



RadiSys

Endura
SC815E
Product Manual

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Revision History

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| 1.0 | First Release | December 2000 |
| 1.1 | Added support for 850 MHz Celeron and 1.0 GHz Pentium III Added support for build-dependant on-board speaker Added section on power supply selection Added MTBF and fan drive current specifications Updated approvals information Added thermal specification section Removed support for Microsoft Windows 95 Format and textual corrections | November 2001 |
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| 1.3 | Updated text for SC815E-FPLAG SKU including connector table in Appendix B Corrected operating mode jumper description | December 2003 |

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.



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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 when installed in a suitable chassis.

Electromagnetic Compatibility

This product is designed to meet the following EMC standards when installed in a suitable chassis.

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 |

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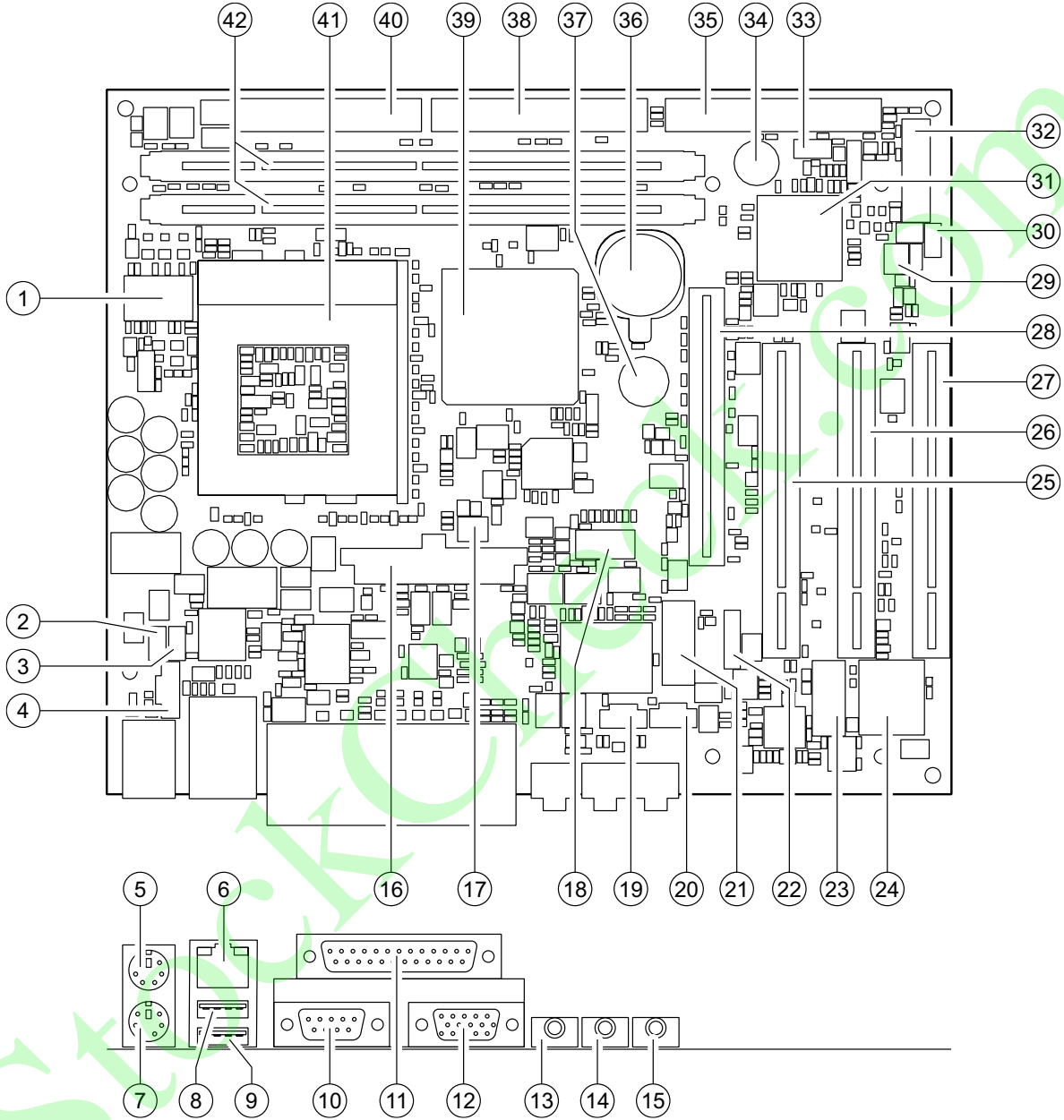
1 Overview

The SC815E is a microATX 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 9.0 x 7.5-inch board and is targeted at the embedded PC technology market. Its small size also enables it to be used in a FlexATX chassis.

| | |
|--------------------------|---|
| Form Factor | microATX/FlexATX, 9.0 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 |
| 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 Optional on-board mini-speaker |
| Power Management | APM, ACPI, PCI PME |
| System Management | Voltage, temperature and fan monitoring for 2 fans Fan speed control for 2 fans |
| BIOS | Based on PhoenixBIOS™ 4.0 release 6.0 4Mbit device Includes POST, Setup, ACPI, APM, PnP, video BIOS Customizable startup logo |
| I/O | Dual rear USB 1.1 Third USB 1.1 channel on header, fourth channel on AGP connector Two serial ports (one on header) with IrDA in lieu of second port Bi-directional/EPP/ECP parallel port PS/2 keyboard and mouse (duplicated on internal headers) 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 3 PCI 2.2 slots |

1.1 Motherboard Layout

The figure below shows the layout of the SC815E motherboard with the major components identified.

