NX440LX Motherboard
Technical Product Specification

Jul, 21,1997

Order Number 674633-00C

The NX440LX motherboard may contain design defects or errors known as errata which may cause the product to deviate from published specifications. Current characterized errata are documented in the NX440LX Motherboard Specification Update.

Revision History

Revision	Revision History	Date
-00C	Added information about IR, tamper detection, and onboard video. Updated illustrations.	7/11/97
-00B	First draft submitted for full review. Introductory and BIOS sections checked. Environmental issues to be resolved.	7/02/97
-00A	First review draft of the NX440LX Technical Product Specification.	6/20/97

This product specification applies only to standard NX440LX motherboards with BIOS identifier 4N4XL0X0.86A.

Changes to this specification will be published in the NX440LX Motherboard Specification Update before being incorporated into a revision of this document.

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Figures

Tables

1 Motherboard Description

1.1 Overview

The NX440LX motherboard is a versatile platform that offers a wide variety of features. Many of the options, however, are implemented – at least in part – on the riser. Throughout this manual, the ‡ symbol is used to indicate such an option. Because there is no standard riser, no detailed description of an implementation can be given.

The NX440LX motherboard supports Pentium® II family of microprocessors operating at 233, 266, and 300 MHz. The motherboard features:

- NLX v1.2 form factor
- Minimal jumper design

Main Memory

- Three 168-pin DIMM sockets
- Support for up to 384 MB of synchronous DRAM (SDRAM) memory
- Support for 66 MHz SDRAM
- Support for ECC and non-ECC memory

Chipset and PCI/IDE Interface

- Intel 82440LX AGPset PCI/A.G.P Controller (PAC)
- Integrated PCI bus mastering controller using PIIX4
- Dual channel EIDE interface
- Real-time clock

I/O Features

- SMC FDC37C677 I/O controller
- Floppy drive interface‡
- Integrates standard I/O functions: one multi-mode parallel port, two FIFO serial ports, and keyboard and mouse controller
- Support for one Universal Serial Bus (USB) interface on the motherboard and another on the riser‡
- Support for consumer infrared‡

Audio Subsystem

- Yamaha OPL3-SA3 codec audio component
- Wavetable upgrade header

Graphics Subsystem

- Optional Cirrus Logic CL-GD5465 A.G.P. graphics accelerator with 2 MB of RAMBUS† (RDRAM) video memory expandable to 4 MB using a 2 MB video upgrade module
- A.G.P. connector

Local Area Network (LAN) Subsystem

- 10/100 Mbit/sec LAN hardware
- Remote wakeup controller

Other features

- Plug and Play compatible
- Support for Advanced Power Management
- ACPI ready
- PC97 compliant

Software drivers and utilities are available from Intel.

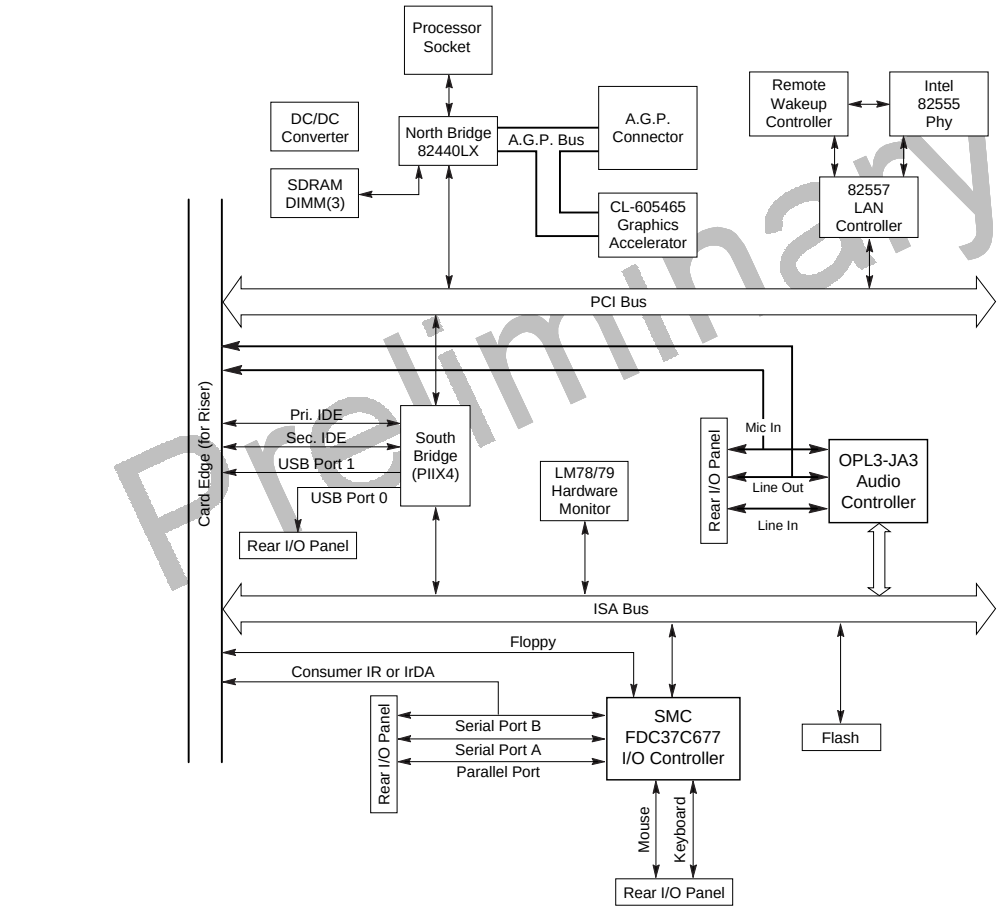

Figure 1. Motherboard Block Diagram

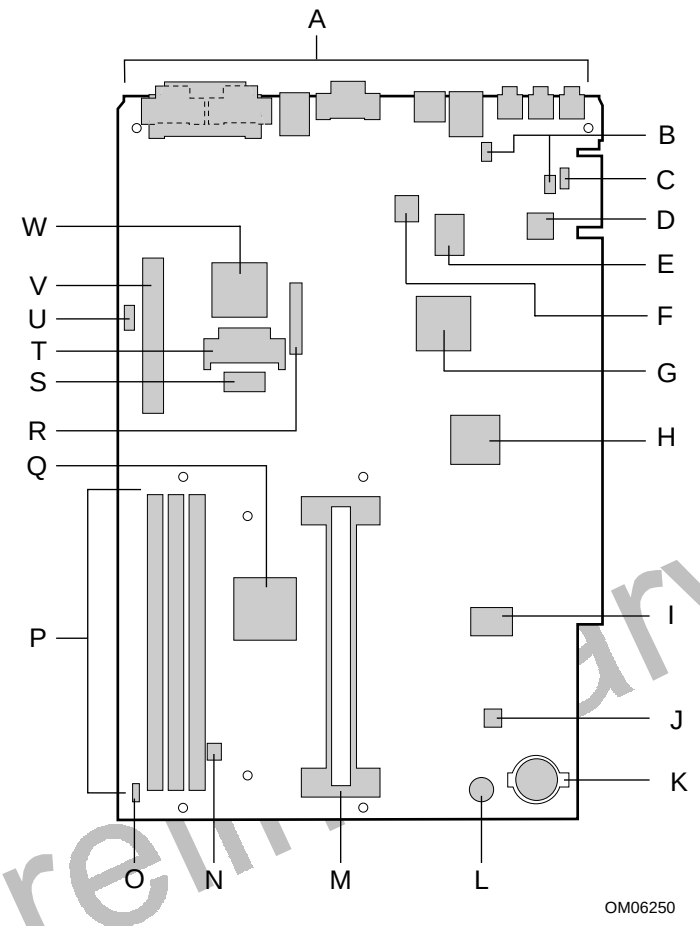

Figure 2. Motherboard Components

A	Back Panel Connectors	M	Slot 1 Connector
B	Yamaha Wavetable Headers	N	Fan Connector
C	CD-ROM Header	O	Configuration Jumper
D	Yamaha OPL3-SA3 (YMF715)	P	DIMM Sockets
E	Intel 82555 PHY	Q	Intel 82443LX AGPset
F	Remote wakeup controller	R	VESA Header (Optional)
G	Intl 82557 LAN Controller	S	RAMBUS Video Memory
H	Intel 82371AB PIIX4 PCIset	T	RAMBUS Memory Upgrade Socket
I	SMC FDC37C677	U	Onboard Video Configuration Jumper
J	LM78/79	V	A.G.P. Connector
K	Battery	W	Optional CL-605465 Graphics Accelerator
L	Piezo Speaker		

1.2 Form Factor

The motherboard is designed to fit into a standard NLX form factor chassis. Figure 3 illustrates the mechanical form factor for the motherboard. Location of the I/O connectors, riser slot, and mounting holes are in strict compliance with the NLX specification (see Section 6.2).

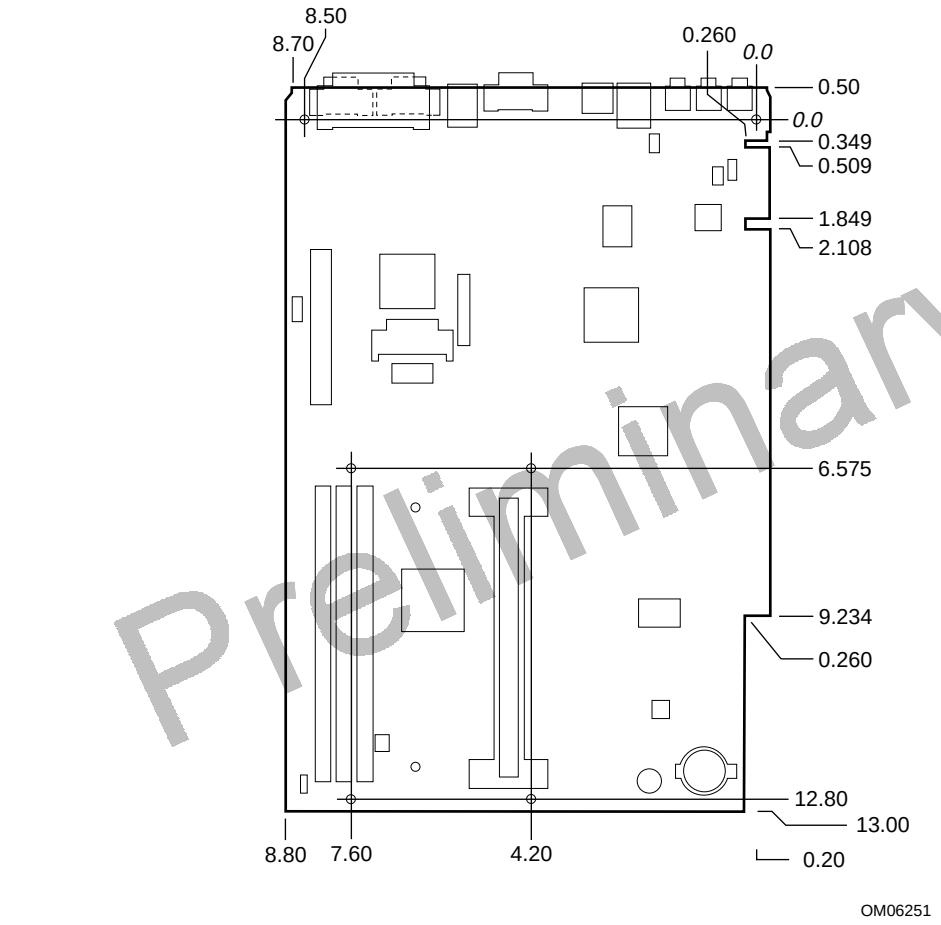

Figure 3. Motherboard Dimensions

1.3 I/O Shield

The back panel I/O shield for the NX440LX motherboard must meet specific dimensional and material requirements. Systems based on this motherboard need the back panel I/O shield in order to pass emission certification testing. Figure 4 shows the critical dimensions for both options of the I/O shield, and indicates the position of each cutout.

