mastering PCI device
- Jumper-less configuration
- RJ45 with two integral LEDs showing line activity, link integrity and line speed

The operation of the two indicators is described in the table below.

LED color	LED state	Indicates
Green	Off	10Mbps link speed
	On	100Mbps link speed
Yellow	Off	No link is established
	Steady on	Link is established but there is no communication activity
	Blinking	Link is established and communication activity is detected

2.7 IDE Drives

Two independent bus-mastering IDE interfaces are provided, each supporting ATA modes up to UltraATA/100. The following drive types are supported.

- ATA hard disks up to UltraATA/100 speeds
- ATAPI devices such as CD-ROMs
- LS120 drives

The BIOS supports logical block addressing (LBA) and extended CHS translation modes for hard disks. When booting from LS120 drives, the correct mode (floppy or hard disk) must be chosen in Setup. The BIOS supports both automatic and manual determination of ATA cable type (80 - or 40-pin) to support UltraATA/66 or ATA/100 drives.

2.8 Diskette Drives

The diskette drive interface supports a maximum of two drives. The drives should be 2- or 3-mode 3.5-inch devices supporting 720kB, 1.2MB or 1.44MB formats. The controller is located at I/O addresses 3F0-3F7h and uses IRQ6.

2.9 Standard PC I/O

The standard PC I/O functions serial ports, parallel ports, keyboard and mouse ports and diskette drive controller are provided via a National Semiconductor PC87366 Super I/O (SIO) device attached to the low pin count (LPC) bus from the chipset ICH2. In addition, this device provides system monitoring and fan control functions and general-purpose I/O lines.

2.9.1 Serial Ports

The GL815E motherboard supports two 16C550-compatible serial ports that can operate at speeds of up to 115.2kbps. Serial port 1 is located on the rear panel whilst serial port 2 is via a header. Each port can be assigned as COM1 through COM4 via the BIOS Setup utility:-

- I/O address 3F8-3FFh, IRQ4
- I/O address 2F8-2FFh, IRQ3
- I/O address 3E8-3EFh, IRQ4
- I/O address 2E8-2EFh, IRQ3

2.9.2 Parallel Port

The GL815E has a 25 way female D-sub parallel port connector located on the rear panel. It supports the following operating modes, configured via the BIOS Setup utility.

- Standard PC-compatible parallel port
- Bi-directional parallel port
- EPP mode
- ECP mode

The I/O locations can be assigned as follows.

- I/O address 378-37Fh & 778-77Fh, IRQ5 or IRQ7
- I/O address 278-27Fh & 678-67Fh, IRQ5 or IRQ7

2.9.3 Infra-red Support

The GL815E motherboard supports an IrDA compliant infra-red interface via the front panel header. An IR transceiver must be added such as the Hewlett Packard HSDL-3201 or the HSDL-3610 device. The IR port shares the serial port 2 channel and thus the two ports cannot be used simultaneously. A transfer rate of up to 115kbps is supported.

2.9.4 Keyboard and Mouse Ports

Two PS/2 style keyboard and mouse ports are provided on the rear panel. The two ports are interchangeable with the motherboard automatically detecting which peripheral is attached to which port. Both ports provide a resettable fuse protected +5V supply to the peripheral. In addition, both the keyboard and mouse ports are accessible internally via 4-way headers.

The keyboard controller is functionally equivalent to the 8042 standard and is located at I/O addresses 60-64h and uses IRQ1. The mouse shares the same controller and uses IRQ12. The keyboard controller code is Phoenix version 42i.

2.10 USB Ports

GL815E supports four independent USB 1.1 compliant ports via the 2 USB controllers (each with 2 channels) contained within the chipset ICH2. Two channels are provided on the rear panel, a third is available internally on a 5-way ATAPI-style header and a fourth via the AGP connector. The first three ports all provide a resettable fuse protected +5V supply to the peripheral. The AGP USB channel power is provided via the AGP connector and it is the responsibility of the AGP adapter to protect this supply if required. The table below summarizes the USB channel allocation.

USB channel	Connector location	Controller
Channel 0	Rear I/O (bottom)	Controller 1
Channel 1	Rear I/O (top)	Controller 1
Channel 2	Header	Controller 2
Channel 3	AGP slot	Controller 2

The BIOS supports the use of a USB keyboard and/or mouse in lieu of a PS/2 device via the BIOS customization tools (the feature is disabled by default). This USB legacy support provides emulation of standard keyboards and/or mice and since it causes performance degradation should be enabled only when the operating system being used also supports USB (the emulation is automatically disabled once the operating system is running).

2.11 General Purpose I/O Lines

In order to support products that require a small number of internal input or output lines (such as switches or LED indicators), the GL815E provides access to 8 general-purpose lines via a 12-pin header. Each line can be programmed independently as an input or an output. The signals are provided by the National Semiconductor PC87366 Super I/O device GPIO port 2. It is the responsibility of the customer to provide suitable software to control these lines.

2.12 CMOS RAM & RTC

The chipset integrates a Motorola MC146818A compatible real-time clock (RTC) and 256 bytes of CMOS RAM that is used by the BIOS to store configuration information. A replaceable primary lithium coin cell or, optionally, a Super Cap backs up both the RTC and the CMOS RAM. The former provides for approximately 5 years of unpowered backup. The SuperCap provides for at least 1-hour life and eliminates cell replacement as a reason for scheduled maintenance.

The lithium coin cell is a CR2032 device.

The RTC includes a century byte and is supported by the BIOS to provide year 2000 compliance.

When the +5V standby power is applied to the motherboard, the RTC and the CMOS RAM are powered from that rather than the lithium cell or the optional SuperCap.

2.13 Expansion Cards

The motherboard provides 7 expansion card slots, one of which supports either an ISA or a PCI adapter.

AGP Slot

The motherboard provides a single universal AGP slot, supporting 1X, 2X and 4X adapter cards and automatically switches the interface appropriate to the adapter. Since there is no physical keying on the universal AGP connector, always ensure that the adapter is fitted correctly before applying power. The AGP card retention mechanism is supported. An independent USB 1.1 compliant port is provided on the AGP interface.

PCI Slots

The motherboard provides 5 bus-master PCI 2.2 compliant slots, one of which is shared with an ISA slot. The motherboard generates the 3.3Vaux supply to these slots using the 5V standby input from the power supply. Always ensure that the 5V standby rail can support the required current when using a PCI card that makes use of the 3.3Vaux supply.

ISA Slots

The motherboard provides 2 ISA slots, one of which is shared with a PCI slot. The National Semiconductor NS87200 provides the PCI to ISA bridge. In order to fully support the ISA bus power rails, the ATX power supply should provide -5V. Since the motherboard makes no use of this rail, it need not be provided if the ISA adapters do not require it.



Support for ISA card option ROMs is possible only if certain BIOS features are disabled – see the BIOS section for details.

2.14 System management

The GL815E motherboard includes hardware system management functions integrated into the National Semiconductor PC87366 Super I/O (SIO) device. They monitor system voltages, motherboard and CPU temperatures, fan speed and control system fans. The following sections describe this in more detail. The BIOS Setup utility can be used to display the status of the system monitors.

2.14.1 Voltage Monitoring

The table below details the motherboard voltage rails monitored and their usage.

Voltage Rail	Usage on Motherboard
+12V	Serial ports, processor voltage generation, audio quiet supply, fans.
+5.0V	Processor voltage generation, internal logic, keyboard, mouse, USB and video ports.
+3.3V	Chipset ICH2, firmware hub, ISA bridge, audio CODEC, SIO, clock generator, flat panel controller.
+2.5V	Clock generator.
+1.8V	Chipset GMCH, chipset ICH2.
+1.5V	Processor bus termination, processor signaling.
-12V	Serial ports.
VCPU	Processor core voltage.
+3.3V Standby	Primary standby voltage to systems that control motherboard wake-up, System memory DIMMs, Ethernet controller.
VBAT*	This rail is used to power the RTC and the CMOS RAM.

* The VBAT supply is generated from the +3.3V standby supply when available in order to preserve the life of the lithium cell. This means, however, that the voltage read via the monitor is that of the standby rail and not of the lithium cell itself.

A regulator on the motherboard generates the processor operating voltage with each processor selecting the correct voltage automatically. The table below indicates the correct operating voltage for the different processors.

Processor Type	Processor Speed	Operating Voltage
Intel Celeron	566 MHz	1.50V or 1.70V
Intel Celeron	733 MHz	1.65V or 1.70V
Intel Pentium III	600 MHz	1.65V or 1.70V
Intel Pentium III	733 MHz	1.65V or 1.70V
Intel Pentium III	700 MHz	1.65V or 1.70V
Intel Pentium III	850 MHz	1.65V or 1.70V
Intel Pentium III	866 MHz	1.65V or 1.70V

2.14.2 Temperature Monitoring

There are two temperature sensors on the motherboard. The first measures the motherboard temperature. Since the sensor is contained within the SIO, this will be a localized reading dominated by the motherboard surface temperature around the SIO component.