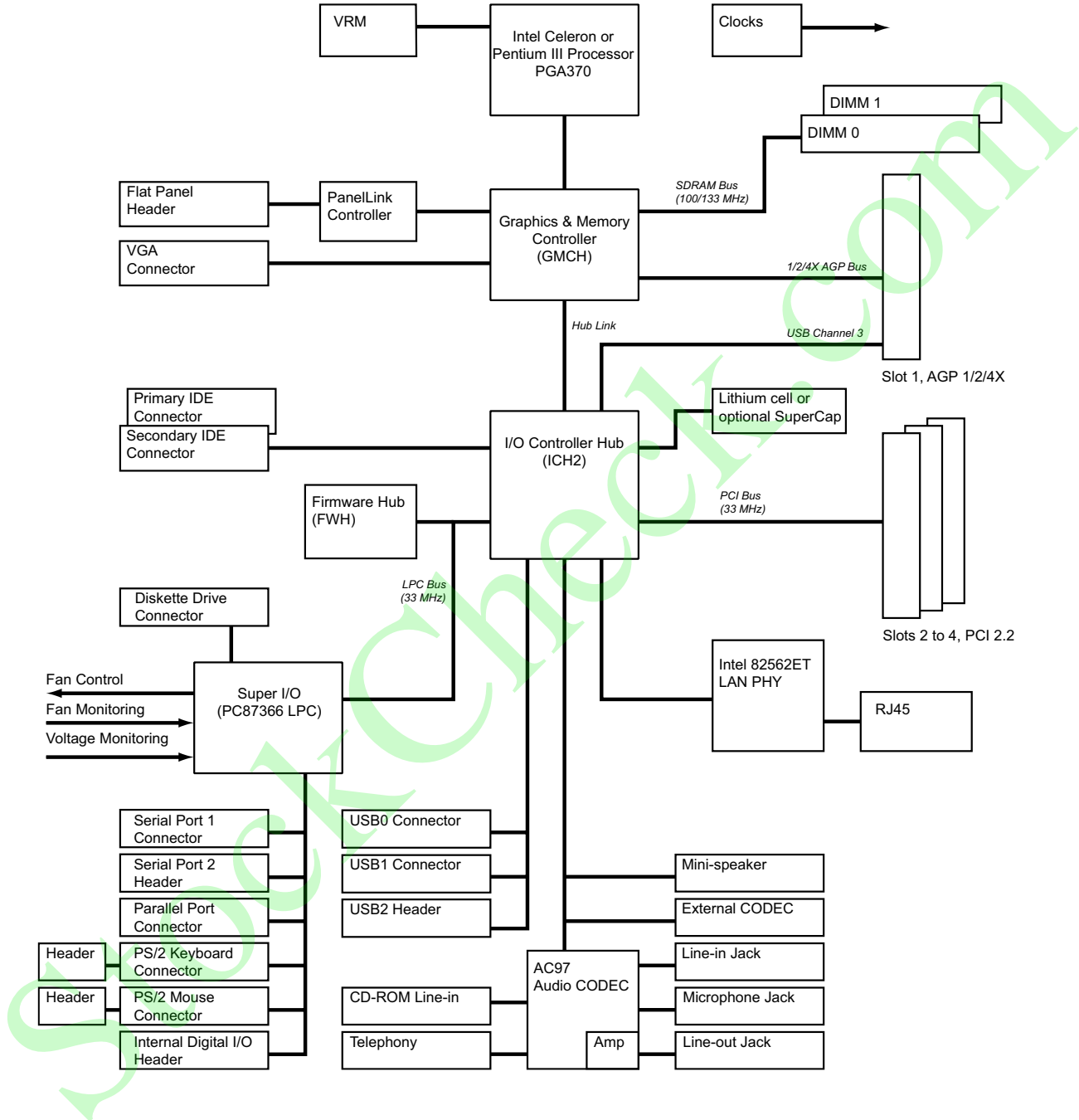


Motherboard Component Identification

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

1.2 Block Diagram

The figure below shows a block diagram of the SC815E motherboard.



1.3 Product Options

The table below lists the product options available.

| Functions | SC815E-L | SC815E-FPL | SC815E-FPLAG ¹ |
|--|----------|------------|---------------------------|
| Audio | Yes | Yes | Yes |
| Flat panel interface | No | Yes | Yes |
| Flat panel rear connector ² | No | No | No |
| LAN | Yes | Yes | Yes |
| On-board speaker | No | No | No |
| 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.