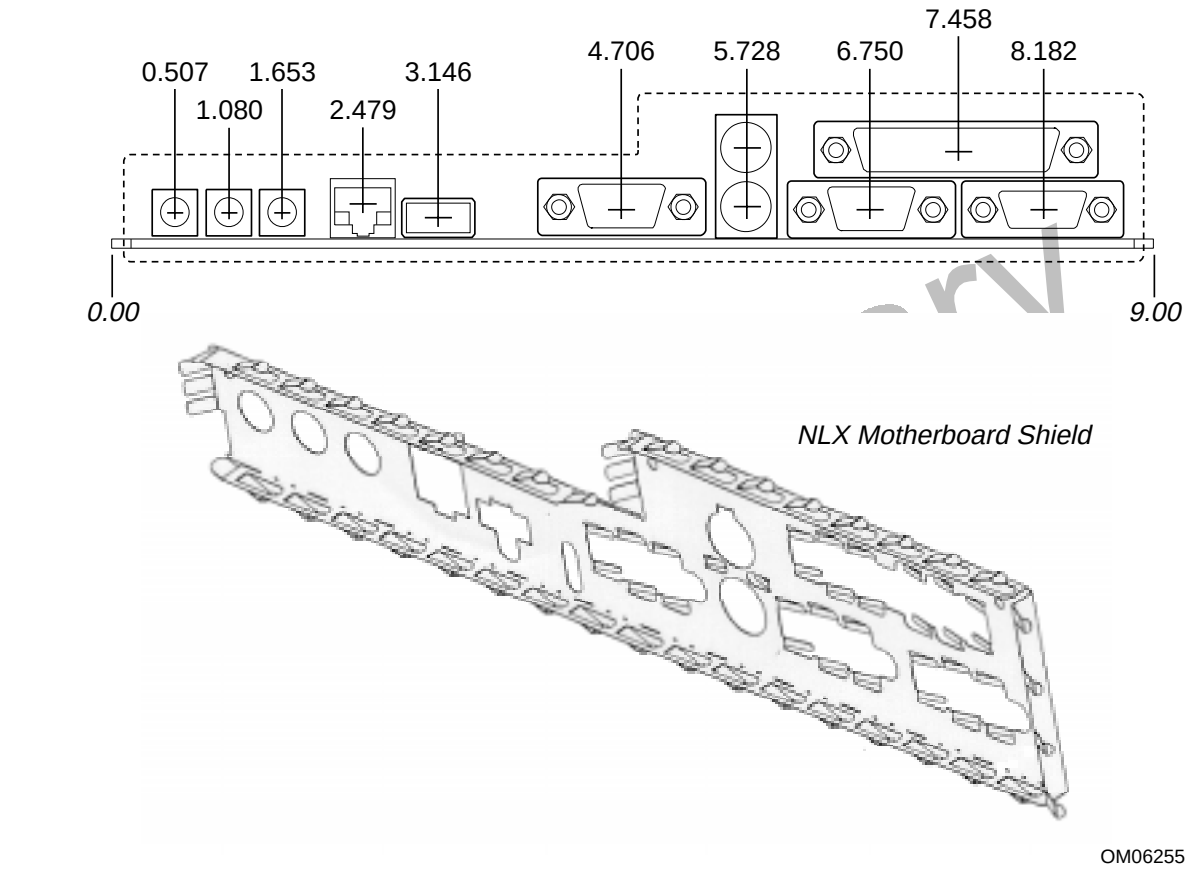

Figure 4. Back Panel I/O Shield Dimensions

1.4 Microprocessor

The motherboard supports a single Pentium II processor. The processor's VID pins automatically program the motherboard's voltage regulator to the required processor voltage. The motherboard operates with processors that run internally at 233, 266, or 300 MHz and have either a 256 KB or 512 KB second-level cache.

The processor implements the MMX™ technology and maintains full backward compatibility with the 8086, 80286, Intel386™, Intel486™, and Pentium processor. The processor's numeric coprocessor significantly increases the speed of floating-point operations and complies with ANSI/IEEE standard 754-1985.

1.4.1 Microprocessor Packaging

The processor is packaged in a Single Edge Contact (S.E.C.) cartridge. The S.E.C. cartridge includes the processor core, the second-level cache, a thermal plate, and a back cover.

The processor connects to the motherboard through the Slot 1 processor connector, a 242-pin edge connector. When the processor is mounted in Slot 1, it is secured by a retention mechanism attached to the motherboard. The processor's heatsink is stabilized by a heatsink support that is attached to the motherboard.

1.4.2 Second Level Cache

The second-level cache is located on the substrate of the S.E.C. cartridge. The cache includes burst pipelined synchronous static RAM (PBSRAM) and tag RAM. There can be two or four BSRAM components totaling 256 KB or 512 KB in size. All supported onboard memory can be cached.

1.4.3 Microprocessor Upgrades

The motherboard can be upgraded with Pentium II processors that run at higher processor speeds. After upgrading the processor, use the BIOS configuration mode to set the proper speed for the processor. See Section 1.14.2 for information about configuration mode.

1.5 Memory

1.5.1 Main Memory

The motherboard has three dual inline memory module (DIMM) sockets. Minimum memory size is 16 MB; maximum memory size is 384 MB. The BIOS automatically detects memory type, size, and speed.

The motherboard supports the following memory features:

- 168-pin DIMMs with gold-plated contacts
- 66 MHz SDRAM only
- Non-ECC (64-bit) and ECC (72-bit) memory
- 3.3 V memory only
- Single- or double-sided DIMMs in the following sizes:

DIMM Size	Non-ECC Configuration	ECC Configuration
16 MB	2 Mbit x 64	2 Mbit x 72
32 MB	4 Mbit x 64	4 Mbit x 72
64 MB	8 Mbit x 64	8 Mbit x 72
128 MB	16 Mbit x 64	16 Mbit x 72

Memory can be installed in one, two, or three sockets. Memory size and speed can vary between sockets.

1.5.2 SDRAM

Synchronous DRAM (SDRAM) improves memory performance through memory access that is synchronous with the memory clock. This simplifies the timing design and increases memory speed because all timing is dependent on the number of memory clock cycles.

NOTE

To function properly, SDRAM DIMMs must meet the Intel 4-clock, 66 MHz, unbuffered SDRAM specification for either 64-bit or 72-bit SDRAM. See Section 6.2 for information about these specifications.

1.5.3 ECC Memory

Error checking and correcting (ECC) memory detects multiple-bit errors and corrects single-bit errors. When ECC memory is installed, the BIOS supports both ECC and non-ECC mode. ECC mode is enabled in the Setup program. The BIOS automatically detects if ECC memory is installed and provides the Setup option for selecting ECC mode. If non-ECC memory is installed, the Setup option for ECC mode does not appear.

The following table describes the effect of using Setup to put each memory type in each supported mode. Whenever ECC mode is selected in Setup, some performance loss occurs.

	Memory Error Detection Mode Established in Setup Program	
	ECC Disabled	**ECC Enabled**
Non-ECC DIMM	No error detection	N/A
ECC DIMM	No error detection	Single-bit error correction, multiple-bit error detection

1.6 Chipset

The Intel 440LX chipset is the third generation of desktop PCIset and is designed for the Pentium II processor. It consists of the Intel 82443LX PCI/A.G.P. controller (PAC) and the Intel 82371AB PCI/ISA IDE Xcelerator (PIIX4) bridge chip.

1.6.1 Intel 82443LX PCI/A.G.P. Controller

The PAC provides bus-control signals, address paths, and data paths for transfers between the processor's host bus, PCI bus, Accelerated Graphics Port (A.G.P.), and main memory. The PAC comes in a 492-pin BGA package and features:

- Processor interface control
  - — Processor host bus speed up to 66 MHz
  - — 32-bit addressing
  - — GTL+ compliant host bus
- Integrated DRAM controller
  - — Supports synchronous DRAM (SDRAM)
  - — 64/72-bit path-to-memory
  - — Auto detection of memory type
  - — Supports 4-, 16-, 64-Mbit DRAM devices
  - — Symmetrical and asymmetrical DRAM addressing
  - — Supports 3.3 V DRAMs
- Accelerated Graphics Port Interface
  - — Complies with A.G.P. specification (see Section 6.2 for specification information)
  - — Supports 3.3 V A.G.P. devices with data transfer rates up to 133 MHz
  - — Synchronous coupling to the host-bus frequency

- Fully-synchronous PCI bus interface
  - Complies with PCI specification (see Section 6.2 for specification information)
  - PCI-to-DRAM access greater than 100 MB/sec
  - Supports five‡ PCI bus masters in addition to the host and PCI-to-ISA I/O bridge
  - Delayed transactions
  - PCI parity checking and generation support
- Data Buffering
  - Host-to-DRAM, PCI-to-DRAM, and A.G.P.-to-DRAM write-data buffering
  - Write-combining for host-to-PCI burst writes
  - Supports concurrent host, PCI, and A.G.P. transactions to main memory
- Supports system management mode (SMM)

1.6.2 Intel 82371AB PCI ISA IDE Xcelerator (PIIX4)

The PIIX4 is a multifunction PCI device implementing the PCI-to-ISA bridge, PCI IDE functionality, Universal Serial Bus (USB) host/hub function, and enhanced power management. The PIIX4 comes in a 324-pin MBGA package that features:

- Multifunction PCI-to-ISA bridge
  - Supports the PCI bus at 33 MHz
  - Complies with PCI specification (see Section 6.2 for specification information)
  - Full ISA or extended I/O (EIO) bus support
- USB controller
  - Two‡ USB ports (see Section 6.2 for compliance level).
  - Supports legacy keyboard and mouse
  - Supports UHCI design guide revision 1.1 interface
- Integrated dual-channel enhanced IDE interface
  - Supports up to four IDE devices
  - PIO Mode 4 transfers at up to 14 MB/sec
  - Supports Ultra DMA/33 synchronous DMA mode transfers up to 33 MB/sec
  - Bus master mode with an 8 x 32-bit buffer for bus master PCI IDE burst transfers
- Enhanced DMA controller
  - Two 8237-based DMA controllers
  - Supports PCI DMA with three PC/PCI channels and distributed DMA protocols
  - Fast type-F DMA for reduced PCI bus usage
- Interrupt controller based on 82C59
  - Supports 15 interrupts
  - Programmable for edge/level sensitivity
  - Supports serial IRQs
- Power management logic
  - Sleep/resume logic
  - Supports wake-on-modem through Ring Indicate input
  - Supports remote wakeup

- Real-Time Clock
  - 256 byte battery-backed CMOS SRAM
  - Includes date alarm
- 16-bit counters/timers based on 82C54

1.6.3 Accelerated Graphics Port (A.G.P.)

The Accelerated Graphics Port (A.G.P.) is a high-performance interconnect for graphic-intensive applications, such as 3D applications. A.G.P. is independent of the PCI bus and is intended for exclusive use with graphical-display devices. A.G.P. provides these performance features:

- Pipelined-memory read and write operations that hide memory access latency
- Demultiplexing of address and data on the bus for near 100 percent bus efficiency
- AC timing for 133 MHz data transfer rates, allowing data throughput of 500 MB/sec

A.G.P. complies with the 66 MHz PCI specification. See Section 6.2 for information about the A.G.P. and PCI specifications.