The second temperature sensor is located on the processor die and thus accurately measures the local die temperature. Since the local die temperature fluctuates rapidly with activity, the controller within the SIO filters the signal to produce an average temperature.

2.14.3 Fan Monitoring

The motherboard includes two fan monitors that check the fan tachometer signal to determine the rotation speed. Fan speed limits can be set to cause an alarm in the event that the fan rotates more slowly than the limit. Using this method, early warning of a failing fan can be generated.

Note that when a fan is temperature controlled, the fan monitoring alarms for that fan should not be used since the speed is determined by the temperature control mechanism and the fan will sometimes be intentionally slowed or stopped.

The two fan tachometer monitors are assigned to fans as follows.

Usage by motherboard	
Fan monitor 0	System fan (see motherboard layout section)
Fan monitor 1	Processor fansink (see motherboard layout section)

2.14.4 Fan Control

The motherboard supports individual variable speed controls for both the processor fansink and the system fan by pulse-width modulation of the fan drive output voltage.

2.14.5 Tamper Detection

The motherboard supports tamper detection security that operates via a chassis tamper switch connected to the front panel connector. When the motherboard detects this signal low the BIOS can be configured to display a warning message or to require a password at the next boot. Since the lithium cell powers the logic, the tamper detection continues to operate even if the board is unpowered.

2.15 Power management

The GL815E motherboard implements a number of power management features with software support for APM and ACPI. Where an operating system does not support ACPI, the motherboard defaults to using APM. An APM driver is required by the operating system in order to take advantage of the APM power management features.

2.15.1 ACPI Power States

An ACPI-aware operating system directs the power management of the motherboard – causing the various devices within the system to change power state as appropriate. The table below describes the ACPI power states available using the GL815E motherboard.

Global State	Sleep State	Device State	Description
G0	S0	C0, D0	Fully operational, all devices powered.
G1 Sleeping	S1 CPU stopped	C1, D1, D2, D3	Sleep state. CPU is stopped but all devices are powered.
G1 Sleeping	S4 Suspend to disk	D3	All devices are unpowered except wake-up logic. Memory and system context saved to disk.
G2/S5	S5 Soft Off	D3	All devices are unpowered. Memory contents and context are lost. No wake-up possible.
G3 Mechanical Off	No power	No power	System is unpowered with no standby rails. No wake-up is possible

2.15.2 ACPI Wake-up Support

The table below indicates which events can cause an ACPI wake-up and from which sleep states.

Event	Sleep State	Comment
Power switch	S1, S4, S5	
RTC alarm	S1, S4	
PS/2 keyboard or mouse	S1	Ports are unpowered in S4, S5
USB device (any port)	S1	Ports are unpowered in S4, S5
On-board LAN (82559ER)	S1, S4	Restricted wake-up support. Magic Packet is NOT supported.
IR device	S1	
PCI PME signal	S1, S4	

2.16 Indicators

The motherboard supports a single dual-color LED indicator that is used to show both power and message waiting status. It is possible to use a single-color LED although some functionality is lost. The table below describes how the indicator is driven when operating with both single and dual-color devices.

LED	LED state	Indicates
Single color	Off	The motherboard is powered down or in one of the ACPI sleep states (including S1).
	On	The motherboard is fully powered up (S0).
	Blinking	The motherboard is fully powered up (S0) with a message waiting (as determined by ACPI TAPI).
Dual color (green/yellow)	Off	The motherboard is powered down or in ACPI sleep states S4 or S5 (no +5V supply available).
	Green	The motherboard is fully powered up (S0).
	Yellow	The motherboard is in sleep state S1.
	Blinking Green	The motherboard is fully powered up (S0) with a message waiting (as determined by ACPI TAPI).
	Blinking Yellow	The motherboard is in sleep state S1 with a message waiting (as determined by ACPI TAPI).

2.17 BIOS

The system BIOS is held within a flash ROM device called the firmware hub (FWH). The device is a 4Mbit part that contains the following code.

- System BIOS, POST and configuration (Setup) utility
- Video BIOS
- Product configuration information including boot logo and CMOS defaults
- Processor microcode updates
- Customizations

The code is built from a number of software and data modules that can be customized and assembled with a software tool that can be provided by RadiSys. Software to support BIOS updates and crisis recovery is also available - see the Manuals, Drivers & BIOS section on www.radisys.com for BIOS updates and support software.

The configuration of the motherboard is generally automatic with intervention possible via the built-in BIOS Setup utility. The operation and feature set are described in the BIOS chapter of this document.

2.18 Operating Systems Support

The following operating systems are validated by RadiSys with the GL815E motherboard. Contact RadiSys for information on the support of other operating systems. See the Manuals, Drivers & BIOS section on www.radisys.com for device drivers.

- Microsoft MS-DOS 6.2
- Microsoft Windows 95, 98, NT 4.0, 2000

3 Specifications

3.1 Regulatory EMC Compliance

The table below lists the safety regulations the GL815E motherboard complies with when correctly installed in a suitable chassis.

Regulation
FCC Class B (Title 47 of Code of Federal Regulations, parts 2 & 15, subpart B)
EN55022:1998 Class B
EN55024:1998

3.2 Regulatory Safety Compliance

The table below lists the safety regulations the GL815E motherboard complies with when correctly installed in a suitable chassis.

Regulation
UL1950/CSA950 3 rd edition
IEC 950 2 nd edition, 1991 with amendments 1, 2, 3, 4
EN60950 2 nd edition, 1992 with amendments 1, 2, 3, 4

3.3 Environmental

Parameter	State	Specification
Temperature*	Operating	0°C to 55°C
	(ambient) Storage	-40 to 85 °C
Humidity		5% to 95% non-condensing
Shock	Packaged	0 to 20lbs: 36 inches free fall, 167 inches/s velocity change 21 to 40lbs: 30 inches free fall, 152 inches/s velocity change 41 to 80lbs: 24 inches free fall, 136 inches/s velocity change 81 to 100lbs: 18 inches free fall, 118 inches/s velocity change
	Unpackaged	30 g trapezoidal waveform, 170 inches/s velocity change
Vibration	Packaged	10Hz to 40Hz: 0.015g ² Hz 40Hz to 500Hz: 0.015g ² Hz sloping down to 0.00015g ² Hz
	Unpackaged	5Hz to 20Hz: 0.01g ² Hz sloping up to 0.02g ² Hz 20Hz to 500Hz: 0.02g ² Hz
Altitude	Operating	To 15000 ft. (4500m)
	Storage	To 40000 ft. (12000m)
ESD	Operating	4kV direct contact, 8kV air



* This is the motherboard specification. Intel Celeron processors have a minimum operating temperature of 5°C. Refer to the relevant Intel processor datasheet for the maximum operating temperature. The user must ensure that the system enclosure provides adequate airflow to ensure the processor temperature is within its operating limits.

3.4 Industry Compliance

The GL815E motherboard implements the following industry specifications.

Specification	Description	Revision
ACPI	Advanced Configuration and Power Interface Specification	1.0b
APM	Advanced Power Management BIOS Specification	1.2
AC'97	Audio CODEC '97 Component Specification	2.1
ATAPI	ATA Packet Interface for CD-ROMs	2.5
ATX	ATX Motherboard Form Factor Specification	2.03
AGP	Accelerated Graphics Port Interface Specification	2.0
PCI	Peripheral Component Interconnect Local Bus Specification	2.2
	PCI Power Management Interface Specification	1.1
USB	Universal Serial Bus Specification	1.1

3.5 Miscellaneous

Parameter	Conditions	Specification
RTC Clock accuracy	25°C, 3.3V	+/- 25 ppm max.
Audio LINE (headphones) continuous average output power	32Ω load, +5V supply at 5.0V	31mW (1.0V rms into 32Ω)
Audio full scale LINE input level	Input impedance 20kΩ typ.	1.0V rms.
Audio full scale MIC input level	Gain set to 0dB	1.0V rms.
	Gain set to 20dB	100mV rms.