1.4 Product Order Codes

Each supported product configuration has an order code and the description below indicates how these codes are created³.

| | | | | | | | |
|-----------|------------|------------|----------|-----------|------------|----------|------------|
| SC | FPL | 00 | - | C | 566 | - | 256 |
| <i>i</i> | <i>ii</i> | <i>iii</i> | | <i>iv</i> | <i>v</i> | | <i>vi</i> |

- i* Product SC SC815E
- ii* Option L Single 10/100 Ethernet (SC815E-L)
 FPL Single 10/100 Ethernet and PanelLink flat panel controller (SC815E-FPL)
 FPA As FPL with modified flat panel connector and I/O filters (SC815E-FPLAG)
- iii* Revision 00 This 2-digit number is used to identify changes to the product
- iv* Processor P Pentium III
 C Celeron
 (none)
- v* CPU Speed (in MHz): 566, 600, 850, 866, 733, 100 (1GHz); 0 = no processor
- vi* Memory capacity (in MB): 128, 256, 512; 0 = no memory

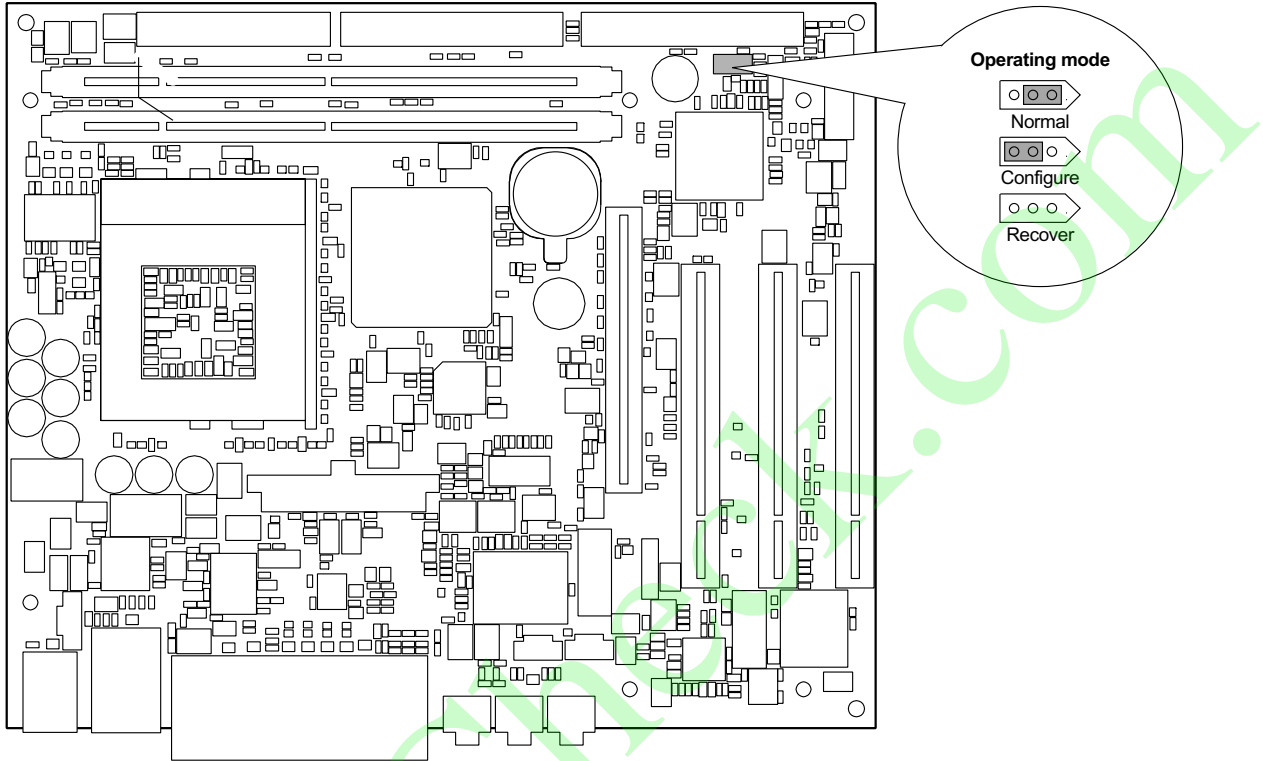
¹ This option is identical to S815E-FPL but with modified flat panel connector

² The flat panel rear connector assembly is available as an accessory.

³ Some early product codes do not follow this format and begin with SC815E

1.5 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.



1.5.1 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.

Recovery Mode

If the jumper is in the recovery mode position 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.

1.5.2 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 an external 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. The speaker should typically be 8Ω.

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 SC815E 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 Celeron | 850 MHz | 100 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 |
| Intel Pentium III | 1.0 GHz | 133 MHz | 256kB | FC-PGA |

2.2 System Memory

The SC815E 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 SC815E 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 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 via external bridge) video cards.

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 |

2.4.2 Video Modes

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.

2.5 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.

An optional mini-speaker can be fitted to provide PC speaker functions (error 'beep' etc.).

2.6 Network

The SC815E 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 SC815E 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 SC815E 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 SC815E 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 and 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

SC815E 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 SC815E 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 4 expansion card slots - three PCI slots and one AGP slot as described below.

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 3 bus-master PCI 2.2 compliant slots. 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.