1.6.3.1 CL-GD5465 High-performance Graphics Accelerator

The CL-GD5465 supports the A.G.P. (accelerated graphics port) for higher bandwidth between the system memory and the graphics subsystem. It is a member of the Laguna family of RAMBUS-based graphics accelerators, offering 3D-graphics capability while maintaining a high level of 2D performance. The features include:

- 64-bit graphics engine with integrated 3D game acceleration
- High-performance 64-bit GUI accelerator
- Video playback acceleration
- Integrated VGA† controller
- Integrated 230-MHz palette DAC and clock synthesizer
- Optional VESA header

1.6.4 Universal Serial Bus (USB)

The motherboard can support two‡ USB ports; however, it is shipped with only one connector. The second is supported through the NLX riser. If you need to connect more than one USB device, you can connect an external hub to the USB port. The motherboard fully supports the universal host controller interface (UHCI) and uses UHCI-compatible software drivers. See Section 6.2 for information about the USB specification. USB features include:

- Self-identifying peripherals that can be plugged in while the computer is running
- Automatic mapping of function to driver and configuration
- Supports isochronous and asynchronous transfer types over the same set of wires
- Supports up to 127 physical devices
- Guaranteed bandwidth and low latencies appropriate for telephony, audio, and other applications
- Error-handling and fault-recovery mechanisms built into the protocol

NOTE

Computer systems that have an unshielded cable attached to a USB port may not meet FCC Class B requirements, even if no device or a low-speed (sub-channel) USB device is attached to the cable. Use shielded cable that meets the requirements for high-speed (fully-rated) devices.

1.6.5 IDE Support

The motherboard has two independent bus-mastering capable PCI IDE interfaces. These interfaces support PIO Mode 3, PIO Mode 4, ATAPI devices (e.g., CD-ROM), and Ultra DMA/33 synchronous-DMA mode transfers. The BIOS supports logical block addressing (LBA) and extended cylinder head sector (ECHS) translation modes. The BIOS automatically detects the IDE device transfer rate.

Programmed I/O operations usually require a substantial amount of processor bandwidth. However, in multitasking operating systems, the bandwidth freed by bus mastering IDE can be devoted to other tasks while disk transfers are occurring.

1.6.6 Real-Time Clock, CMOS SRAM, and Battery

The real-time clock is compatible with DS1287 and MC146818 components. The clock provides a time-of-day clock and a multicentury calendar with alarm features and century rollover. The real-time clock supports 256 bytes of battery-backed CMOS SRAM in two banks that are reserved for BIOS use.

The time, date, and CMOS values can be specified in the Setup program. The CMOS values can be returned to their defaults by using the Setup program.

An external coin-cell battery powers the real-time clock and CMOS memory. When the computer is not plugged into a wall socket, the battery has an estimated life of three years. When the computer is plugged in, the 3 V standby current from the power supply extends the life of the battery. The clock is accurate to ± 13 minutes/year at 25 ºC with 5 V applied.

1.7 I/O Interface Controller

- Enhanced Ultra I/O SMC FDC37C677
  - 5 Volt operation
  - ISA Plug-and-Play compatible register set
- Two serial ports or one serial port and one IR port‡
- One floppy controller
- FIFO support on both serial and floppy interfaces
- One parallel port with ECP and EPP support
- PS/2† style mouse and keyboard interfaces
- Supports BIOS setup for various configuration options

1.7.1 Serial Ports

The motherboard has two 9-pin D-Sub serial port connectors located on the back panel. The NS16C550-compatible UARTs support data transfers at speeds up to 460 Kbits/sec.

1.7.2 Parallel Port

The connector for the multimode bi-directional parallel port is a 25-pin D-Sub connector located on the back panel of the motherboard. In the Setup program, there are four options for parallel port operation:

- Compatible (standard mode)
- Bi-directional (PS/2 compatible)
- Bi-directional Enhanced Parallel Port (EPP). A driver from the peripheral manufacturer is required for operation. See Section 6.2 for EPP compatibility.
- Bi-directional high-speed Extended Capabilities Port (ECP)

1.7.3 Floppy Controller

The I/O controller is software compatible with the 82077 floppy drive controller. (The floppy connector is located on the riser card.) In the Setup program, the floppy interface can be configured for the following floppy drive capacities and sizes:

- 360 KB, 5.25-inch
- 1.2 MB, 5.25-inch
- 720 KB, 3.5-inch
- 1.2 MB, 3.5-inch (Mode 3 floppy support, driver required)
- 1.25/1.44 MB, 3.5-inch
- 2.88 MB, 3.5-inch
- 120 MB (LS120)

1.7.4 Keyboard and Mouse Interface

PS/2 keyboard and mouse connectors are located on the back panel of the motherboard. The +5 V lines to these connectors are protected with a PolySwitch† circuit that, like a self-healing fuse, reestablishes the connection after an over-current condition is removed. While this device eliminates the possibility of having to replace a fuse, power to the computer should be turned off before connecting or disconnecting a keyboard or mouse.

NOTE

You can plug the mouse and keyboard into either connector.

The keyboard controller contains code which provides the traditional keyboard and mouse control functions, and also supports Power On/Reset password protection. A Power On/Reset password can be specified in the Setup program.

The keyboard controller also supports the following hot-key sequences:

- <Ctrl><Alt><Del> Software reset. This key sequence resets the computer's software by jumping to the beginning of the BIOS code and running the Power On Self Test (POST).

1.7.5 Optional IR

There is no IR header on the motherboard; however, the edge connector does accommodate IR signals from the riser. If either IrDA† or ASK-IR is available, use the BIOS Peripheral Configuration Submenu to change the mode for Serial Port B from COM2 to infrared applications.

1.8 Audio Subsystem

1.8.1 OPL3-SA3 Audio System

The optional onboard audio subsystem features the Yamaha OPL3-SA3 (YMF715) device. The features of the device include:

- A 16-bit audio codec
- OPL3 FM synthesis
- An integrated 3D enhanced stereo controller including all required analog components
- Stereo analog-to-digital and digital-to-analog converters
- Analog mixing, anti-aliasing, and reconstruction filters
- Supports 16-bit address decoding
- Line In, line out, and microphone connectors
- ADPCM, A-law, or µlaw digital audio compression and decompression
- Full digital control of all mixer and volume control functions
- Plug and Play compatible
- Sound Blaster Pro† and Microsoft Windows Sound System compatible
- Support for amplified speakers

⟹ NOTE:

Using the front panel line in, line out, and microphone connectors disables the back panel connectors.

1.8.2 Audio Subsystem Resources

The following table shows the IRQ, DMA channel, and base I/O address options for the audio subsystem. Options are listed in order of preference specified by Yamaha. These options are automatically chosen by the Plug and Play interface, so there are no default settings. Onboard audio can be enabled or disabled in the Setup program.

Table 1. Audio Subsystem Resources

Resource	IRQ (Options)	DMA channel (Options)	I/O Address (Options)
Sound Blaster† (DMA playback, DMA shared with Windows Sound System capture)	10 7 5,7, 10,11	1 0,1,3	220-22Fh 240-24Fh 16 bytes on 16-byte boundary in the range of 220-280h
Windows Sound System (DMA playback)	5 11 5,7, 10,11	0 0,1,3	530-537h E80-E87h 8 bytes on 8-byte boundary in the range of 530-F48h
MPU-401 (IRQ shared with Sound Blaster)			330-331h 300-301h 2 bytes on 2-byte boundary in the range of 300-334h
MIDI / Game Port			201h 1 byte on 1-byte boundary in the range of 201-20Fh
AdLib†			388-38Dh 6 bytes on 8-byte boundary in the range of 388-3F8h

1.8.3 Audio Drivers and Utilities

Audio software and utilities are available from Intel's World Wide Web site (see Section 6.1). Audio driver support is provided for the Microsoft Windows† 3.1, Microsoft Windows 95, Microsoft Windows NT† (versions 3.51 and 4.0), and IBM OS/2† Warp† (versions 3.0 and 4.0) operating systems.

1.8.4 Audio Connectors

The audio connectors include the following connectors:

- Back panel connectors: Line In, Mic In, Line Out
- CD-ROM audio
- Hardware wavetable

1.8.4.1 CD-ROM Audio Connector

An optional 1 x 4-pin Creative Labs-type connector (J9N1) is available for connecting an internal CD-ROM drive to the audio mixer. The connector is designed for audio add-in cards and is compatible with most cables supplied with Creative Labs CD-ROM drives. Audio signals from the riser are supported on the edge connector.

1.8.4.2 Hardware Wavetable Headers

Two 2 x 3-pin headers (J9M1, J7N1) are available for a wavetable add-in module. An optional OPL4-ML reference design module that can be plugged into the motherboard may be licensed from Yamaha Corporation. Compatible wavetable module cards are available from several vendors.

1.9 Management Extension Hardware

The optional management extension hardware provides low-cost instrumentation capabilities on a National LM78/79 chip. The features include:

- Integrated temperature sensor
- Fan speed sensors
- Power supply voltage monitoring to detect levels above or below acceptable values
- Remote reset capabilities from a remote peer or server through LANDesk® Client Manager, Version 3.0 and service layers (when available)

See Section 6.2 for information about the management extension hardware specification.

1.9.1 Tamper Detection

If the riser is equipped with a tamper detection switch, the motherboard will emit a continuous beeping sound anytime the cover is opened and the A/C power cord is still connected. This warning is intended to remind the user that 5V standby power is still applied within the system. To avoid this warning, unplug the power cord before opening the cover. The act of removing the cover will still be recorded by circuitry on the motherboard, to be subsequently reported to any management suite software in use.

NOTE

Disconnecting the power cord can leave the system without an adequate electrical ground. Use proper procedures to prevent electrostatic discharge (ESD) which could damage your system.

1.10 Onboard Networking

The onboard networking subsystem is an Ethernet† LAN interface that provides both 10Base-T and 100Base-TX connectivity. Features include:

- 32-bit direct bus mastering on the PCI bus
- Shared memory structure in the host memory that copies data directly to/from host memory
- 10Base-T and 100Base-TX capability using a single RJ-45 connector
- IEEE 802.3 Auto-Negotiation for the fastest available connection
- Jumperless configuration; the LAN subsystem is completely software configurable
- Remote wake up controller

1.10.1 Intel 82557 LAN Controller

This device is the heart of the LAN subsystem. It provides the following functions:

- CSMA/CD protocol engine
- PCI compatibility
- DMA engine for movement of commands, status, and network data across the PCI bus
- Standard MII interface for access to IEEE 802.3-compliant physical layer devices

1.10.2 Intel 82555 PHY 10 / 100 Mbit/sec Physical Layer Interface

The physical layer interface provides the following:

- Integrated 10/100 Mbit/sec single chip solution
- Complete 10/100 Mbit/sec media independent interface compliance with MDI support
- Full duplex operation available in both 10 and 100 Mbit/sec modes
- 25 MHz clock for 10 and 100 Mbit/sec modes
- Single magnetics for 10 and 100 Mbit/sec operation
- IEEE 802.3u Auto-Negotiation support for 10Base-T, 10Base-T FDX, 100Base-TX FDX, 100Base-TX FDX-FC and 100Base-T4 configurations
- Parallel detection algorithm for legacy support of non-Auto-Negotiation enabled link partner
- Glueless interface to T4-PHY for combo T4/TX solution with single magnetics
- LED function mapping support via MDI interface
- Support for a LAN activity LED on an NLX riser‡

1.10.3 Remote Wakeup Controller

The Remote Wakeup ASIC performs the Wake on LAN† function of the motherboard via the onboard LAN interface. When the system is powered off, the Remote Wakeup ASIC and the 82555 PHY remain powered by a 5 V standby voltage. The ASIC monitors network traffic at the MII interface and when it detects a Magic Packet† it asserts a wakeup signal that powers up the system.