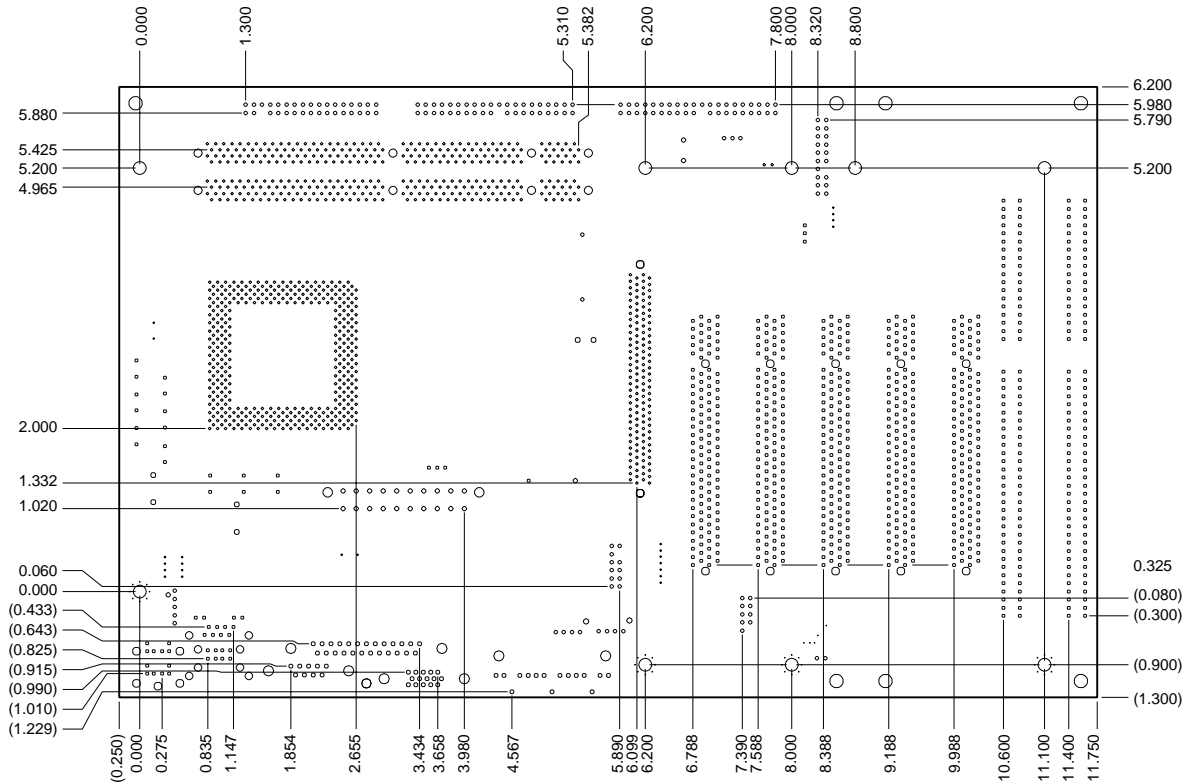
3.6 Mechanical

3.6.1 Motherboard

The GL815E motherboard meets the ATX Motherboard Interface Specification, version 2.03. It measures 12.0 x 7.5 inches and is manufactured using a 4-layer PCB with components on the topside only. The screen-printing includes the following.

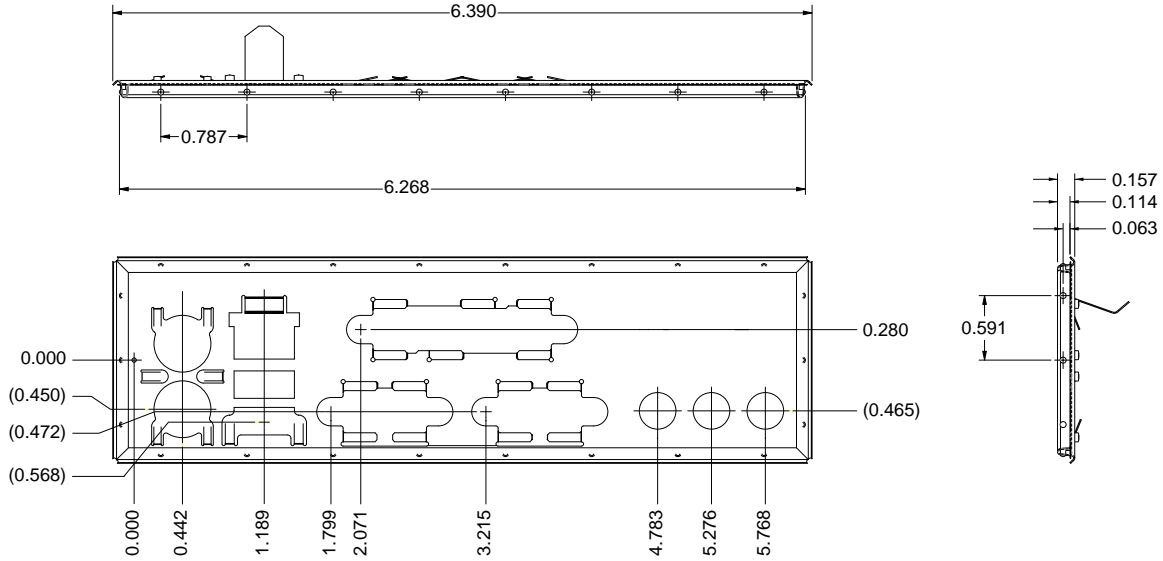
- Product Name, RadiSys part number and RadiSys branding.
- Location for serial number label
- Selected component reference designators

The figure below shows the dimensions of the motherboard and the location of the rear panel connectors (referenced via pin 1) and the location of the processor, memory sockets and expansion slots.



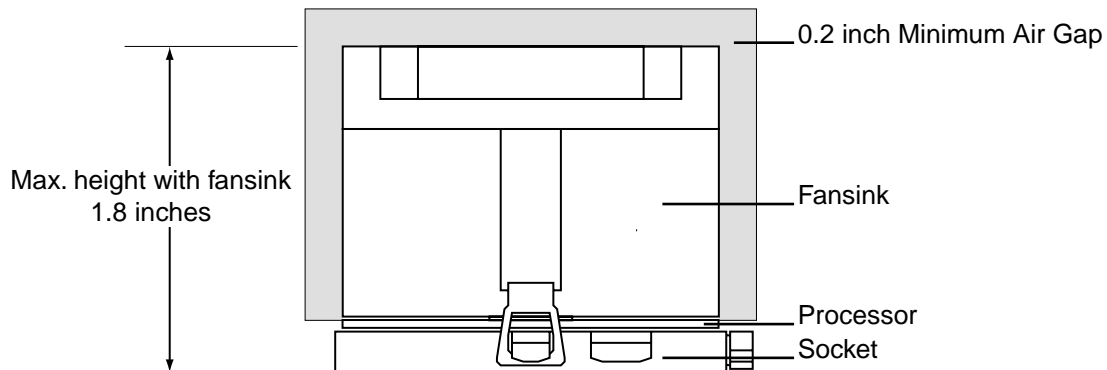
3.6.2 I/O Shield

An I/O shield is available for the GL815E when used in a standard ATX chassis and is illustrated below. The shield press-fits into the chassis shield aperture. The shield illustrated includes the RJ45 Ethernet aperture but not the optional flat panel display connector aperture.



3.6.3 Fansink

The motherboard can be optionally shipped with a processor fansink, which must have a minimum air space of 0.2 inches around it to function correctly. This is shown in the drawing below.



3.7 Electrical

3.7.1 Motherboard Power Consumption

The motherboard power consumption is highly dependent on the processors, memory and devices attached and also on the software that is running and the power state that the board is in. The figures given in the table below are designed to give the user a guide to the power requirements that should be expected under selected conditions. They should not be interpreted as maximum requirements.

The figures are based on measurements of a real system configured in the following manner.

Processor	Intel Pentium III at 866MHz
Memory	128MB
Drives	IBM DTLA 30.7GB, CD-ROM, floppy drive (all powered independently)
Video	On-board

Mode	Motherboard Current				
	+3.3V	+5V	+12V	-12V	+5Vsbby
MS-DOS Prompt without power management	2.6A	3.3A	0.3A	60mA	10mA
Windows 2000 desktop idle	2.3A	0.6A	0.3A	60mA	10mA
Windows 2000 standby	2.2A	0.6A	0.3A	70mA	10mA
Off with AC connected and LAN					250mA
Stress test maximums*	3.1A	5.5A	0.3A	70mA	10mA

* These results are from a suite of stress tests designed to maximize the power dissipation of the above configuration. Each figure is the worst case seen from any test – they are not maximums that can be measured together.



It is very important that the power supply used can support the required load current on all rails – failure to meet this can cause damage to the power supply or the motherboard. Pay particular attention to the 5V Standby power requirement – the LAN controller (when fitted) is powered from this rail.

3.7.2 General Purpose I/O Lines

Symbol	Parameter	Conditions	Min	Max	Unit
V_{IH}	Input High Voltage		2.0	5.5	V
V_{IL}	Input Low Voltage		-0.5	0.8	V
I_{IL}	Input Leakage Current	$V_{IN} = V_{3.3V}$		10	μA
		$V_{IN} = V_{GND}$		10	μA
V_H	Input Hysteresis		250		mV
V_{OH}	Output High Voltage	$I_{OH} = -3mA$	2.4		V
V_{OL}	Output Low Voltage	$I_{OL} = 6mA$		0.4	V

4 Motherboard BIOS

4.1 Configuration

The motherboard BIOS includes a setup utility that can be used to both view and modify the board's configuration. The settings are stored in CMOS RAM with the default settings held in the flash ROM. To start the utility, press the F2 key when prompted. If 'silent-boot' is on (logo displayed) then press the ESC key to show the start-up messages.