2.14 System management

The SC815E 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, 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, 1.70V or 1.75V |
| Intel Celeron | 733 MHz | 1.65V, 1.70V or 1.75V |
| Intel Celeron | 850 MHz | 1.70V or 1.75V |
| Intel Pentium III | 600 MHz | 1.65V, 1.70V or 1.75V |
| Intel Pentium III | 733 MHz | 1.65V, 1.70V or 1.75V |
| Intel Pentium III | 700 MHz | 1.65V, 1.70V or 1.75V |
| Intel Pentium III | 850 MHz | 1.65V, 1.70V or 1.75V |
| Intel Pentium III | 866 MHz | 1.65V, 1.70V or 1.75V |
| Intel Pentium III | 1.0 GHz | 1.70V or 1.75V |

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 SC815E 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 SC815E 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 SC815E 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 98, NT 4.0, 2000

3 Specifications

3.1 Regulatory EMC Compliance

The table below lists the EMC regulations the SC815E motherboard is designed to meet 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 SC815E motherboard complies with when correctly installed in a suitable chassis.

| Regulation |
|---|
| UL1950/07.95 |
| CAN/CSA-C22.2 No. 950-95 |
| IEC60950, 1991 2 nd edition with amendments 1, 2, 3, 4 |

3.3 Environmental

| Parameter | State | Specification |
|---------------------------------------|------------|--|
| Temperature ⁴ (ambient) | Operating | 0°C to 55°C |
| | 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 |
| MTBF | | 506,975 hours at 35°C using Bellcore Issue 6 |

⁴ See Thermal specification section

3.4 Thermal

The ambient operating temperature range for the motherboard is 0 - 55°C but the selection of processor and heatsink (or fansink) can reduce the system operating range. Intel Celeron processors have a minimum operating temperature of 5°C. The processor and fansink combinations normally supplied as standard with the motherboards are tested using software designed to cause maximum power dissipation in the processor. This testing is done in an environmental test chamber with forced-air circulation. The maximum operating temperature of the supplied processor and fansink combination is specified in the Endura Processor Support document, which can be found in the motherboard section of the RadiSys web site.



Always test the final system configuration to determine if the operating temperature range limits for the motherboard and processor are being met. Failure to do so can lead to motherboard or processor damage and/or shortened life.



Intel Celeron processors have a minimum operating temperature of 5°C. Refer to the relevant Intel processor datasheet for the maximum operating temperature.

3.5 Industry Compliance

The SC815E 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 |
| microATX | microATX Motherboard Interface Specification | 1.0 |
| FlexATX | FlexATX Addendum to the microATX Specification 1.0 | 1.0 |
| 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 |

3.6 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. |
| CPU and system fan drive capability | 12.0V | 300mA max. |

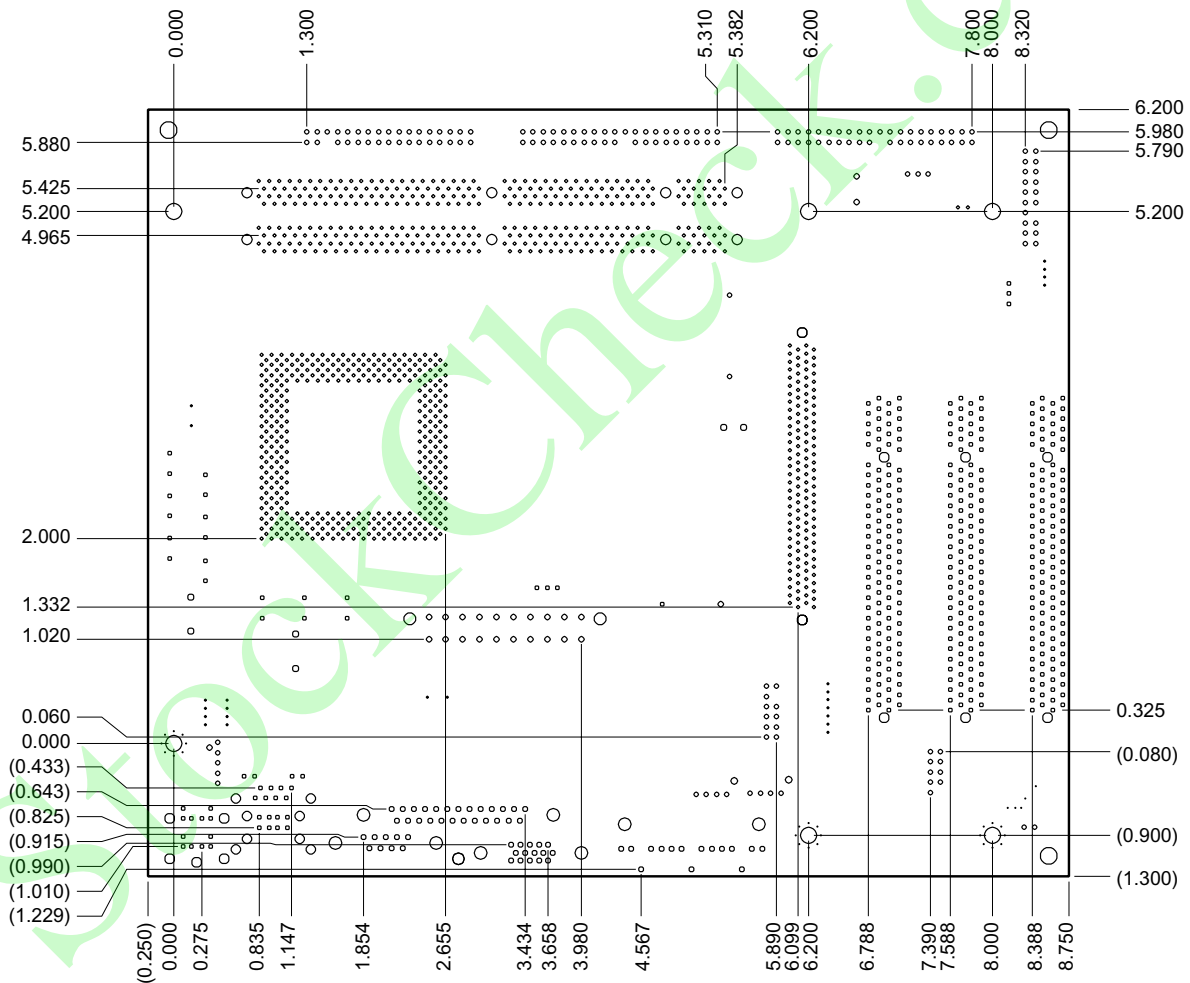
3.7 Mechanical

3.7.1 Motherboard

The SC815E motherboard meets the microATX Motherboard Interface Specification, version 1.0 and its FlexATX addendum, version 1.0. It measures 9.0 x 7.5 inches and is manufactured using a 4-layer PCB with components on the topside only. The screen-printing includes the following.