If an external network interface card (NIC) with remote wakeup capabilities is added to the system‡, the NIC's remote wakeup header must be connected to the header on an NLX riser.

1.10.4 LAN Software

The software for the LAN subsystem, including setup/diagnostic software (SETUP.EXE) and a readme file viewer (README.EXE) that lists supported drivers, is available on the web site.

1.11 Motherboard Connectors

The following figure show the connectors on the motherboard.

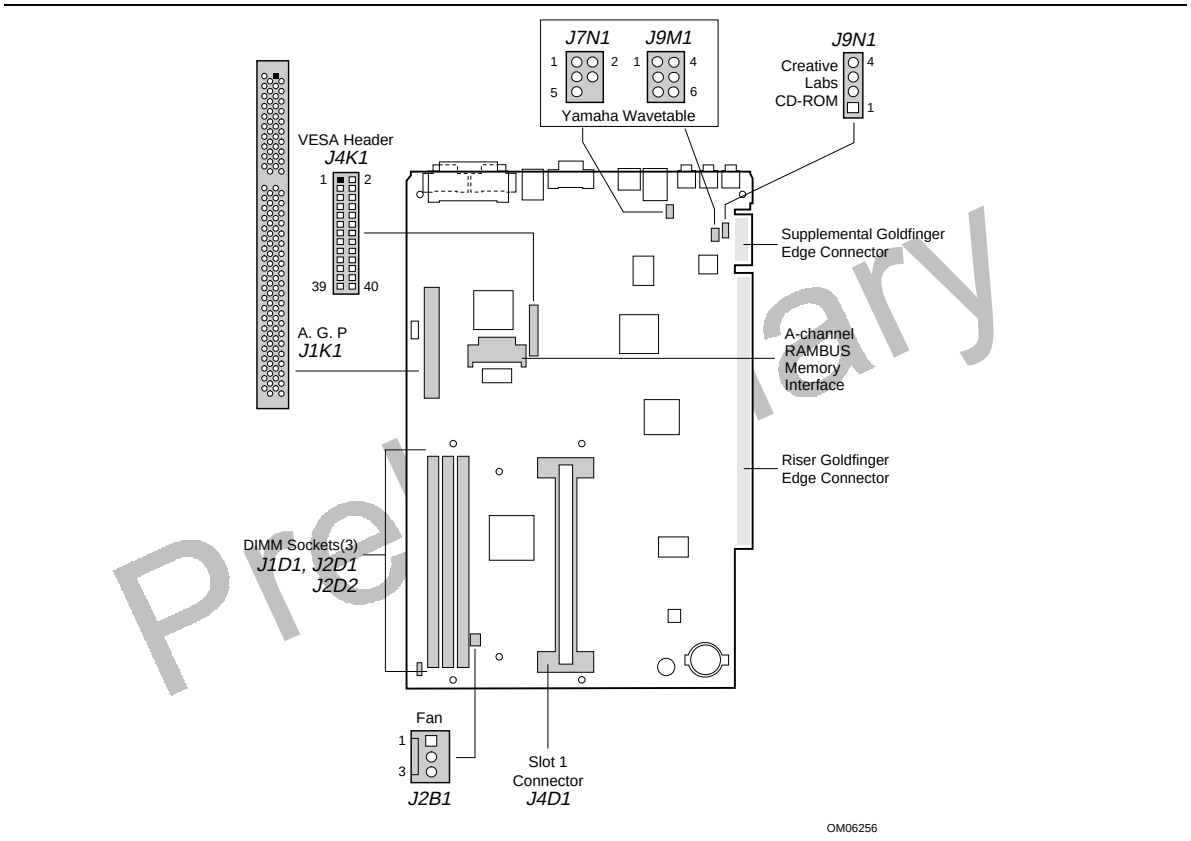

Figure 5. Motherboard Connectors

Table 2. CD Audio Connector (J9N1)

Pin	Signal Name
1	Ground
2	CD_IN-Left
3	Ground
4	CD_IN-Right

Table 3. Yamaha Wavetable Module Connectors (J9M1) and J7N1)

Connector (J9M1)

Pin	Signal Name	Pin	Signal Name
1	EXTEN#	4	Ground
2	SIN	5	BCK
3	Vcc	6	LACK

Connector (J7N1)

Pin	Signal Name	Pin	Signal Name
1	RSTSLOT	4	MIDI Out
2	Vcc	5	Ground
3	AUD33MHZ	6	Key

Note: There are two 2x3 headers that connect to the Yamaha wavetable daughter card

Table 4. Fan (J2B1)

Pin	Signal Name
1	GND
2	Fan Power
3	Tachometer

Table 5. (Optional) VESA Header Connector (J4K1)

Pin	Signal Name	Pin	Signal Name
1	Ground	2	VID[0]
3	Ground	4	VID[1]
5	Ground	6	VID[2]
7	EVIDEO#	8	VID[3]
9	ESYNC#	10	VID[4]
11	EDCLK#	12	VID[5]
13	SCL	14	VID[6]
15	Ground	16	VID[7]
17	Ground	18	CLK
19	Ground	20	BLANK#
21	Ground	22	HXYNC
23	N/C	24	VSYNC
25	SDA	26	Ground

1.12 Onboard Video Configuration

Use the configuration jumper at J1J1 to enable or disable the onboard video. Connecting pins 1 and 2 enables the onboard video, and jumpering pins 2 and 3 disables the onboard video. Disabling the onboard video allows you to use a video subsystem on the riser or an add-in AGP card on the motherboard.

NOTE

Due to the relative location of the third DIMM socket, only half-length AGP cards are supported.

1.13 Back Panel Connectors

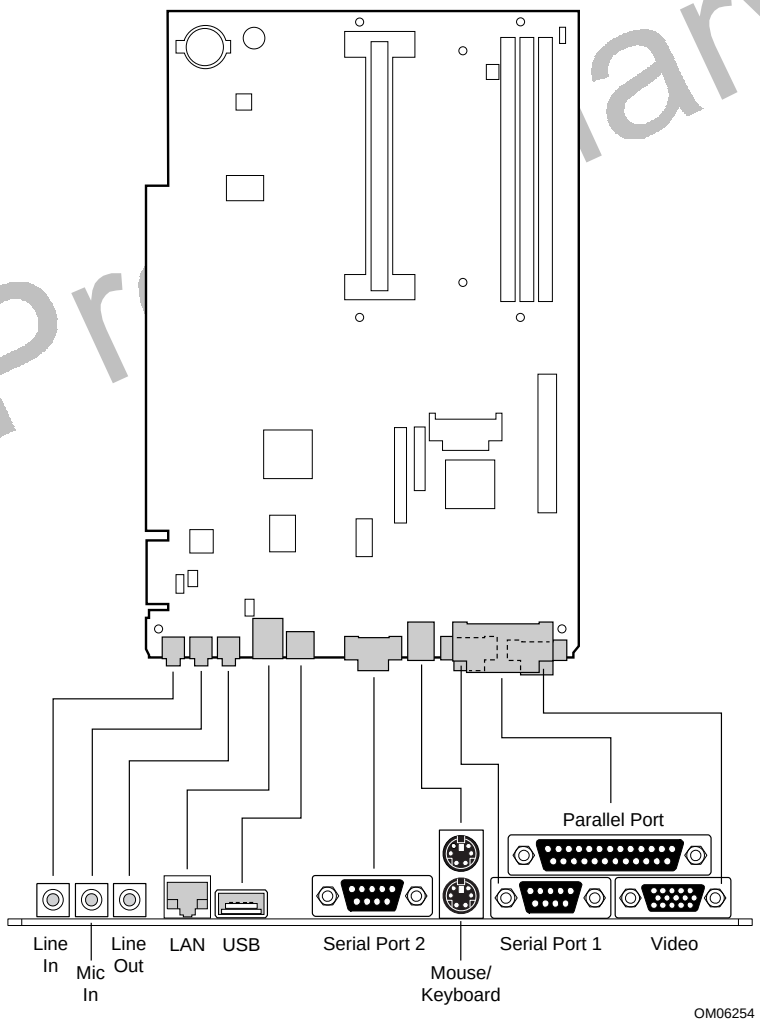

Figure 6. Back Panel I/O Connectors

1.14 Configuration Jumpers

The following figure shows the location of the configuration jumper block on the motherboard.

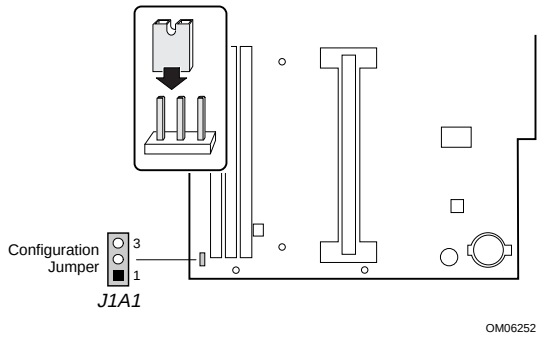

Figure 7. Single Configuration Jumper

Table 6. Configuration Jumper Table (J1A1)

Function	Jumper	Configuration
Normal	1-2	The BIOS uses current configuration information and passwords for booting.
Configure	2-3	After the POST runs, Setup is run automatically. The maintenance menu is displayed.
Recovery	none	The BIOS attempts to recover the BIOS configuration. A recovery diskette is required.

CAUTION

Do not move the jumper with the power on. Always turn off the power and unplug the power cord from the computer before changing the jumper.

1.14.1 Normal Mode

This mode is for normal computer booting and operations. To enable this mode, pins 1 and 2 must be connected on the configuration jumper (J1A1). The BIOS uses the current bus/processor frequency ratio, configuration information, and passwords to boot the computer. Access to the Setup program can be restricted using an administrative or user password.

1.14.2 Configuration Mode

This mode is for configuring special BIOS settings, including processor speed and special maintenance options. This mode is used when upgrading the BIOS, upgrading the processor, or clearing the passwords. To enable this mode, pins 2 and 3 must be connected on the configuration jumper (J1A1). In this mode, Setup automatically executes after the POST runs. No password is required, and this mode overrides any passwords that are set. The Maintenance menu is the first menu displayed. This menu provides options for setting the processor speed and clearing passwords. All other Setup screens are available. Configure mode uses the default BIOS settings for booting, not the current user or administrative settings. The default settings include using the lowest bus/processor frequency ratio the processor supports. User and administrative settings are preserved and used when the computer is rebooted.

For the configuration changes to take effect after exiting the Setup program, power down the computer, set the configuration jumper to normal mode (see Section 1.14.1), and boot the computer.

1.14.3 Recovery Mode

This mode is for upgrading the BIOS or recovering BIOS data. To enable this mode, no pins are connected on the configuration jumper (J1A1). After the computer is powered-on, the BIOS attempts to upgrade or recover the BIOS data from a floppy diskette in the floppy drive. If a diskette is not in the boot drive, the BIOS runs the POST, does not boot the operating system, and displays a message that the jumper is not properly installed. If the recovery fails with a diskette in the boot drive, a beep code indicates that the recovery failed.

For the configuration changes to take effect after a successful recovery, power down the computer, set the configuration jumper to normal mode (see Section 1.14.1), and boot the computer.