The display is divided into four areas.

- The top bar shows the six main menus
- The large left area shows the options
- The large right area displays help text specific to the highlighted option or menu
- The bottom bar shows the action of the active keys

The primary menus are briefly described in the table below. The help text describes each option more fully. Many options have sub-menus.

Menu	Options
Main	Product description including processor and memory fitted. Date and time. IDE disks found and sub-menus for extra configuration.
Advanced	Start-up display mode (silent-boot etc.). Operating system type (ACPI etc.). Advanced chipset configuration. Processor cache control. PCI space configuration. I/O devices configuration. Advanced hard disk drive options.
Security	Passwords and permissions.
Power	Action after AC-reconnect. Power savings modes and timers.
Boot	Selects device boot order.
Exit	Save with or without changes. Load/save default settings (from flash ROM).

4.2 Update and Recovery

This section describes how to update the code and data held in the BIOS ROM. The process should be undertaken with care and must not be interrupted. A recovery mechanism is also described that enables a corrupted BIOS ROM (as a result of an interrupted update, for example) to be repaired.

Updates are available online from the RadiSys site in the form of a compressed image (ZIP) of a number of files. Using the software contained in the ZIP file, you must first create a flash diskette that is then used for the update or recovery process. Included in the ZIP file is a 'Readme.txt' file that contains information on the update and instructions on how to use it. Always read this document before proceeding as it may contain updates to the descriptions below.

The update process assumes you have a PC that can be used to create an update diskette and that the system to be updated or recovered has a diskette drive attached.



Updating the BIOS is a process that should be undertaken with caution. Always complete the process before powering-down or restarting the motherboard – failure to do this may result in a corrupted BIOS that will require recovery.

4.2.1 Creating a BIOS Update Diskette

Follow the steps below. You need a PC with Microsoft MS-DOS, Windows 95 or Windows 98 and a blank diskette.

1. Obtain the update ZIP file from the Manuals, Drivers & BIOS section on the RadiSys web site, www.radisys.com.
2. Unzip the contents to an empty directory on your hard drive.
3. Insert a blank diskette into the floppy drive.
4. Run CRISDISK from the directory created in step 2 to create the update diskette
5. Follow the steps as directed. A copy of MS-DOS 'Format.com' must be available for CRISDISK to complete successfully.

4.2.2 Updating the System BIOS

The system BIOS can be updated from MS-DOS without changing jumpers as described below. It is recommended that you create a recovery diskette (described later) before updating the BIOS. This operation does not affect the customization area in the BIOS. If you use the BIOS Setup utility CMOS Save and Restore functions to save a set of defaults, you will need to recreate and re-save these once the update is complete.

1. Create an update diskette as described above.
2. Boot the system to be updated into MS-DOS without memory managers or boot from the update diskette.
3. If you did not boot from the update diskette, do the following.
 - A. Insert the update diskette into the floppy drive.
 - B. Change the MS-DOS directory to match the floppy drive's directory.
 - C. Type UPDATE and press Enter.
4. Follow the instructions to initiate the update. When it is finished, the following message appears:

```
Flash memory has been successfully programmed
PRESS ANY KEY TO RESTART THE SYSTEM
If the system does not restart
TURN THE POWER OFF, THEN ON
```

5. Turn off the system power and re-boot. The motherboard will boot using RadiSys defaults.

If the update operation fails for any reason (if it was interrupted, for example), and the motherboard will no longer operate, then the BIOS must be recovered.

4.2.3 Creating a BIOS Recovery Diskette

Follow the steps below. You need a PC with Microsoft MS-DOS, Windows 95, Windows 98 or Windows NT and a blank diskette.

1. Obtain the update ZIP file from the Manuals, Drivers & BIOS section on the RadiSys web site, www.radisys.com.
2. Unzip the contents to an empty directory on your hard drive.
3. Insert a blank diskette into the floppy drive.
4. Run CRISDISK /R from the directory created in step 2 and follow the steps as directed to create the recovery diskette. A copy of MS-DOS 'Format.com' must be available for CRISDISK to complete successfully.

4.2.4 Recovering the System BIOS

The recovery diskette should be used to recover a system BIOS when the motherboard no longer operates after a failed BIOS update operation. The process is described below.

1. Remove the operating mode selection jumper to place the board into the recover mode (see Configuration section of this document).
 - A. Turn off the power.
 - B. Remove any covers to gain access to the jumper.
 - C. Remove the jumper from the operating mode selection block
2. Insert the recovery diskette into the floppy drive.
3. Power up the motherboard. You will hear the following audio signals if you have a speaker connected. If you do not have a speaker, wait for approximately 1 minute after all activity has stopped to ensure the operation has completed.

Beep code	Definition
One short beep	BIOS update begins.
One long beep	BIOS update is finished.
Three beeps	This indicates an error.

4. Power down the motherboard.
5. If you removed the operating mode jumper,
 - A. Refit the jumper into the normal operating position.
 - B. Replace the system cover(s).
6. Power up the motherboard. The recovery process is now complete and the product should boot normally.

4.2.5 Updating the Flash Bootblock

There is an area of the BIOS ROM, the bootblock, which is normally not updated. It contains code to perform the recovery process and data that identifies the motherboard. Occasionally, a BIOS release may require this bootblock area to be updated and the update disk will do this automatically. However, exercise caution when attempting such an update as a damaged bootblock area means that the motherboard may need to be returned to RadiSys for repair.



Exercise caution when updating BIOS that includes a bootblock update. If this process is interrupted, the motherboard cannot be recovered and must be returned to RadiSys for repair.

4.3 Customization

There are a number of features of the BIOS that can be customized and the software to accomplish this is contained within the BIOS OEM kit ZIP file that can be obtained from the Manuals, Drivers & BIOS section on the RadiSys web site, www.radisys.com. The 'Readme.txt' file also contained in this ZIP provides updated customization information and should be read before proceeding.

The process involves creating a new update disk that contains the customized BIOS. The steps below will guide you through the process.

1. Obtain both the update and OEMKIT ZIP files from the Manuals, Drivers & BIOS section on the RadiSys web site, www.radisys.com.
2. Unzip the contents of the update ZIP to an empty directory on your hard drive.
3. Unzip the contents of the OEMKIT ZIP to the same directory as step 2. This may replace some files.
4. Replace the 'Logo.bmp' file with a customized logo if required (see description below).
5. Replace the 'P6upd.bin' file with a customized version if required (see description below).
6. Run MAKEBIOS to create the customized binary.
7. Create the update diskette by running CRISDISK /O with a blank diskette in the floppy drive and following the instructions.
8. Using a reference or 'gold' board, update its BIOS with the diskette created in step 6 above using the standard update procedure.
9. Re-boot the board and run the BIOS setup utility.
10. Configure the board as required.
11. From the Exit menu, save the new settings to flash and re-boot the board with the update disk still in the floppy drive.
12. There should be no reported difference between disk and ROM BIOS versions at this point and you will be prompted to read-back the BIOS. Select this to extract the motherboard ROM image and save it to the update disk, replacing the BIOS binary in the file BIOS.ROM.
13. The diskette is now a fully customized update disk. Save the BIOS.ROM file back to the directory on your hard disk used in step 2, replacing the previous version.
14. Create a new version of the update disk by running CRISDISK (with no switches) with a blank diskette in the floppy drive and following the instructions.

The customized 'Logo.bmp' file must be a 16-colour standard BMP format file. The palette can be chosen at will but note that three colors are used by the BIOS for the start-up progress indicator, text and background - palette entries 8, 7 and 0 respectively. The total size of the BMP file must not exceed 40960 bytes which represents approximately 80k pixels. The BIOS will center the image on the screen.

Intel microprocessors allow for their microcode to be updated by the BIOS to workaround some outstanding errata. Each processor type and revision has a unique update image and the BIOS supports a maximum of four contained in the 'P6upd.bin' file. To customize the processor microcode update selections, create a new version of this file by concatenating four microcode updates in binary form - these can be obtained from Intel.

4.4 BIOS Error Indications

Once the motherboard powers-up the BIOS code runs Power-On-Self-Test software to check that the motherboard is operating correctly. During this process, the code writes an 8-bit value to an error port at various code checkpoints. If a fatal error is determined, then the error code indicates the last successful checkpoint reached. The BIOS will attempt to write this code to the display. The error port (I/O location 80h) can be read via “off-the-shelf” Debug cards. The table below lists the checkpoint codes.

There are a number of checkpoints that also generate an audible ‘beep’ code on failure using the standard PC speaker (also routed through the motherboard audio system). The beep codes are made up of up to 4 groups of short beeps and are also listed below.

Once the video is enabled further errors generated during and after POST are sent to the video display as text messages. These messages are always displayed unless the motherboard is configured for silent boot or headless (no keyboard, mouse or display) operation.