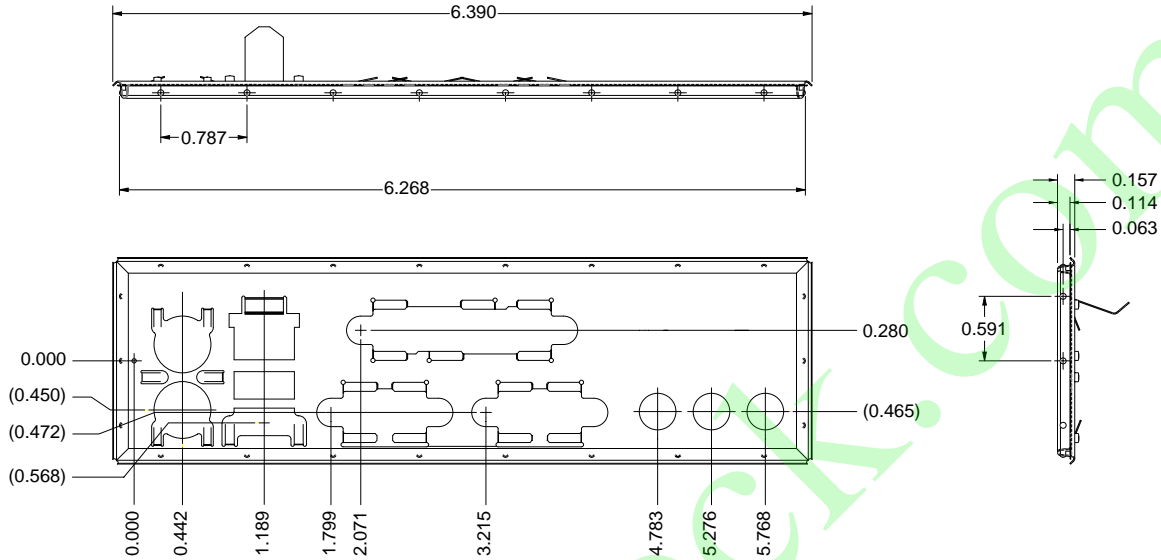
- Product Name, RadiSys part number and RadiSys branding.
- Location for serial number label
- Selected component reference designators

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.



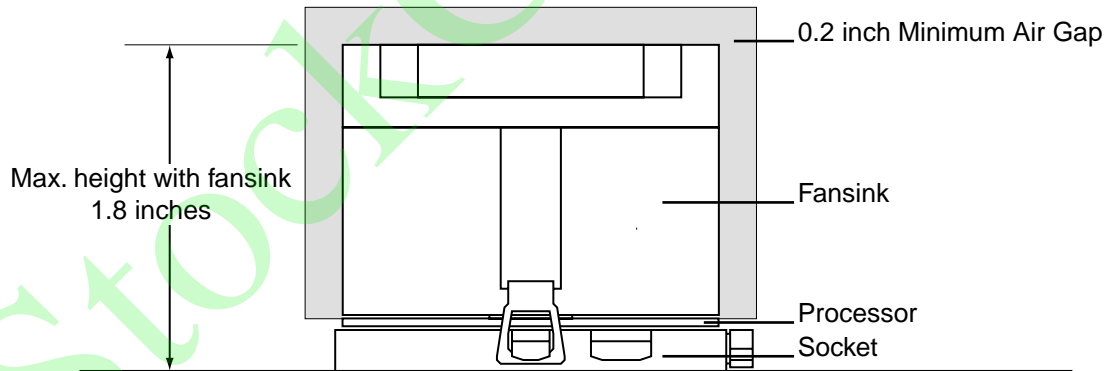
3.7.2 I/O Shield

An I/O shield is available for the SC815E when used in a standard ATX, microATX or FlexATX 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.



3.7.3 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.



3.8 Electrical

3.8.1 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 | +5Vsby |
| 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.

3.8.2 Power Supply Selection

The SC815E motherboard is designed to operate in conjunction with an ATX compatible power supply, as defined in section 4.2 of the ATX 2.03 specification. The provision of a 5V standby power rail is optional but, if not provided, the soft-switched power supply control features of the motherboard cannot be used. Where the standby rail is provided, ensure it is capable of providing sufficient current for the motherboard, particularly when the optional motherboard LAN controller is fitted or a PCI adapter card that draws current from the auxiliary 3.3V supply is used.

The tolerances on the voltage rails are described in the ATX specification 2.03 section 4.2.3 and reproduced below. The -5.0V rail is not used by the SC815E motherboard.

| Voltage Rail | Tolerance |
|------------------|-----------|
| +5.0V DC | ± 5% |
| +12.0V DC | ± 5% |
| -12.0V DC | ± 10% |
| +3.3V DC | ± 4% |
| +5.0V DC standby | ± 5% |



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.