1.15 NLX Card Edge Connectors

The NLX riser connector on the motherboard consists of a 340 (2x170) position and a supplemental 26 (2x13) position gold finger contact. All edge connector pin definitions are defined in the NLX specification, version 1.2.

1.15.1 Requirements

According to the NLX specification, the riser must provide the following:

- PCI signals (the motherboard supports of to 4 PCI signals)
- ISA signals
- 2 IDE channels
- 1 floppy drive
- Serial bus
- Miscellaneous front panel signals
- Power Requirements:
  - Up to 100 W of 5V DC power
  - Up to 60 W of 3.3V DC power
  - Up to 1.5 A of isolated IEEE-1394 power

1.16 Reliability

The Mean Time Between Failures (MTBF) data is calculated from predicted data at 55 ºC.
Motherboard MTBF: **TBD** hours calculated

1.17 Environmental

Table 7. Motherboard Environmental Specifications

Parameter	Specification		
Temperature			
Non-Operating	-40 °C to +70 °C		
Operating	0 °C to +55 °C		
Shock			
Unpackaged	50 G trapezoidal waveform		
	Velocity change of 170 inches/second		
Packaged	Half sine 2 millisecond		
	Product Weight	**Free Fall (inches)**	**Velocity Change (inches/sec)**
	<20 lbs.	36	167
	21-40 lbs.	30	152
	41-80 lbs.	24	136
	81-100 lbs.	18	118
Vibration			
Unpackaged	5 Hz to 20 Hz : 0.01g² Hz sloping up to 0.02 g² Hz		
	20 Hz to 500 Hz : 0.02g² Hz (flat)		
Packaged	10 Hz to 40 Hz : 0.015g² Hz (flat)		
	40 Hz to 500 Hz : 0.015g² Hz sloping down to 0.00015 g² Hz		

1.18 Power Consumption

Tables 8 and 9 list voltage and current specifications for a computer that contains the motherboard, a **TBD** MHz Pentium II processor, **TBD** MB RAM, **TBD** KB cache, 3.5-inch floppy drive, **TBD** GB IDE hard drive, and a **TBD**X IDE CD-ROM. This information is provided only as a guide for calculating **approximate** power usage with additional resources added.

Values for the Windows 95 desktop mode are measured at **TBD** x **TBD** x **TBD** colors and **TBD** Hz refresh rate. AC watts are measured with a typical **TBD**W supply, nominal input voltage and frequency, with true RMS wattmeter at the line input.

Table 8. DC Voltage

DC Voltage	Acceptable Tolerance
+3.3 V	± 5%
+5 V	± 5%
+5 V SB (standby)	± 5%
-5 V	± 5%
+12 V	± 5%
-12 V	± 5%

Table 9. Power Usage

		DC (amps) at:				
Mode	**AC (watts)**	**+3.3 V**	**+5 V**	**-5 V**	**+12 V**	**-12 V**
DOS prompt, APM disabled	**TBD**	**TBD**	**TBD**	**TBD**	**TBD**	**TBD**
Windows 95 desktop, APM disabled	**TBD**	**TBD**	**TBD**	**TBD**	**TBD**	**TBD**
Windows 95 desktop, APM enabled, in System Management Mode (SMM)	**TBD**	**TBD**	**TBD**	**TBD**	**TBD**	**TBD**

1.18.1 Power Supply Considerations

For typical configurations, the motherboard is designed to operate with at least a **TBD** W NLX power supply (see Section 6.2 for the specification). Use a higher wattage supply for heavily loaded configurations. The power supply must meet the following requirements:

- Rise time for power supply: 2 ms to 20 ms
- Minimum delay for Reset to Power Good: 100 ms
- Minimum Powerdown warning: 1 ms
- 3.3 V output must reach its minimum regulation level within ± 20 ms of the 5V output reaching its minimum regulation level

1.19 Regulatory Compliance

This printed circuit assembly complies with the following safety and EMI regulations when correctly installed in a compatible host system.

1.19.1 Safety

1.19.1.1 UL 1950 - CSA 950-95, 3rd edition, Dated 07-28-95

The Standard for Safety of Information Technology Equipment including Electrical Business Equipment. (USA & Canada)

1.19.1.2 CSA C22.2 No. 950-93, 3rd Edition

The Standard for Safety of Information Technology Equipment including Electrical Business Equipment. (Canada)

1.19.1.3 EN 60 950, 2nd Edition, 1992 (with Amendments 1, 2 & 3)

The Standard for Safety of Information Technology Equipment including Electrical Business Equipment. (European Union)

1.19.1.4 IEC 950, 2nd edition, 1991 (with Amendments 1, 2 & 3)

The Standard for Safety of Information Technology Equipment including Electrical Business Equipment. (International)

1.19.1.5 EMKO-TSE (74-SEC) 207/94

Summary of Nordic deviations to EN 60 950. (Norway, Sweden, Denmark & Finland)

1.19.2 EMI

1.19.2.1 FCC Class B

Title 47 of the Code of Federal Regulations, Parts 2 & 15, Subpart B, pertaining to unintentional radiators. (USA)

1.19.2.2 CISPR 22, 2nd Edition, 1993

Limits and methods of measurement of Radio Interference Characteristics of Information Technology Equipment. (International)

1.19.2.3 EN 55 022, 1995

Limits and methods of measurement of Radio Interference Characteristics of Information Technology Equipment. (Europe)

1.19.2.4 EN 50 082-1 (1992)

Generic Immunity Standard; Currently compliance is determined via testing to IEC 801-2, -3, and -4. (Europe)

1.19.2.5 VCCI Class 2 (ITE)

Implementation Regulations for Voluntary Control of Radio Interference by Data Processing Equipment and Electronic Office Machines. (Japan)

1.19.2.6 ICES-003, Issue 2

Interference-Causing Equipment Standard, Digital Apparatus. (Canada)

1.19.3 Product Certification Markings

This printed circuit assembly has the following product certification markings:

- European CE Marking: Consists of a marking on the board and shipping container.
- UL Recognition Mark: Consists of the UL File No. E139761 on the component side of the board and the PB No. on the solder side of the board. Board material flammability is 94V-1 or -0.
- Canadian Compliance: Consists of small c followed by a stylized backward UR on component side of board.

2 Motherboard Resources

NOTE

For more detailed information about the resources used for onboard audio, see the Audio Subsystem section in Chapter 1.

2.1 Memory Map

Table 10. Memory Map

Address Range (decimal)	Address Range (hex)	Size	Description
1024 K - 393216 K	100000 - 18000000	383 MB	Extended memory
1008 K - 1024 K	FC000 - FFFFF	16 KB	Boot block
1000 K - 1008 K	FA000 - FBFFF	8 KB	ESCD (Plug and Play configuration and DMI)
996 K - 1000 K	F9000 - F9FFF	4 KB	Reserved for BIOS
992 K - 996 K	F8000 - F8FFF	4 KB	OEM Logo or Scan User Flash
928 K - 992 K	E8000 - F7FFF	64 KB	POST BIOS
896 K - 928 K	E0000 - E7FFF	32 KB	POST BIOS (Available as UMB)
800 K - 896 K	C8000 - DFFFF	96 KB	Available high DOS memory (open to ISA and PCI bus)
640 K - 800 K	A0000 - C7FFF	160 KB	Video memory and BIOS
639 K - 640 K	9FC00 - 9FFFF	1 KB	Extended BIOS data (movable by memory manager software)
512 K - 639 K	80000 - 9FBFF	127 KB	Extended conventional memory
0 K - 512 K	00000 - 7FFFF	512 KB	Conventional memory

2.2 DMA Channels

Table 11. DMA Channels

DMA Channel Number	Data Width	System Resource
0	8- or 16-bits	Audio
1	8- or 16-bits	Audio / Parallel Port
2	8- or 16-bits	Floppy Drive
3	8- or 16-bits	Parallel Port (for ECP or EPP) / Audio
4		Reserved - Cascade Channel
5	16-bits	Open
6	16-bits	Open
7	16-bits	Open

2.3 I/O Map

Table 12. I/O Map

Address (hex)	Size	Description
0000 - 000F	16 bytes	PIIX4- DMA 1
0020 - 0021	2 bytes	PIIX4 - interrupt controller 1
002E - 002F	2 bytes	I/O controller configuration registers
0040 - 0043	4 bytes	PIIX4 - Counter/Timer 1
0048 - 004B	4 bytes	PIIX4- Counter/Timer 2
0060	1 byte	Keyboard Controller Byte - Reset IRQ
0061	1 byte	PIIX4 - NMI, Speaker Control
0064	1 byte	Keyboard controller, CMD/STAT Byte
0070, bit 7	1 bit	PIIX4 - enable NMI
0070, bits 6:0	7 bits	PIIX4 - real time clock, address
0071	1 byte	PIIX4 - real time clock, data
0078	1 byte	Reserved - motherboard configuration
0079	1 byte	Reserved - motherboard configuration
0080 - 008F	16 bytes	PIIX4 - DMA page registers
00A0 - 00A1	2 bytes	PIIX4 - interrupt controller 2
00B2 - 00B3	2 bytes	APM control
00C0 - 00DE	31 bytes	PIIX4 - DMA 2
00F0	1 byte	Reset numeric error
0170 - 0177	8 bytes	Secondary IDE channel
01F0 - 01F7	8 bytes	Primary IDE channel
0200 - 0207	8 bytes	Audio / game port
0220 - 022F	16 bytes	Audio (Sound Blaster compatible)
0240 - 024F	16 bytes	Audio (Sound Blaster compatible)
0278 - 027F	8 bytes	LPT2
0290 - 0297	8 bytes	Management extension hardware
02E8 - 02EF	8 bytes	COM4/Video (8514A)
02F8 - 02FF	8 bytes	COM2
0300 - 0301	2 bytes	MPU-401 (MIDI)
0330 - 0331	2 bytes	MPU-401 (MIDI)
0332 - 0333	2 bytes	MPU-401 (MIDI)
0334 - 0335	2 bytes	MPU-401 (MIDI)
0376	1 byte	Secondary IDE channel command port
0377	1 byte	Floppy channel 2 command
0377, bit 7	1 bit	Floppy disk change, channel 2

continued ☛

Table 12 I/O Map (continued)

Address (hex)	Size	Description
0377, bits 6:0	7 bits	Secondary IDE channel status port
0378 - 037F	8 bytes	LPT1
0388- 038D	6 bytes	AdLib (FM synthesizer)
03B4 - 03B5	2 bytes	Video (VGA)
03BA	1 byte	Video (VGA)
03BC - 03BF	4 bytes	LPT3
03C0 - 03CA	11 bytes	Video (VGA)
03CC	1 byte	Video (VGA)
03CE - 03CF	2 bytes	Video (VGA)
03D4 - 03D5	2 bytes	Video (VGA)
03DA	1 byte	Video (VGA)
03E8 - 03EF	8 bytes	COM3
03F0 - 03F5	6 bytes	Floppy Channel 1
03F6	1 byte	Primary IDE channel command port
03F7 (Write)	1 byte	Floppy channel 1 command
03F7, bit 7	1 bit	Floppy disk change channel 1
03F7, bits 6:0	7 bits	Primary IDE channel status port
03F8 - 03FF	8 bytes	COM1
04D0 - 04D1	2 bytes	Edge/level triggered PIC
0530 - 0537	8 bytes	Windows Sound System
0604 - 060B	8 bytes	Windows Sound System
LPT*n* + 400h	8 bytes	ECP port, LPT*n* base address + 400h
0CF8 - 0CFB*	4 bytes	PCI configuration address register
0CF9**	1 byte	Turbo and reset control register
0CFC - 0CFF	4 bytes	PCI configuration data register
0E80 - 0E87	8 bytes	Windows Sound System
0F40- 0F47	8 bytes	Windows Sound System
0F86 - 0F87	2 bytes	Yamaha OPL3-SA3 configuration
FF00 - FF07	8 bytes	IDE bus master register
FFA0 - FFA7	8 bytes	Primary bus master IDE registers
FFA8 - FFAF	8 bytes	Secondary bus master IDE registers

* DWORD access only

** Byte access only

NOTE

See the Audio section(s) in Chapter 1 for specific I/O addresses that can be used by the audio components on your motherboard. This table does not list I/O addresses that may be used by add-in cards in the system.