BIOS POST Checkpoint Codes			
02h	Verify Real Mode	6Ch	Display shadow message
03h	Disable NMI	6Eh	Display non-disposable segments
04h	Get CPU type	70h	Display error messages
06h	Initialize system hardware	72h	Check for configuration errors
08h	Initialize chipset registers with initial POST values	74h	Test real-time clock
09h	Set in POST flag	76h	Check for keyboard errors
0Ah	Initialize CPU registers	7Ah	Test for key lock on
0Bh	Enable CPU cache	7Ch	Set up hardware interrupts vectors
0Ch	Initialize cache to initial POST values	7Eh	Test coprocessor if present
0Eh	Initialize I/O	80h	Disable onboard I/O ports
0Fh	Initialize local bus IDE	81h	Late device initialization
10h	Initialize Power Management	82h	Detect and install external RS232 ports
11h	Load alternate registers with initial POST values	83h	Configure IDE controller
12h	Restore CR0	84h	Detect and install external parallel ports
13h	Reset PCI BM	85h	Initialize PCI PCC devices
14h	Initialize keyboard controller	86h	Re-initialize onboard I/O ports
16h	BIOS ROM checksum	87h	Configure MCD devices
17h	Pre-size DRAM	88h	Initialize BIOS Data Area
18h	8254 timer initialization	89h	Enable NMI
1Ah	8237 DMA controller initialization	8Ah	Initialize Extended BIOS Data Area
1Ch	Reset Programmable Interrupt Controller	8Bh	Initialize mouse
20h	Test DRAM refresh	8Ch	Initialize floppy controller
22h	Test 8742 Keyboard Controller	8Eh	Execute auto-typing
24h	Set ES segment to register to 4GB	8Fh	Hard disk controller fast pre-initialization

BIOS POST Checkpoint Codes			
26h	Enable A20	90h	Initialize hard disk controller
28h	Autosize DRAM	91h	Initialize local bus hard disk controller
29h	Initialize PMM	92h	Jump to UserPatch2
2Ah	Clear 512KB base RAM	93h	Build MPTABLE for multiprocessor boards
2Ch	Test 512KB base address lines	95h	Install CDROM for boot
2Eh	Test low byte of 512KB base memory	96h	Clear huge ES segment register
2Fh	Pre-System Shadow	97h	Fix up MP table
30h	Test high byte of 512KB base memory	98h	Search for option ROMs (beep for bad checksum)
32h	Test CPU bus-clock frequency	99h	Check for SMART HDD
33h	Initialize PDM	9Ah	Shadow option ROMs
34h	Test CMOS RAM	9Ch	Set up Power Management
35h	Initialize alternate chipset registers	9Dh	Initialize security
36h	Warm start shutdown entry point	9Eh	Enable hardware interrupts
37h	Reinitialize the chipset	9Fh	(Second) HDD fast initialization
38h	Shadow system BIOS ROM	A0h	Set time of day
39h	Reinitialize the cache	A2h	Check keylock
3Ah	Auto-size cache	A4h	Initialize typematic rate
3Ch	Configure advanced chipset registers	A8h	Erase F2 prompt
3Dh	Load alternate registers with CMOS values	AAh	Scan for F2 keystroke
3Eh	Read HW	ACh	Enter SETUP
40h	Set Initial CPU speed	A Eh	Clear in-POST flag
42h	Initialize interrupt vectors	B0h	Check for errors
44h	Initialize BIOS interrupts	B2h	POST done--prepare to boot operating system
45h	Core Device Init	B4h	One beep before boot
46h	Check ROM copyright notice	B5h	Quiet boot end/Display MultiBoot menu
48h	Check video configuration against CMOS	B6h	Check password (optional)
49h	Initialize PCI bus and devices	B8h	Clear global descriptor table
4Ah	Initialize all video adapters in system	B9h	Prepare to boot
4Bh	Display QuietBoot™ screen	BAh	DMI
4Ch	Shadow video BIOS ROM	BBh	Initialize BCVS
4Eh	Display copyright notice	BCh	Clear parity checkers
50h	Display CPU type and speed	BDh	Boot Menu
51h	Initialize EISA board	BEh	Clear screen (optional)
52h	Test keyboard	BFh	Check virus and backup reminders
54h	Set key click if enabled	C0h	Try to boot with INT19

BIOS POST Checkpoint Codes			
56h	Enable keyboard	C1h	Initialize PEM
58h	Test for unexpected interrupts	C2h	PEM log
59h	Initialize PDS	C3h	PEM Display
5Ah	Display prompt "Press F2 to enter SETUP"	C4h	PEM sys error initialization
5Bh	CPU cache off	C5h	Dual CMOS
5Ch	Test RAM between 512KB and 640KB	C6h	Docking initialization
5Eh	Base Address	C7h	Late docking initialization
60h	Test extended memory	D0h	Interrupt handler error
62h	Test extended memory address lines	D2h	Unknown interrupt error
64h	Jump to UserPatch1	D4h	Pending interrupt error
66h	Configure advanced cache registers	D6h	Initialize option ROM error
68h	Enable external and CPU caches	D8h	Shutdown error
69h	PM set up SMM	DAh	Extended Block Move
6Ah	Display external cache size	DCh	Shutdown 10 error
6Bh	Load custom defaults	DFh	A20 Error

Checkpoint Code	Beep Code
16h BIOS ROM checksum	1-2-2-3
20h Test DRAM refresh	1-3-1-1
22h Test 8742 Keyboard Controller	1-3-1-3
28h Autosize DRAM	1-3-3-1
29h Initialize PMM	1-3-3-2
2Ch Test 512KB base address lines	1-3-4-1
2Eh Test low byte of 512KB base memory	1-3-4-3
34h Test CMOS RAM	1-4-3-1
3Ah Auto-size cache	1-4-3-3
46h Check ROM copyright notice	2-1-2-3
58h Test for unexpected interrupts	2-2-3-1
90h Initialize hard disk controller	3-2-1-1
98h Search for option ROMs (beep for bad checksum)	1-2
B4h One beep before boot	1
DFh A20 Error	4-2-4-4

5 Customer Support

RadiSys Online Support can be found at www.radisys.com and includes device drivers, BIOS updates, support software and documentation. See the Manuals, Drivers & BIOS section.

RadiSys hotline numbers for the US and Canada are

Support: (800) 438-4769

Service: (800) 256-5917



Online specifications and reference material:

Specification	Description	Location
AC97	Audio CODEC specification	http://developer.intel.com/pc-supp/platform/ac97
ACPI	Advanced Configuration and Power Interface specification	www.teleport.com/~acpi
AGP	Advanced Graphics Port Interface Specification	www.agpforum.org
APM	Advanced Power Management specification	www.microsoft.com/hwdev/busbios/amp_12.htm
DDWG	Digital Display Working Group	www.ddwg.org
Intel 815E Chipset	Intel 815E chipset datasheet	http://developer.intel.com/design/chipsets/815e/index.htm
Intel Celeron processor	Intel Celeron processor datasheet	http://developer.intel.com/design/celeron
Intel Pentium III processor	Intel Pentium III processor datasheet	http://developer.intel.com/design/pentiumiii
ATX	Form factor specifications	www.teleport.com/~ffsupprt/spec/index.htm
PCI	PCI local bus specification	www.pcisig.com
SDRAM DIMMs	PC SDRAM module specification	http://developer.intel.com/design/chipsets/memory
SMBus	System management bus	www.sbs-forum.org/index.htm
USB	Universal Serial Bus specification	www.usb.org/developers
VESA	Video Electronics Standards Association	www.vesa.org

Appendix A Technical Reference

A.1. I/O Map

Address (hex)*	Description
0000 – 000F	DMA controller 1
0020 – 0021	Interrupt controller 1
0040 – 0043	Timer counter
0060 – 0064	Keyboard and mouse controller
0070 – 0071	RTC and CMOS RAM
0080 – 008F	DMA controller page registers (for channels 1 and 2)
0092	PC compatible Port 92 (fast A20 and PIC)
x094	VGA controller POS102 access control
00A0 – 00A1	Interrupt controller 2
00B2 – 00B3	Advanced power management (APM) control registers
00C0 – 00DF	DMA controller 2
00F0	Floating point error control
x102	VGA controller POS102 register
015C – 015D	SIO control registers
0170 – 0177	Secondary IDE controller
01F0 – 01F7	Primary IDE controller
0278 – 027F	Parallel port, LPT2
02E8 – 02EF	COM4 serial port
02F8 – 02FF	COM2 serial port
0374 – 0376	Secondary IDE controller
0378 – 037F	Parallel port, LPT1
x3B0 – x3BB	VGA controller
x3C0 – x3CF	EGA controller registers
x3D4 – x3DA	CGA controller registers
03F0 – 03F5	Flexible diskette controller
03F6 – 03F7	Primary IDE controller
03E8 – 03EF	COM3 serial port
03F8 – 03FF	COM1 serial port
04D0 – 04D1	Interrupt controller
0778 – 077A	ECP registers (for parallel port)
0CF8 – 0CFF	PCI configuration address and data registers
1000 – 105F	ACPI registers
1060 – 107F	TCO controller
1600 – 165F	SIO system management controller and GPIO

Address (hex)*	Description
FFA0 – FFA7	Primary IDE bus master registers
FFA8 – FFAF	Secondary IDE bus master registers
Dynamically assigned	USB controller (32 locations on 32-byte boundary)
Dynamically assigned	SMBus controller (16 locations on 16-byte boundary)
Dynamically assigned	PCI bridge (4096 locations on a 4096-byte boundary)
Dynamically assigned	LAN controller (32 locations on a 32-byte boundary)

* An 'x' prefix for the address indicates that only the low-order 10 address bits are decoded.