The power supply must be properly approved by a third party agency for use in IEC/EN/UL/CSA 1950/60950 applications.

3.8.3 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 | Disable unused PCI clocks |
| 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-supply/platform/ac97 |
| ACPI | Advanced Configuration and Power Interface specification | www.acpi.info |
| AGP | Advanced Graphics Port Interface Specification | www.agpforum.org |
| APM | Advanced Power Management specification | www.microsoft.com/hwdev/archive/BUSBIOS/amp_12.asp |
| 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, microATX, FlexATX | Form factor specifications | www.formfactors.org |
| 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.smbus.org |
| 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 PCI interrupts PIRQA – PIRQD 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 motherboard PCI interrupts (PIRQE and PIRQH) that are not routed to the slots. Interrupts PIRQF and PIRQG are not used and not available to the slots.

| Device | PIRQA | PIRQB | PIRQC | PIRQD | PIRQE | PIRQH |
|-----------------------|-------|-------|-------|-------|-------|-------|
| 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 | - | - |
| 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 PIRQB.

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 (Includes DMA, timers, PIC, APIC, RTC, power & system management, GPIO) | - | 0 | 31 | 0 |
| 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 | - |
| 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. SMBus Resource Allocation

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

A.5. ISA Interrupt Allocation

Whilst the motherboard does not include an ISA bus, it includes an ISA-compatible interrupt controller (PIC) in order to be compatible with AT standard architecture. The 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 |

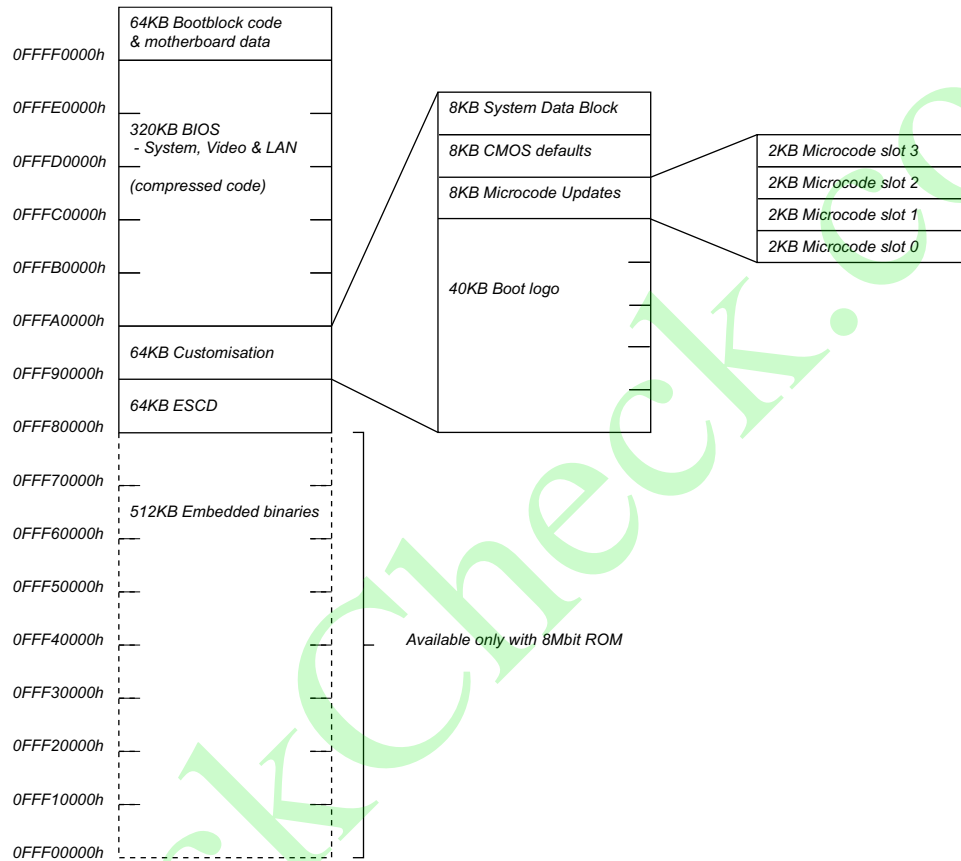
A.6. ISA DMA Channel Allocation

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.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 | Dual vertically stacked USB for 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 (Not SC815E-FPLAG SKU) | Foxconn E6220S0-P3 | 20-pin Flex SMT header |
| Flat panel monitor header (SC815E-FPLAG SKU only) | Hirose FH12A-20S-0.5SH | 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 5-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 HL07171-P4 | 34-pin shrouded header |
| Keyboard and mouse headers | Foxconn HF55040 | 4-pin 2mm headers |
| USB channel 2 header | Foxconn HF01051 | 5-pin ATAPI-style |
| AGP connector | Foxconn EE06649 | Universal AGP |
| PCI connector | Foxconn EH06001-GU-V | 5V signaling |
| External ISA bridge support | Foxconn HF55040 | 4-pin 2mm header |
| External audio CODEC | Foxconn HF55070 | 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