2.4 PCI Configuration Space Map

Table 13. PCI Configuration Space Map

Bus Number (hex)	Device Number (hex)	Function Number (hex)	Description
00	00	00	Intel 82440LX (PAC)
00	01	00	Intel 82371AB (PIIX4) A.G.P. bus
00	07	00	Intel 82371AB (PIIX4) PCI/ISA bridge
00	07	01	Intel 82371AB (PIIX4) IDE bus master
00	07	02	Intel 82371AB (PIIX4) USB
00	07	03	Intel 82371AB (PIIX4) power management
00	0D	00	PCI expansion slot 1
00	0E	00	PCI expansion slot 2
00	0F	00	PCI expansion slot 3

2.5 Interrupts

Table 14. Interrupts

IRQ	System Resource
NMI	I/O Channel Check
0	Reserved, Interval Timer
1	Reserved, Keyboard Buffer Full
2	Reserved, Cascade Interrupt From Slave PIC
3	COM2*
4	COM1*
5	LPT2 (Plug and Play option) / Audio / User available
6	Floppy Drive
7	LPT1*
8	Real Time Clock
9	User available
10	User available
11	Windows Sound System* / User available
12	Onboard Mouse Port (if present, else user available)
13	Reserved, Math Coprocessor
14	Primary IDE (if present, else user available)
15	Secondary IDE (if present, else user available)

* Default, but can be changed to another IRQ

2.6 PCI Interrupt Routing Map

This section describes interrupt sharing and how the interrupt signals are connected between the PCI expansion slots and onboard PCI devices. The PCI specification specifies how interrupts can be shared between devices attached to the PCI bus. In most cases, the small amount of latency added by interrupt sharing does not affect the operation or throughput of the devices. In some special cases where maximum performance is needed from a device, a PCI device should not share an interrupt with other PCI devices. Use the following information to avoid sharing an interrupt with a PCI add-in card.

PCI devices are categorized as follows to specify their interrupt grouping:

- INTA: By default, all add-in cards that require only one interrupt are in this category. For almost all cards that require more than one interrupt, the first interrupt on the card is also classified as INTA.
- INTB: Generally, the second interrupt on add-in cards that require two or more interrupts is classified as INTB. (This is not an absolute requirement.)
- INTC and INTD: Generally, a third interrupt on add-in cards is classified as INTC and a fourth interrupt is classified as INTD.

The PIIX4 PCI-to-ISA bridge has four programmable interrupt request (PIRQ) input signals. Any PCI interrupt source (either onboard or from a PCI add-in card) connects to one of these PIRQ signals. Because there are only four signals, some PCI interrupt sources are mechanically tied together on the motherboard and therefore share the same interrupt. Table 15 lists the PIRQ signals and shows how the signals are connected to the PCI expansion slots and to onboard PCI interrupt sources.

Table 15. PCI Interrupt Routing Map

PIIX4 PIRQ Signal	First PCI Expansion Slot	Second PCI Expansion Slot	Third PCI Expansion Slot	Onboard Video	USB	Ethernet LAN Controller
PIRQA	INTA	INTD	INTC			
PIRQB	INTB	INTA	INTD			
PIRQC	INTC	INTB	INTA			
PIRQD	INTD	INTC	INTB	X	X	X

For example, assume an add-in card has one interrupt (group INTD) into the second PCI slot. In this slot, an interrupt source from group INTA connects to the PIRQD signal, which is already connected to the onboard video and USB PCI sources. The add-in card shares an interrupt with these onboard interrupt sources.

Now, however, plug an add-in card that has one interrupt (group INTA) into the first PCI slot. Plug a second add-in card that has two interrupts (groups INTA and INTB) into the second PCI slot. INTA in the first slot is connected to signal PIRQA. INTA in the second slot is connected to signal PIRQB, and INTB is connected to signal PIRQC. With no other cards added, the three interrupt sources on the first two cards each have a PIRQ signal to themselves. Typically, they will not share an interrupt.

NOTE

The PIIX4 can connect each PIRQ line internally to one of the IRQ signals (3,4,5,7,9,11,14,15). Typically, a device that does not share a PIRQ line will have a unique interrupt. However, in certain interrupt-constrained situations, it is possible for two or more of the PIRQ lines to be connected to the same IRQ signal.

3 Overview of BIOS Features

3.1 Introduction

The motherboard uses an Intel/Phoenix BIOS, which is stored in flash memory and can be upgraded using a disk-based program. In addition to the BIOS, the flash memory contains the Setup program, Power-On Self Test (POST), Advanced Power Management (APM), the PCI auto-configuration utility, and Windows 95-ready Plug and Play. See Section 6.2 for the supported versions of these specifications.

This motherboard supports system BIOS shadowing, allowing the BIOS to execute from 64-bit onboard write-protected DRAM.

The BIOS displays a message during POST identifying the type of BIOS and a the revision code. The initial production BIOS is identified as 4N4XL0X0.86A.

3.1.1 BIOS Upgrades

A new version of the BIOS can be upgraded from a diskette using the iFLASH.EXE utility that is available from Intel. This utility does BIOS upgrades as follows:

- Updates the flash BIOS from a file on a disk
- Updates the language section of the BIOS
- Makes sure that the upgrade BIOS matches the target system to prevent accidentally installing a BIOS for a different type of system.

BIOS upgrades and the iFLASH.EXE utility are available from Intel through the Intel World Wide Web site. See Section 6.1 for information about this site.

NOTE

Please review the instructions distributed with the upgrade utility before attempting a BIOS upgrade.

3.1.2 BIOS Flash Memory Organization

The 2-Mbit flash component is organized as 256 KB x 8 bits and is divided into areas as described in Table 16. The table shows the addresses in the ROM image in normal mode (the addresses change in BIOS Recovery Mode).

Table 16. Flash Memory Organization

Address (Hex)	Size	Description
FFFFC000 - FFFFFFFF	16 KB	Boot Block
FFFFA000 - FFFFBFFF	8 KB	Vital Product Data (VPD) Extended System Configuration Data (ESCD) (DMI configuration data / Plug and Play data)
FFFF9000 - FFFF9FFF	4 KB	Used by BIOS (e.g., for Event Logging)
FFFF8000 - FFFF8FFF	4 KB	OEM logo or Scan Flash Area
FFFC0000 - FFFF7FFF	224 KB	Main BIOS Block

3.1.3 Plug and Play: PCI Autoconfiguration

The BIOS automatically configures PCI devices and Plug and Play devices. PCI devices may be onboard or add-in cards. Plug and Play devices are ISA add-in cards built to meet the Plug and Play specification. Autoconfiguration lets a user insert or remove PCI or Plug and Play cards without having to configure the system. When a user turns on the system after adding a PCI or Plug and Play card, the BIOS automatically configures interrupts, the I/O space, and other system resources. Any interrupts set to Available in Setup are considered to be available for use by the add-in card.

PCI interrupts are distributed to available ISA interrupts that have not been assigned to an ISA card or to system resources. The assignment of PCI interrupts to ISA IRQs is non-deterministic. PCI devices can share an interrupt, but an ISA device cannot share an interrupt allocated to PCI or to another ISA device. Autoconfiguration information is stored in the extended system configuration data (ESCD) format.

For information about the versions of PCI and Plug and Play supported by this BIOS, see Section 6.2. Copies of the specifications can be obtained from the Intel World Wide Web site (see Section 6.1).

3.1.4 PCI IDE Support

If Auto is selected as a primary or secondary IDE device (see Section 4.2.2) in Setup, the BIOS automatically sets up the two local-bus IDE connectors with independent I/O channel support. The IDE interface supports hard drives up to PIO Mode 4 and recognizes any ATAPI devices, including CD-ROM drives and tape drives (see Section 6.2 for the supported version of ATAPI). The BIOS determines the capabilities of each drive and configures them so as to optimize capacity and performance. To take advantage of the high-capacity storage devices, hard drives are automatically configured for logical block addressing (LBA) and to PIO Mode 3 or 4, depending on the capability of the drive. To override the autoconfiguration options, use the specific IDE device options in Setup. The ATAPI specification recommends that ATAPI devices be configured as shown in Table 17.

Table 17. Recommendations for Configuring an ATAPI Device

	Primary Cable		Secondary Cable	
Configuration	Drive 0	Drive 1	Drive 0	Drive 1
Normal, no ATAPI	ATA			
Disk and CD-ROM for enhanced IDE systems	ATA		ATAPI	
Legacy IDE system with only one cable	ATA	ATAPI		
Enhanced IDE with CD-ROM and a tape or two CD-ROMs	ATA		ATAPI	ATAPI

3.1.5 ISA Plug and Play

If Plug and Play operating system (see Section 4.3) is selected in Setup, the BIOS autoconfigures only ISA Plug and Play cards that are required for booting (IPL devices). If Plug and Play operating system is not selected in Setup, the BIOS autoconfigures all Plug and Play ISA cards.

3.1.6 ISA Legacy Devices

Since ISA legacy devices are not autoconfigurable, the resources for them must be reserved. Resources can be reserved in the Setup program or with an ISA configuration utility. The ISA configuration utility can be downloaded from the Intel World Wide Web site (see Section 6.1).

3.1.7 Desktop Management Interface (DMI)

Desktop Management Interface (DMI) is an interface for managing computers in an enterprise environment. The main component of DMI is the management information format (MIF) database, which contains information about the computing system and its components. Using DMI, a system administrator can obtain the system types, capabilities, operational status, and installation dates for system components. The MIF database defines the data and provides the method for accessing this information. The BIOS enables applications such as Intel LANDesk Client Manager to use DMI. The BIOS stores and reports the following DMI information:

- BIOS data, such as the BIOS revision level
- Fixed-system data, such as peripherals, serial numbers, and asset tags
- Resource data, such as memory size, cache size, and processor speed
- Dynamic data, such as event detection and error logging

OEMs can use a utility that programs flash memory so the BIOS can report on system and chassis information. This utility is available through Intel sales offices. See Section 6.1 for information about contacting a local Intel sales office. See Section 6.2 for information about the latest DMI specification.

DMI does not work directly under non-Plug and Play operating systems (e.g., Windows NT). However, the BIOS supports a DMI table interface for such operating systems. Using this support, a DMI service-level application running on a non-Plug and Play OS can access the DMI BIOS information.

3.1.8 Advanced Power Management (APM)

The BIOS supports APM and standby mode. See Section 6.2 for the version of the APM specification that is supported. The energy saving standby mode can be initiated in the following ways:

- Time-out period specified in Setup
- Suspend/resume switch connected to the front panel sleep connector
- From the operating system, such as the Suspend menu item in Windows 95

In standby mode, the motherboard reduces power consumption by using SMM capabilities, spinning down hard drives, and reducing power to or turning off VESA DPMS-compliant monitors. Power-management mode can be enabled or disabled in Setup (see Section 4.5).