A.2. PCI Interrupt Allocation

In order to share PCI interrupts efficiently, the routing of the PCI interrupts INTA - INTD to the motherboard interrupts PCIINT0 – PCIINT3 are rotated for each slot. Thus the PCI card INTA signal for PCI slots 1 to 4 are spread across all four motherboard inputs. The Ethernet controller and the second USB channel use additional PCI interrupts (IRQE and IRQH) that are not routed to the slots.

Device	PCIINT0	PCIINT1	PCIINT2	PCIINT3	IRQE	IRQH
Slot 1 (AGP4X)	INTA	INTB	-	-	-	-
Slot 2 (PCI 2.2)	INTD	INTA	INTB	INTC	-	-
Slot 3 (PCI 2.2)	INTC	INTD	INTA	INTB	-	-
Slot 4 (PCI 2.2)	INTB	INTC	INTD	INTA	-	-
Slot 5 (PCI 2.2)	INTA	INTB	INTC	INTD	-	-
Slot 6 (PCI 2.2)	INTD	INTA	INTB	INTC	-	-
VGA controller	INTA	-	-	-	-	-
Ethernet controller	-	-	-	-	INTA	-
USB controller 1	-	-	-	INTD	-	-
USB controller 2	-	-	-	-	-	INTC
SMBus controller	-	INTB	-	-	-	-
AC97 audio controller	-	INTB	-	-	-	-

Example. From the table above, the INTA interrupt from a card plugged into slot 2 would be routed to the motherboard PCIINT1.

A.3. PCI Device Assignments

Device	IDSEL	Bus Number	Device Number	Function Number
Chipset host bridge		0	0	0
AGP bridge		0	1	0
Graphics controller		0	2	0
PCI bridge		0	30	0
LPC bridge		0	31	0
(Includes DMA, timers, PIC, APIC, RTC, power & system management, GPIO)				

Device	IDSEL	Bus Number	Device Number	Function Number
IDE controller		0	31	1
USB controller 1		0	31	2
SMBus controller		0	31	3
USB controller 2		0	31	4
AC97 audio controller		0	31	5
AC97 Modem controller		0	31	5
Slot 1 (AGP 4X)	AD16	1	0	
Slot 2 (PCI 2.2)	AD29	1 or 2	13	
Slot 3 (PCI 2.2)	AD27	1 or 2	11	
Slot 4 (PCI 2.2)	AD25	1 or 2	9	
Slot 5 (PCI 2.2)	AD23	1 or 2	7	
Slot 6 (PCI 2.2)	AD21	1 or 2	5	
ISA bridge controller	AD22	1 or 2	6	0
Ethernet controller		1 or 2	8	0

Note that the PCI slots and the Ethernet controller are behind a virtual bridge implemented by the chipset ICH2. Each device therefore resides on PCI bus 1 if there is no AGP card detected or bus 2 if there is an AGP card present.

A.4. ISA Interrupt Allocation

The ISA interrupts are allocated as described in the table below.

Interrupt	Description
IRQ0	System Timer
IRQ1	Keyboard Controller
IRQ2	Cascade interrupt
IRQ3	COM2, COM1 or unassigned
IRQ4	COM1, COM2 or unassigned
IRQ5	Parallel port or unassigned
IRQ6	Floppy
IRQ7	Printer port or unassigned
IRQ8	Real time clock/CMOS RAM
IRQ9	Unassigned
IRQ10	Unassigned
IRQ11	Unassigned
IRQ12	PS/2 mouse or unassigned
IRQ13	Floating point unit
IRQ14	Primary IDE or unassigned
IRQ15	Secondary IDE or unassigned
NMI	PCI PERR and SERR signals and ISA IOCHCHK

A.5. ISA DMA Channel Allocation

Whilst the motherboard does not support an ISA bus, it includes an ISA-compatible DMA controller in order to be compatible with AT standard architecture. The DMA channels are allocated as described in the table below.

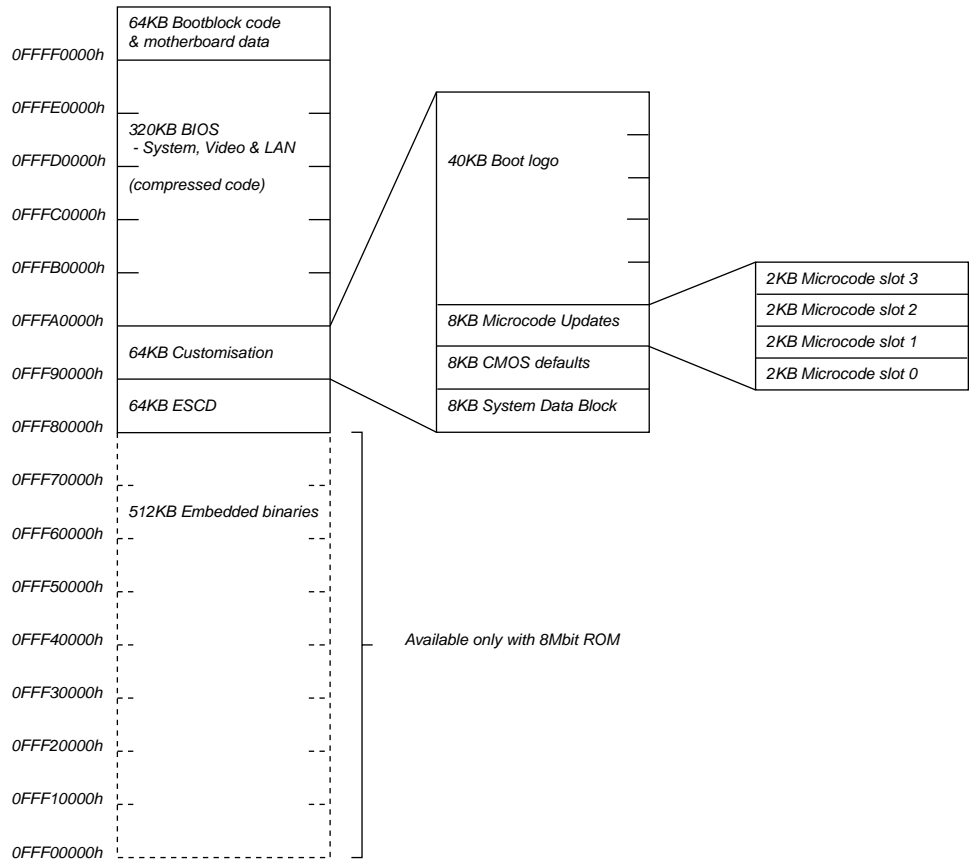
DMA Channel	Description
Channel 0	Unassigned 8-bit channel
Channel 1	Unassigned 8-bit channel
Channel 2	Floppy controller or unassigned 8-bit channel
Channel 3	ECP parallel port or unassigned 8-bit channel
Channel 4	Cascade channel
Channel 5	Unassigned 16-bit channel
Channel 6	Unassigned 16-bit channel
Channel 7	Unassigned 16-bit channel

A.6. SMBus Resource Allocation

Address	Description
1010 000X	Memory module 1
1010 001X	Memory module 2
1101 001X	Clock synthesizer

A.7. BIOS Organization

The BIOS ROM is a 4Mbit device containing eight symmetrical 64KB blocks. The diagram below shows how the ROM is used to store code and control information. The addresses shown refer to the ROM image at the top of the 4GB-address space. Note that the system BIOS segment is compressed in this image. When the BIOS runs, the code is uncompressed in real-time and the resulting code and data image is found at physical address 0E0000h through 0FFFFFFh. The diagram includes the map for products that contain an 8Mbit ROM where fitted although this is not fitted as standard.



Appendix B Connector Descriptions

B.1. Connector Part Numbers

The various motherboard connectors are listed in the table below along with the part number of one of the approved vendors. The list is intended to assist in the selection of mating connectors.