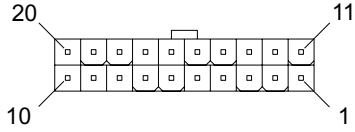
| Pin | Signal | Pin | Signal | Pin | Signal | Pin | Signal |
|-----|----------------------|-----|------------------|-----|----------|-----|---------|
| A1 | TRST# ⁵ | B1 | -12V | A32 | AD16 | B32 | AD17 |
| A2 | +12V | B2 | TCK ⁵ | A33 | +3.3V | B33 | C/BE2# |
| A3 | TMS ⁶ | B3 | GND | A34 | FRAME# | B34 | GND |
| A4 | TDI ⁶ | B4 | TDO ⁷ | 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 | CLKRUN# ⁷ | B9 | PRSNT1# | A40 | Not Used | B40 | PERR# |
| A10 | +5V | B10 | RESERVED | A41 | Not Used | 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 |

⁵ Not used but pulled low

⁶ Not used but pulled high to +5V

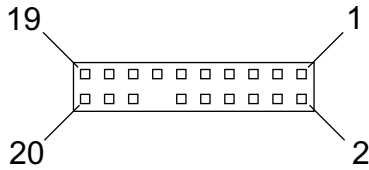
⁷ Not connected

B.4. ATX Power Supply



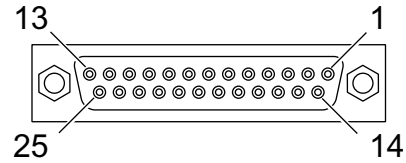
| Pin | Signal | Pin | Signal |
|-----|----------|-----|----------|
| 11 | +3.3V | 1 | +3.3V |
| 12 | -12.0V | 2 | +3.3V |
| 13 | GND | 3 | GND |
| 14 | PS_ON# | 4 | +5.0V |
| 15 | GND | 5 | GND |
| 16 | GND | 6 | +5.0V |
| 17 | GND | 7 | GND |
| 18 | Not Used | 8 | PWR_OK |
| 19 | +5.0V | 9 | +5.0VSBY |
| 20 | +5.0V | 10 | +12.0V |

B.5. Front Panel Header



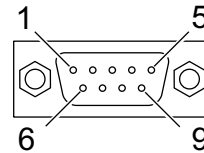
| Pin | Signal | Pin | Signal |
|-----|----------|-----|-----------|
| 1 | HDLED+ | 2 | GREENLED+ |
| 3 | HDLED- | 4 | GREENLED- |
| 5 | RESETSW- | 6 | PWRSW+ |
| 7 | RESETSW+ | 8 | PWRSW- |
| 9 | IR +5V | 10 | SPKR+ |
| 11 | IRRXDAT | 12 | SPKR- |
| 13 | IR GND | 14 | KEY |
| 15 | IRTXDAT | 16 | SPKR- |
| 17 | Not Used | 18 | TMPSW+ |
| 19 | Not Used | 20 | TMPSW- |

B.6. Parallel Port



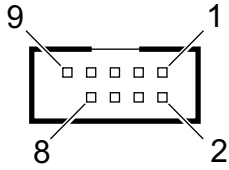
| Pin | Signal | Pin | Signal |
|-----|--------|-----|--------|
| 1 | STB# | 14 | AFD# |
| 2 | DB0 | 15 | ERR# |
| 3 | DB1 | 16 | INIT# |
| 4 | DB2 | 17 | SLIN# |
| 5 | DB3 | 18 | GND |
| 6 | DB4 | 19 | GND |
| 7 | DB5 | 20 | GND |
| 8 | DB6 | 21 | GND |
| 9 | DB7 | 22 | GND |
| 10 | ACK# | 23 | GND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

B.7. Serial Port 1



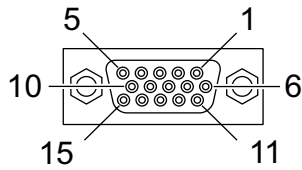
| Pin | Signal | Pin | Signal |
|-----|--------|-----|--------|
| 1 | DCD | 6 | DSR |
| 2 | RxD | 7 | RTS |
| 3 | TxD | 8 | CTS |
| 4 | DTR | 9 | RING |
| 5 | GND | | |

B.8. Serial Port 2



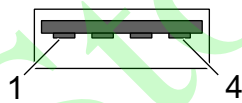
| Pin | Signal | Pin | Signal |
|-----|--------|-----|--------|
| 1 | DCD | 2 | DSR |
| 3 | RxD | 4 | RTS |
| 5 | TxD | 6 | CTS |
| 7 | DTR | 8 | RING |
| 9 | GND | 10 | KEY |

B.9. VGA Monitor



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

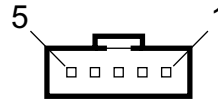
B.10. Rear I/O USB Ports



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

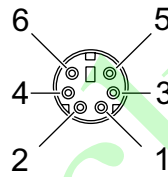
⁸ Pulled high to +5V

B.11. USB Channel 2 Header



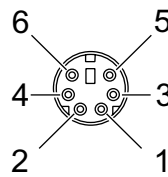
| Pin | Signal |
|-----|--------|
| 1 | +5V |
| 2 | DATA- |
| 3 | DATA+ |
| 4 | SGND |
| 5 | FGND |

B.12. PS/2 Keyboard



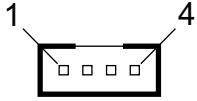
| Pin | Signal | Pin | Signal |
|-----|----------|-----|----------|
| 1 | DATA | 4 | +5V |
| 2 | Not Used | 5 | CLOCK |
| 3 | GND | 6 | Not Used |