While in standby mode, the system retains the ability to respond to external interrupts and service requests, such as incoming faxes or network messages. Any keyboard or mouse activity brings the system out of standby mode and immediately restores power to the monitor.

The BIOS enables APM by default; but the operating system must support an APM driver for the power-management features to work. For example, Windows 95 supports the power-management features upon detecting that APM is enabled in the BIOS.

3.1.9 Language Support

The Setup program and help messages can be supported in 32 languages. Five languages are available at this time: American English, German, Italian, French, and Spanish. The BIOS includes extensions to support the Kanji character set and other non-ASCII character sets. Translations of other languages may become available at a later date.

The default language is American English, which is always present unless another language is programmed into the BIOS using the flash memory update utilities. See Section 3.1.1 for information about the BIOS update utilities.

3.1.10 Boot Options

In the Setup program, the user can choose to boot from a floppy drive, hard drive, CD-ROM, or the network. The default setting is for the floppy drive to be the primary boot device and the hard drive to be the secondary boot device. By default the third and fourth devices are disabled.

Booting from CD-ROM is supported in compliance to the El Torito bootable CD-ROM format specification. See Section 6.2 for information about the El Torito specification. Under the Boot menu in the Setup program, CD-ROM is listed as a boot device. Boot devices are defined in priority order. If the CD-ROM is selected as the boot device, it must be the first device.

The network can be selected as a boot device. This selection allows booting from a network add-in card with a remote boot ROM installed.

3.1.11 OEM Logo or Scan Area

A 4 KB flash-memory user area at memory location FFFF8000h-FFFF8FFFh is for displaying a custom OEM logo during POST. A utility is available from Intel to assist with installing a logo into the flash memory. Contact Intel customer support for further information. See Section 6.1 for information on contacting Intel customer support.

3.1.12 USB Support

The USB connectors allow any of several USB devices to be attached to the computer. Typically, the device driver for USB devices is managed by the operating system. However, because keyboard and mouse support may be needed in the Setup program before the operating system boots, the BIOS supports USB keyboards and mice.

3.1.13 BIOS Setup Access

Access to the Setup program can be restricted using passwords. User and supervisor passwords can be set using the Security menu in Setup. The default is no passwords enabled. See Section 4.4 for information about setting user and supervisor passwords.

3.1.14 Recovering BIOS Data

Some types of failure can destroy the BIOS. For example, the data can be lost if a power outage occurs while the BIOS is being updated in flash memory. The BIOS can be recovered from a diskette using the BIOS recovery mode (see Section 1.14.3).

To create a BIOS recovery diskette, a bootable diskette must be created and the recovery files copied to it. The recovery files are available from Intel, contact Intel customer support for further information. See Section 6.1 for information on contacting Intel customer support.

4 BIOS Setup Program

The Setup program is for viewing and changing the BIOS settings for a computer. Setup is accessed by pressing the <F2> key after the Power-On Self Test (POST) memory test begins and before the operating system boot begins. Table 18 shows the menus available from the menu bar at the top of the Setup screen.

Table 18. Setup Menu Bar

Setup Menu Screen	Description
Maintenance	Sets the processor speed and clears the Setup passwords.
Main	Allocates resources for hardware components.
Advanced	Sets advance features available through the chipset.
Security	Sets passwords and security features.
Power	Sets power management features.
Boot	Sets boot options and power supply controls.
Exit	Saves or discards changes.

Table 19 shows the function keys available for menu screens.

Table 19. Setup Function Keys

Setup Key	Description
<F1> or <Alt-H>	Brings up a help screen for the current item.
<Esc>	Exits the menu.
<←> or <→>	Selects a different menu screen.
<↑> or <↓>	Moves cursor up or down.
<Home> or <End>	Moves cursor to top or bottom of the window.
<PgUp> or <PgDn>	Moves cursor to top or bottom of the window.
<F5> or <->	Selects the previous value for a field.
<F6> or <+> or <Space>	Selects the next value for a field.
<F9>	Load the default configuration values for the current menu.
<F10>	Save the current values and exit Setup.
<Enter>	Executes command or selects the submenu.

4.1 Maintenance Menu

This menu is for setting the processor speed and clearing the Setup passwords. Setup only displays this menu in configure mode. See Section 1.14.2 for information about setting configure mode.

Table 20. Maintenance Menu

Feature	Options	Description
Processor Speed	• 233 • 266 • 300	Specifies the processor speed in megahertz.
Clear All Passwords	None	Clears the user and supervisor passwords.

4.2 Main Menu

This menu reports processor and memory information, and is for configuring the language, system date, system time, floppy options, and IDE devices.

Table 21. Main Menu

Feature	Options	Description
Processor Type	None	Displays processor type.
Processor Speed	None	Displays processor speed.
Cache RAM	None	Displays size of L2 cache.
Total Memory	None	Displays the total amount of RAM on the motherboard.
BIOS Version	None	Displays the version of the BIOS.
Language	• **English (US) (default)** • Italiana • Français • Deutsche • Español	Selects the current default language used by the BIOS.
System Time	Hour, minute, and second	Specifies the current time.
System Date	Month, day, and year	Specifies the current date.
Floppy Options, submenu	None	Configures the diskette drives. When selected, displays the Floppy Options submenu. See Section 4.2.1.
Primary IDE Master, submenu	None	Reports type of a connected IDE device. When selected, displays the Primary IDE Master submenu. See Section 4.2.2.
Primary IDE Slave, submenu	None	Reports type of a connected IDE device. When selected, displays the Primary IDE Slave submenu. See Section 4.2.2.
Secondary IDE Master, submenu	None	Reports type of a connected IDE device. When selected, displays the Secondary IDE Master submenu. See Section 4.2.2.
Secondary IDE Slave, submenu	None	Reports type of a connected IDE device. When selected, displays the Secondary IDE Slave submenu. See Section 4.2.2.

4.2.1 Floppy Options Submenu

This submenu is for configuring floppy drives.

Table 22. Floppy Options Submenu

Feature	Options	Description
Diskette A:	• Disabled • 360 KB, 5.25 inch • 1.2 MB, 5.25 inch • 720 KB, 3.5 inch • **1.44/1.25 MB, 3.5 inch (default)** • 2.88 MB, 3.5 inch	Specifies the capacity and physical size of the diskette drive A.
Diskette B:	• **Disabled (default)** • 360 KB, 5.25 inch • 1.2 MB, 5.25 inch • 720 KB, 3.5 inch • 1.44/1.25 MB, 3.5 inch • 2.88 MB, 3.5 inch	Specifies the capacity and physical size of the diskette drive B.
Floppy Write Protect	• **Disabled (default)** • Enabled	Disables or enables write protect for the diskette drive(s).

4.2.2 IDE Device Configuration Submenus

This submenu is for configuring the IDE device features for the following:

- Primary IDE master
- Primary IDE slave
- Secondary IDE master
- Secondary IDE slave

Table 23. IDE Device Configuration Submenus

Feature	Options	Description
Type	• None • ATAPI Removable • CD-ROM • User • **Auto (default)**	Specifies the IDE configuration mode for IDE devices. User allows the cylinders, heads, and sectors fields to be changed. Auto automatically fills in the values for the cylinders, heads, and sectors fields.
Cylinders	1 to *XXXX*	Specifies number of disk cylinders.
Heads	1 to 16	Specifies number of disk heads.
Sectors	1 to 64	Specifies number of disk sectors.
Maximum Capacity	None	Reports maximum capacity for the hard disk. Value calculated from number of cylinders, heads, and sectors.
Multi-Sector Transfers	• Disabled • 2 Sectors • 4 Sectors • 8 Sectors • **16 Sectors (default)**	Specifies number of sectors per block for transfers from the hard drive to memory. Check the hard drive's specifications for optimum setting of this feature.
LBA Mode Control	• Disabled • **Enabled (default)**	Enables or disables logical block addressing (LBA) in place of the Cylinders, Heads, and Sectors fields. ⚠ **CAUTION** *Changing the LBA Mode Control after a hard drive was formatted can corrupt data on the hard drive.*
32 Bit I/O	• **Disabled (default)** • Enabled	Enables or disables 32 bit IDE data transfers between the processor and the IDE device.
Transfer Mode	• Standard • Fast PIO 1 • Fast PIO 2 • Fast PIO 3 • **Fast PIO 4 (default)**	Specifies method for transferring data between the hard drive and system memory.
Ultra DMA	• **Disabled (default)** • Mode 0 • Mode 1 • Mode 2	Specifies the ultra DMA mode for the hard drive.

4.3 Advanced Menu

This menu is for setting advance features that are available through the computer's chipset.

Table 24. Advanced Menu

Feature	Options	Description
Plug & Play O/S	• No • **Yes (default)**	Specifies if a Plug and Play operating system is being used. No lets BIOS configure all devices. Yes lets the operating system configure Plug and Play devices. Not required with a Plug and Play operating system.
Reset Configuration Data	• **No (default)** • Yes	Clears the BIOS configuration data on the next boot.
Memory Cache	• Disabled • **Enabled (default)**	Enables or disables the memory cache.
ECC Configuration	• **Non-ECC (default)** • ECC	Indicates if ECC memory is present.
Resource Configuration, submenu	None	Configures memory blocks and IRQs for legacy ISA devices. When selected, displays the Resource Configuration submenu. See Section 4.3.1.
Peripheral Configuration, submenu	None	Configures peripheral ports and devices. When selected, displays the Peripheral Configuration submenu. See Section 4.3.2.
Keyboard Features, submenu	None	Configures keyboard features. When selected, displays the Keyboard Features submenu. See Section 4.3.3.
Video Configuration, submenu	None	Configures video features. When selected, displays the Video Configuration submenu. See Section 4.3.4.
DMI Event Logging, submenu	None	Configures DMI Events Logging. When selected, displays the DMI Events Logging submenu. See Section 4.3.5.

4.3.1 Resource Configuration Submenu

This submenu is for configuring the memory and interrupts.

Table 25. Resource Configuration Submenu

Feature	Options	Description
Memory Reservation	• C800 - CBFF **Available (default)** | Reserved • CC00- CFFF **Available (default)** | Reserved • D000 - D3FF **Available (default)** | Reserved • D400 - D7FF **Available (default)** | Reserved • D800 - DBFF **Available (default)** | Reserved • DC00 - DFFF **Available (default)** | Reserved • Memory hole **Disabled (default)** | Conventional | Extended	Reserves specific upper memory blocks for use by legacy ISA devices.
IRQ Reservation	• IRQ3 **Available (default)** | Reserved • IRQ4 **Available (default)** | Reserved • IRQ5 **Available (default)** | Reserved • IRQ7 **Available (default)** | Reserved • IRQ9 **Available (default)** | Reserved • IRQ10 **Available (default)** | Reserved • IRQ11 **Available (default)** | Reserved • IRQ15 **Available (default)** | Reserved An * (asterisk) next to an IRQ indicates an IRQ conflict.	Reserves specific IRQs for use by legacy ISA devices.

4.3.2 Peripheral Configuration Submenu

This submenu is for the configuring the computer peripherals.