Connector	Part Number	Type
Rear audio jacks	Foxconn JA5333L-102	Triple 3.5mm stereo jack
Dual rear USB	Foxconn UB1112C-81	Non-LAN products
Dual rear USB and RJ45	Foxconn UB1112C-L29	Stacked dual USB and RJ45 with LEDs and transformer for LAN-enabled products
Rear PS/2 keyboard and mouse	Foxconn MH11061-D2	Stacked 6-way mini-DIN
Flat panel monitor header	Foxconn E6220S0-13	20-pin Flex SMT header
Rear VGA monitor, parallel port and serial port (1) stack	Foxconn DM11353-BV5	Combination 15-way high-density female, 25-way female and 15-way male D-type
Serial port 2 header	Foxconn HL09051-P5	2 by 10-way shrouded header
CPU and system fan	Foxconn HF06031	3-way with locking ramp
GPIO header	Foxconn HL09061-P9	2 by 6-way shrouded header
DIMM sockets	Foxconn AT08413-K8	168-pin, 3V SDRAM
ATAPI CD-ROM LINE input and Telephony headers	Foxconn HF11040-P1	4-pin ATAPI-style
Processor socket	Foxconn PZ37047-S01-S	370-pin ZIF PGA
Primary and secondary IDE	Foxconn HL07207-D2	40-pin shrouded header
Diskette drive	Foxconn HL16176-P0	34-pin shrouded header
Keyboard and mouse headers	JST B4B-PH-K-S	4-pin 2mm headers
USB channel 2 header	Foxconn HF01051	5-pin ATAPI-style
AGP connector	Foxconn EE06611-TM	Universal AGP
PCI connector	Foxconn EH06001-GU-V	5V signaling
ISA connector	Foxconn EQ04901-GB-N	
External audio CODEC	JST B7B-PH-K-S	7-pin 2mm headers

B.2. AGP Expansion Slot

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
A1	+12V	B1	USBOC#	A34	VDDQ3.3	B34	VDDQ3.3
A2	TYPEDET#	B2	+5V	A35	AD22	B35	AD21
A3	RESERVED	B3	+5V	A36	AD20	B36	AD19
A4	USB-	B4	USB+	A37	GND	B37	GND
A5	GND	B5	GND	A38	AD18	B38	AD17
A6	INTA#	B6	INTB#	A39	AD16	B39	C/BE2#
A7	RST#	B7	CLK	A40	VDDQ3.3	B40	VDDQ3.3
A8	GNT#	B8	REQ#	A41	FRAME#	B41	IRDY#
A9	+3.3V	B9	+3.3V	A42	RESERVED	B42	+3.3VAUX
A10	ST1	B10	ST0	A43	GND	B43	GND
A11	RESERVED	B11	ST2	A44	RESERVED	B44	RESERVED
A12	PIPE#	B12	RBF#	A45	+3.3V	B45	+3.3V
A13	GND	B13	GND	A46	TRDY#	B46	DEVSEL#
A14	WBF#	B14	RESERVED	A47	STOP#	B47	VDDQ3.3
A15	SBA1	B15	SBA0	A48	PME#	B48	PERR#
A16	+3.3V	B16	+3.3V	A49	GND	B49	GND
A17	SBA3	B17	SBA2	A50	PAR	B50	SERR#
A18	SBSTB#	B18	SBSTB	A51	AD15	B51	C/BE1#
A19	GND	B19	GND	A52	VDDQ3.3	B52	VDDQ3.3
A20	SBA5	B20	SBA4	A53	AD13	B53	AD14
A21	SBA7	B21	SBA6	A54	AD11	B54	AD12
A22	RESERVED	B22	RESERVED	A55	GND	B55	GND
A23	GND	B23	GND	A56	AD9	B56	AD10
A24	RESERVED	B24	+3.3VAUX	A57	C/BE0#	B57	AD8
A25	+3.3V	B25	+3.3V	A58	VDDQ3.3	B58	VDDQ3.3
A26	AD30	B26	AD31	A59	ADSTB0#	B59	ADSTB0
A27	AD28	B27	AD29	A60	AD6	B60	AD7
A28	+3.3V	B28	+3.3V	A61	GND	B61	GND
A29	AD26	B29	AD27	A62	AD4	B62	AD5
A30	AD24	B30	AD25	A63	AD2	B63	AD3
A31	GND	B31	GND	A64	VDDQ3.3	B64	VDDQ3.3
A32	ADSTB1#	B32	AD_STB1	A65	AD0	B65	AD1
A33	C/BE3#	B33	AD23	A66	VREFGC	B66	VREFGC

B.3. PCI Expansion Slot

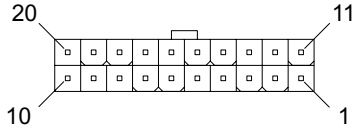
Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
A1	GND	B1	-12V	A32	AD16	B32	AD17
A2	+12V	B2	GND	A33	+3.3V	B33	C/BE2#
A3	TMS*	B3	GND	A34	FRAME#	B34	GND
A4	TDI*	B4	NC	A35	GND	B35	IRDY#
A5	+5V	B5	+5V	A36	TRDY#	B36	+3.3V
A6	INTA#	B6	+5V	A37	GND	B37	DEVSEL#
A7	INTC#	B7	INTB#	A38	STOP#	B38	GND
A8	+5V	B8	INTD#	A39	+3.3V	B39	LOCK#
A9	RESERVED	B9	PRSNT1#	A40	NC	B40	PERR#
A10	+5V	B10	RESERVED	A41	NC	B41	+3.3V
A11	RESERVED	B11	PRSNT2#	A42	GND	B42	SERR#
A12	GND	B12	GND	A43	PAR	B43	+3.3V
A13	GND	B13	GND	A44	AD15	B44	C/BE1#
A14	+3.3V AUX	B14	RESERVED	A45	+3.3V	B45	AD14
A15	RST#	B15	GND	A46	AD13	B46	GND
A16	+5V	B16	CLK	A47	AD11	B47	AD12
A17	GNT#	B17	GND	A48	GND	B48	AD10
A18	GND	B18	REQ#	A49	AD9	B49	GND
A19	PME#	B19	+5V	A50	KEY	B50	KEY
A20	AD30	B20	AD31	A51	KEY	B51	KEY
A21	+3.3V	B21	AD29	A52	C/BE0#	B52	AD8
A22	AD28	B22	GND	A53	+3.3V	B53	AD7
A23	AD26	B23	AD27	A54	AD6	B54	+3.3V
A24	GND	B24	AD25	A55	AD4	B55	AD5
A25	AD24	B25	+3.3V	A56	GND	B56	AD3
A26	IDSEL	B26	C/BE3#	A57	AD2	B57	GND
A27	+3.3V	B27	AD23	A58	AD0	B58	AD1
A28	AD22	B28	GND	A59	+5V	B59	+5V
A29	AD20	B29	AD21	A60	REQ64#	B60	ACK64#
A30	GND	B30	AD19	A61	+5V	B61	+5V
A31	AD18	B31	+3.3V	A62	+5V	B62	+5V

* Unused and pulled high to +5V

B.4. ISA Expansion Slot

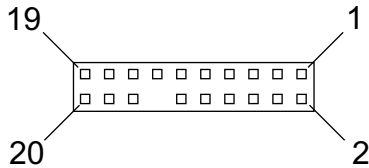
Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
A1	IOCHK#	B1	GND	C1	SBHE#	D1	MEMCS16#
A2	SD7	B2	RESET	C2	LA23	D2	IOCS16#
A3	SD6	B3	+5V	C3	LA22	D3	IRQ10
A4	SD5	B4	IRQ9	C4	LA21	D4	IRQ11
A5	SD4	B5	-5V	C5	LA20	D5	IRQ12
A6	SD3	B6	DRQ2	C6	LA19	D6	IRQ15
A7	SD2	B7	-12V	C7	LA18	D7	IRQ14
A8	SD1	B8	OWS#	C8	LA17	D8	DACK0#
A9	SD0	B9	+12V	C9	MEMR#	D9	DRQ0
A10	IOCHRDY	B10	GND	C10	MEMW#	D10	DACK5#
A11	AEN	B11	SMEMW#	C11	SD8	D11	DRQ5
A12	SA19	B12	SMEMR#	C12	SD9	D12	DACK6#
A13	SA18	B13	IOW#	C13	SD10	D13	DRQ6
A14	SA17	B14	IOR#	C14	SD11	D14	DACK7#
A15	SA16	B15	DACK3#	C15	SD12	D15	DRQ7
A16	SA15	B16	DRQ3	C16	SD13	D16	+5V
A17	SA14	B17	DACK1#	C17	SD14	D17	MASTER#
A18	SA13	B18	DRQ1	C18	SD15	D18	GND
A19	SA12	B19	REFRESH#				
A20	SA11	B20	BCLK				
A21	SA10	B21	IRQ7				
A22	SA9	B22	IRQ6				
A23	SA8	B23	IRQ5				
A24	SA7	B24	IRQ4				
A25	SA6	B25	IRQ3				
A26	SA5	B26	DACK2#				
A27	SA4	B27	TC				
A28	SA3	B28	BALE				
A29	SA2	B29	+5V				
A30	SA1	B30	OSC				
A31	SA0	B31	GND				