B.13. PS/2 Mouse



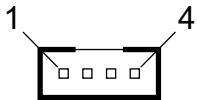
| Pin | Signal | Pin | Signal |
|-----|----------|-----|----------|
| 1 | DATA | 4 | +5V |
| 2 | Not Used | 5 | CLOCK |
| 3 | GND | 6 | Not Used |

B.14. Keyboard Header



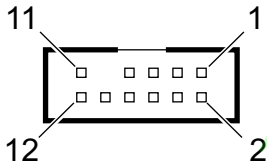
| Pin | Signal |
|-----|--------|
| 1 | +5V |
| 2 | DATA |
| 3 | GND |
| 4 | CLOCK |

B.15. Mouse Header



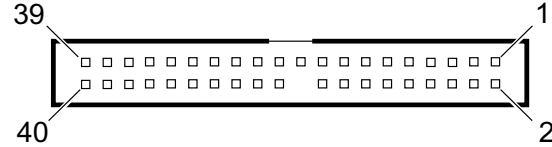
| Pin | Signal |
|-----|--------|
| 1 | +5V |
| 2 | DATA |
| 3 | GND |
| 4 | CLOCK |

B.16. General Purpose I/O



| Pin | Signal | Pin | Signal |
|-----|--------|-----|--------|
| 1 | GPIO20 | 2 | GPIO21 |
| 3 | GPIO22 | 4 | GPIO23 |
| 5 | GPIO24 | 6 | GPIO25 |
| 7 | GPIO26 | 8 | GPIO27 |
| 9 | KEY | 10 | GND |
| 11 | +5V | 12 | +3.3V |

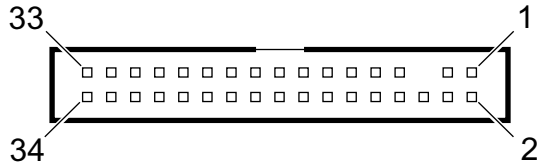
B.17. IDE Drive Headers



| 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 | IRQ ⁹ | 32 | Not Used |
| 33 | DA1 | 34 | CBLID# |
| 35 | DA0 | 36 | DA2 |
| 37 | CS1# | 38 | CS3# |
| 39 | HDACT# | 40 | GND |

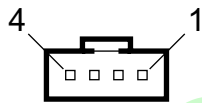
⁹ IRQ14 for Primary, IRQ15 for Secondary

B.18. Diskette Drive Header



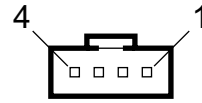
| Pin | Signal | Pin | Signal |
|-----|--------|-----|----------|
| 1 | GND | 2 | DENSEL |
| 3 | GND | 4 | Not Used |
| 5 | KEY | 6 | DRATE0 |
| 7 | GND | 8 | INDEX# |
| 9 | GND | 10 | MTR0# |
| 11 | GND | 12 | DS1# |
| 13 | GND | 14 | DS0# |
| 15 | GND | 16 | MTR1# |
| 17 | GND | 18 | DIR# |
| 19 | 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.19. ATAPI CD-ROM



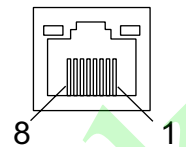
| Pin | Signal |
|-----|--------|
| 1 | LEFT |
| 2 | GND |
| 3 | GND |
| 4 | RIGHT |

B.20. ATAPI Telephony



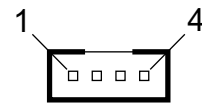
| Pin | Signal |
|-----|------------------|
| 1 | PHONE IN |
| 2 | GND |
| 3 | GND |
| 4 | MONO LINE OUTPUT |

B.21. RJ45 Ethernet



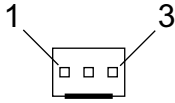
| Pin | Signal |
|-----|------------|
| 1 | TxD+ |
| 2 | TxD- |
| 3 | RxD+ |
| 4 | 75Ω to GND |
| 5 | 75Ω to GND |
| 6 | RxD- |
| 7 | 75Ω to GND |
| 8 | 75Ω to GND |

B.22. ISA Bridge Support



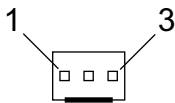
| Pin | Signal |
|-----|--------|
| 1 | NOGO |
| 2 | REQ# |
| 3 | GNT# |
| 4 | SERIRQ |

B.23. Processor Fan



| Pin | Signal |
|-----|--------|
| 1 | GND |
| 2 | POWER |
| 3 | TACH# |

B.24. System Fan



| Pin | Signal |
|-----|--------|
| 1 | GND |
| 2 | POWER |
| 3 | TACH# |

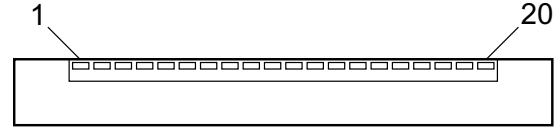
B.25. LINE In and Out Jacks

| Pin | Signal |
|--------|-------------|
| TIP | LEFT AUDIO |
| RING | RIGHT AUDIO |
| SLEEVE | GND |

B.26. MIC Jack

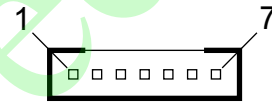
| Pin | Signal |
|--------|----------------|
| TIP | MIC MONO INPUT |
| RING | BIAS VOLTAGE |
| SLEEVE | GND |

B.27. 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 |

B.28. External Audio CODEC



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