B.5. ATX Power Supply



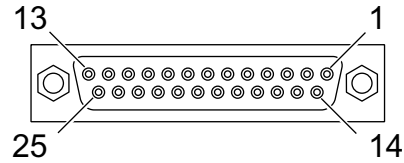
Pin	Signal	Pin	Signal
11	+3.3V	1	+3.3V
12	-12.0V	2	+3.3V
13	GND	3	GND
14	PS_ON#	4	+5.0V
15	GND	5	GND
16	GND	6	+5.0V
17	GND	7	GND
18	NC	8	PWR_OK
19	+5.0V	9	+5.0VSBY
20	+5.0V	10	+12.0V

B.6. Front Panel Header



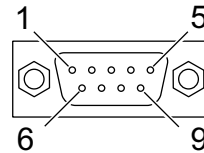
Pin	Signal	Pin	Signal
1	HDLED+	2	GREENLED+
3	HDLED-	4	GREENLED-
5	RESETSW+	6	PWRSW+
7	RESETSW-	8	PWRSW-
9	IR +5V	10	SPKR+
11	IRRXDAT	12	SPKR-
13	IR GND	14	KEY
15	IRTXDAT	16	SPKR-
17	NC	18	TMPSW+
19	NC	20	TMPSW-

B.7. Parallel Port



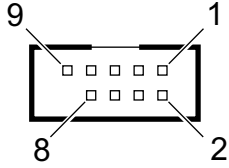
Pin	Signal	Pin	Signal
1	STB#	14	AFD#
2	DB0	15	ERR#
3	DB1	16	INIT#
4	DB2	17	SLIN#
5	DB3	18	GND
6	DB4	19	GND
7	DB5	20	GND
8	DB6	21	GND
9	DB7	22	GND
10	ACK#	23	GND
11	BUSY	24	GND
12	PE	25	GND
13	SLCT		

B.8. Serial Port 1



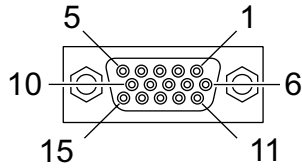
Pin	Signal	Pin	Signal
1	DCD	6	DSR
2	RxD	7	RTS
3	TxD	8	CTS
4	DTR	9	RING
5	GND		

B.9. Serial Port 2



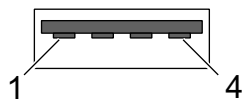
Pin	Signal	Pin	Signal
1	DCD	2	DSR
3	RxD	4	RTS
5	TxD	6	CTS
7	DTR	8	RING
9	GND	10	KEY

B.10. VGA Monitor



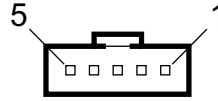
Pin	Signal	Pin	Signal
1	RED	9	+5V
2	GREEN	10	GND
3	BLUE	11	RESERVED
4	RESERVED	12	SDA
5	GND	13	HSYNC
6	RED RTN	14	VSYNC
7	GREEN RTN	15	SCL
8	BLUE RTN		

B.11. Rear I/O USB Ports



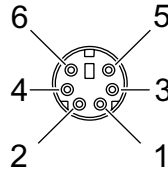
Pin	Signal
1	+5V
2	DATA-
3	DATA+
4	GND

B.12. USB Channel 2 Header



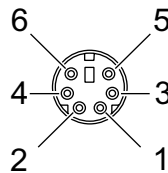
Pin	Signal
1	+5V
2	DATA-
3	DATA+
4	SGND
5	FGND

B.13. PS/2 Keyboard



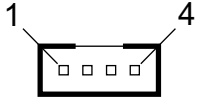
Pin	Signal	Pin	Signal
1	DATA	4	+5V
2	Not Used	5	CLOCK
3	GND	6	Not Used

B.14. PS/2 Mouse



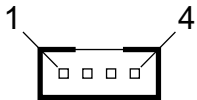
Pin	Signal	Pin	Signal
1	DATA	4	+5V
2	Not Used	5	CLOCK
3	GND	6	Not Used

B.15. Keyboard Header



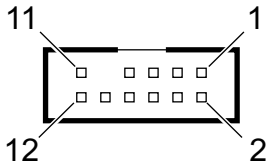
Pin	Signal
6	+5V
7	DATA
8	GND
9	CLOCK

B.16. Mouse Header



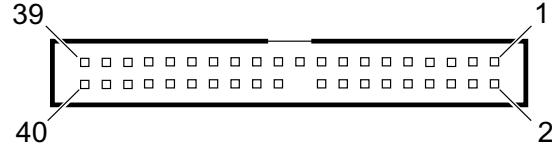
Pin	Signal
1	+5V
2	DATA
3	GND
4	CLOCK

B.17. General Purpose I/O



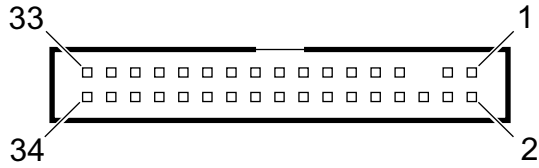
Pin	Signal	Pin	Signal
21	GPIO20	22	GPIO21
23	GPIO22	24	GPIO23
25	GPIO24	26	GPIO25
27	GPIO26	28	GPIO27
29	KEY	30	GND
31	+5V	32	+3.3V

B.18. IDE Drive Headers



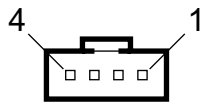
Pin	Signal	Pin	Signal
1	RST#	2	GND
3	D7	4	D8
5	D6	6	D9
7	D5	8	D10
9	D4	10	D11
11	D3	12	D12
13	D2	14	D13
15	D1	16	D14
17	D0	18	D15
19	GND	20	KEY
21	DRQ	22	GND
23	IOW#	24	GND
25	IOR#	26	GND
27	IORDY	28	CSEL
29	DAK#	30	GND
31	IRQ14	32	NC
33	DA1	34	CBLID#
35	DA0	36	DA2
37	CS1#	38	CS3#
39	HDACT#	40	GND

B.19. Diskette Drive Header



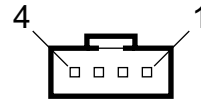
Pin	Signal	Pin	Signal
1	GND	2	DENSEL
3	GND	4	NC
5	KEY	6	DRATE0
7	GND	8	INDEX#
9	GND	10	MTR2#
11	GND	12	DS1#
13	GND	14	DS0#
15	GND	16	MTR0#
17	GND	18	DIR#
19	GND	20	STEP#
21	GND	22	WDATA#
23	GND	24	WGATE#
25	GND	26	TRK0#
27	GND	28	WP#
29	GND	30	RDATA#
31	GND	32	HDSEL#
33	GND	34	DSKCHG#

B.20. ATAPI CD-ROM



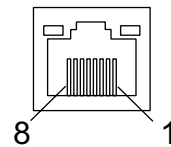
Pin	Signal
1	LEFT
2	GND
3	GND
4	RIGHT

B.21. ATAPI Telephony



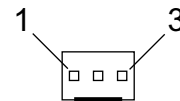
Pin	Signal
1	PHONE IN
2	GND
3	GND
4	MONO LINE OUTPUT

B.22. RJ45 Ethernet



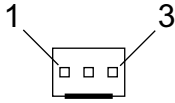
Pin	Signal
1	TxD+
2	TxD-
3	RxD+
4	GND
5	GND
6	RxD-
7	GND
8	GND

B.23. Processor Fan



Pin	Signal
1	GND
2	POWER
3	TACH#

B.24. System Fan



Pin	Signal
1	GND
2	POWER
3	TACH#

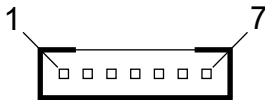
B.25. LINE In and Out Jacks

Pin	Signal
TIP	LEFT AUDIO
RING	RIGHT AUDIO
SLEEVE	GND

B.26. MIC Jack

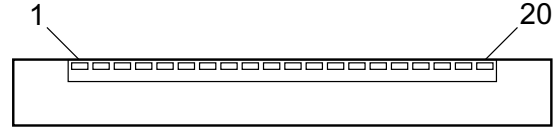
Pin	Signal
TIP	MIC MONO INPUT
RING	BIAS VOLTAGE
SLEEVE	GND

B.27. External Audio CODEC



Pin	Signal
1	AC97 RESET#
2	AC97 SDOUT
3	AC97 SYNC
4	AC97 SDIN
5	AC97 BITCLK
6	GND
7	EXTCODEC#

B.28. Flat Panel Header



Pin	Signal	Pin	Signal
1	GND	11	TXC+
2	TX2+	12	TXC-
3	TX2-	13	SHLDC
4	SHLD2	14	+5V
5	TX1+	15	GND
6	TX1-	16	HPD
7	SHLD1	17	GND
8	TX0+	18	DDC_DAT
9	TX0-	19	DDC_CLK
10	SHLD0	20	GND