Table 26. Peripheral Configuration Submenu

Feature	Options	Description
Serial Port A	• Disabled • Enabled • **Auto (default)**	Used to configure serial port A. Auto assigns the first free COM port, normally COM1, the address 3F8h and the interrupt IRQ4. An * (asterisk) indicates a conflict with another device.
Serial Port B	• Disabled • Enabled • **Auto (default)**	Used to configure serial port B. Auto assigns the first free COM port, normally COM2, the address 2F8h and the interrupt IRQ3. An * (asterisk) indicates a conflict with another device. If either serial port address is set, that address will not appear in the list of options for the other serial port. If an *ATI mach32*† or an *ATI mach64*† video controller is active as an add-in card, the COM4, 2E8h address will not appear in the list of options for either serial port.
Mode	• **Normal (default)** • IrDA • ASK-IR	Sets the mode for Serial Port B for normal (COM2) or infrared applications.
Parallel Port	• Disabled • Enabled • **Auto (default)**	Configures the parallel port. Auto assigns LPT1 the address 378h and the interrupt IRQ7. An * (asterisk) indicates a conflict with another device.
Mode	• Output Only • **Bi-directional (default)** • EPP • ECP	Selects the mode for the parallel port. Output Only operates in AT†-compatible mode. Bi-directional operates in bi-directional PS/2-compatible mode. EPP is Extended Parallel Port mode, a high-speed bi-directional mode. ECP is Enhanced Capabilities Port mode, a high-speed bi-directional mode.
Floppy Disk Controller	• Disabled • **Enabled (default)**	Configures the floppy disk controller.
IDE Controller	• Disabled • Primary • Secondary • **Both (default)** (primary and secondary)	Configures the IDE controller.
Audio	• Disabled • **Enabled (default)**	Enables or disables the onboard audio subsystem.
LAN	• Disabled • **Enabled (default)**	Enables or disables the onboard LAN subsystem.

4.3.3 Keyboard Configuration Submenu

Table 27. Keyboard Configuration Submenu

Feature	Options	Description
Numlock	• **Auto (default)** • On • Off	Sets the power on state of the Numlock feature on the numeric keypad of the keyboard.
Key Click	• **Disabled (default)** • Enabled	Enables the key click option.
Keyboard Auto-repeat Rate	• **30/sec (default)** • 26.7/sec • 21.8/sec • 18.5/sec • 13.3/sec • 10/sec • 6/sec • 2/sec	Selects the key repeat rate.
Keyboard Auto-repeat Delay	• ¼ sec • **½ sec (default)** • ¾ sec • 1 sec	Selects the delay before key repeat.

4.3.4 Video Configuration Submenu

Table 28. Video Configuration Submenu

Feature	Options	Description
Palette Snooping	• **Disabled (default)** • Enabled	Controls the ability of a primary PCI graphics controller to share a common palette with an ISA add-in video card.

4.3.5 DMI Event Logging Submenu

Table 29. DMI Event Logging Submenu

Feature	Options	Description
Event Log Capacity	None	Indicates if there is space available in the event log.
Event Log Validity	None	Indicates if the contents of the event log are valid.
View DMI Event Log	None	Enables viewing of DMI event log.
Clear All DMI Event Logs	• **No (default)** • Yes	Clears the DMI Event Log after rebooting.
Event Logging	• Disabled • **Enabled (default)**	Enables logging of DMI events.
ECC Event Logging	• **Disabled (default)** • Enabled	
Mark DMI Events as read	None	Marks all DMI events as read.

4.4 Security Menu

This menu is for setting passwords and security features for the computer.

Table 30. Security Menu

Feature	Options	Description
User Password Is	None	Reports if there is a user password set.
Supervisor Password Is	None	Reports if there is a supervisor password set.
Set User Password	Password can be up to seven alphanumeric characters.	Sets the user password.
Set Supervisor Password	Password can be up to seven alphanumeric characters.	Sets the supervisor password.
Unattended Start	• **Disabled (default)** • Enabled	Sets the unattended start feature. When enabled, the computer boots, but the keyboard is locked. Enter the user password unlocks the computer. The user password is required to boot from a floppy diskette.

4.5 Power Menu

This menu is for setting power management features for the computer.

Table 31. Power Menu

Feature	Options	Description
Power Management	• Disabled • **Enabled (default)**	Enables or disables the BIOS power management feature.
Inactivity Timer	• **Off (default)** • 1 Minute • 2 Minutes • 4 Minutes • 6 Minutes • 8 Minutes • 12 Minutes • 16 Minutes	Sets the amount of time before the computer enters standby mode.
Hard Drive	• Disabled • **Enabled (default)**	Enables the hard disks to be power managed during standby and suspend modes.
VESA Video Power Down	• Disabled • **Enabled (default)**	Enables power management for video during standby and suspend modes.

4.6 Boot Menu

This menu is for setting the boot features for the computer.

Table 32. Boot Menu

Feature	Options	Description
Restore on AC/Power Loss	• Stay Off • **Last State (default)** • Power On	Specifies action following a power failure if computer is powered on. Stay Off keeps power off until power button pressed. Power On restores previous power state before power was lost.
On Modem Ring	• **Stay Off (default)** • Power On	Specifies action of computer when power is off and an incoming call is detected on an installed modem.
On LAN	• **Stay Off (default)** • Power On	Specifies action of computer when power is off and LAN activity is detected on.
On PME	• **Stay Off (default)** • Power On	Specifies action of computer when a PCI Power Management Enable Event occurs.
First Boot Device Second Boot Device Third Boot Device Fourth Boot Device	• Hard Drive • Removable devices • ATAPI CD-ROM • Drive • Network boot	Specifies the boot sequence from the available devices. To specify boot sequence: 1. Select the boot device with <↑> or <↓>. 2. Press <+> to move the device up the list or <-> to move the device down the list. The operating system assigns drive letters to the devices in the order listed. The order can be changed and therefore the drive lettering for these devices.
Hard Drive, submenu	None	Lists drives available. When selected, displays the Hard Drive submenu. See Section 4.6.1.
Removable Devices, submenu	None	Lists available removable devices. When selected, displays the Removable Devices submenu. See Section 4.6.2.

4.6.1 Hard Drive Submenu

Table 33. Hard Drive Submenu

Options	Description
• Installed hard drive • Bootable ISA Cards	Specifies the boot sequence for the hard drives attached to the computer. To specify boot sequence: 1. Select the boot device with <↑> or <↓>. 2. Press <+> to move the device up the list or <-> to move the device down the list. The operating system assigns drive letters to the devices in the order listed. The order can be changed and therefore the drive lettering for these devices.

4.6.2 Removable Devices Submenu

Table 34. Removable Devices Submenu

Options	Description
• Legacy Floppy Drives	Specifies the boot sequence for the removable devices attached to the computer. To specify boot sequence: 1. Select the boot device with <↑> or <↓>. 2. Press <+> to move the device up the list or <-> to move the device down the list. The operating system assigns drive letters to the devices in the order listed. The order can be changed and therefore the drive lettering for these devices.

4.7 Exit Menu

This section describes how to exit the Setup program. The screen features have no options.

Table 35. Exit Menu

Feature	Description
Exit Saving Changes	Exits Setup and saves the changes in CMOS RAM.
Exit Discarding Changes	Exits Setup program without saving any changes. Any changes made in Setup are not saved.
Load Setup Defaults	Returns all of the Setup options to their defaults. The default Setup values are loaded from the ROM table.
Load Custom Defaults	Loads the setup settings from the Custom Defaults.
Save Custom Defaults	Normally, the BIOS reads the setup settings from flash memory. If this memory is corrupted, the BIOS uses the custom defaults. If no custom defaults are set, the BIOS uses the factory defaults.
Discard Changes	Discards any changes made without exiting Setup. The option values that were present when the computer was turned on are used.

5 Error Messages and Beep Codes

5.1 BIOS Error Messages

Table 36. BIOS Error Messages

Error Message	Explanation
Diskette drive A error or Diskette drive B error	Drive A: or B: is present but fails the POST diskette tests. Check that the drive is defined with the proper diskette type in Setup and that the diskette drive is installed correctly.
Extended RAM Failed at offset: *nnnn*	Extended memory not working or not configured properly at offset *nnnn*.
Failing Bits: *nnnn*	The hex number nnnn is a map of the bits at the RAM address (System, Extended, or Shadow memory) that failed the memory test. Each 1 in the map indicates a failed bit.
Fixed Disk 0 Failure or Fixed Disk 1 Failure or Fixed Disk Controller Failure	Fixed disk is not working or not configured properly. Check to see if fixed disk is installed properly. Run Setup be sure the fixed-disk type is correctly identified.
Incorrect Drive A type - run SETUP	Type of floppy drive for drive A: not correctly identified in Setup.
Incorrect Drive B type - run SETUP	Type of floppy drive for drive B: not correctly identified in Setup.
Invalid NVRAM media type	Problem with NVRAM (CMOS) access.
Keyboard controller error	The keyboard controller failed test. Try replacing the keyboard.
Keyboard error	Keyboard not working.
Keyboard error nn	BIOS discovered a stuck key and displays the scan code nn for the stuck key.
Keyboard locked - Unlock key switch	Unlock the system to proceed.
Monitor type does not match CMOS - Run SETUP	Monitor type not correctly identified in Setup.
Operating system not found	Operating system cannot be located on either drive A: or drive C:. Enter Setup and see if fixed disk and drive A: are properly identified.
Parity Check 1	Parity error found in the system bus. BIOS attempts to locate the address and display it on the screen. If it cannot locate the address, it displays ????.
Parity Check 2	Parity error found in the I/O bus. BIOS attempts to locate the address and display it on the screen. If it cannot locate the address, it displays ????.
Press <F1> to resume, <F2> to Setup	Displayed after any recoverable error message. Press <F1> to start the boot process or <F2> to enter Setup and change any settings.

continued ☛

Table 37. BIOS Error Messages (continued)

Error Message	Explanation
Real time clock error	Real-time clock fails BIOS test. May require motherboard repair.
Shadow RAM Failed at offset: *nnnn*	Shadow RAM failed at offset *nnnn* of the 64 KB block at which the error was detected.
System battery is dead - Replace and run SETUP	The CMOS clock battery indicator shows the battery is dead. Replace the battery and run Setup to reconfigure the system.
System cache error - Cache disabled	RAM cache failed the BIOS test. BIOS disabled the cache.
System CMOS checksum bad - run SETUP	System CMOS RAM has been corrupted or modified incorrectly, perhaps by an application program that changes data stored in CMOS. Run Setup and reconfigure the system either by getting the default values and/or making your own selections.
System RAM Failed at offset: *nnnn*	System RAM failed at offset *nnnn* of the 64 KB block at which the error was detected.
System timer error	The timer test failed. Requires repair of system motherboard.

5.2 Port 80h POST Codes

During the POST, the BIOS generates diagnostic progress codes (POST codes) to I/O port 80h. If the POST fails, execution stops and the last POST code generated is left at port 80h. This code is useful for determining the point where an error occurred.

Displaying the POST codes requires an add-in card (often called a POST card). The POST card can decode the port and display the contents on a medium such as a seven-segment display. These cards can be purchased from JDR Microdevices or other sources.

The following table provides the POST codes that can be generated by the BIOS. Some codes are repeated in the table because that code applies to more than one operation.

Table 37. Port 80h Codes

Code	Description of POST Operation
02h	Verify real mode
03h	Disable non-maskable interrupt (NMI)
04h	Get processor type
06h	Initialize system hardware
08h	Initialize chipset with initial POST values
09h	Set IN POST flag
0Ah	Initialize CPU registers
0Bh	Enable CPU cache
0Ch	Initialize caches to initial POST values
0Eh	Initialize I/O component
0Fh	Initialize the local bus IDE
10h	Initialize power management

continued ☛

Table 37. Port 80h Codes (continued)

Code	Description of POST Operation Currently In Progress
11h	Load alternate registers with initial POST valuesnew
12h	Restore CPU control word during warm boot
13h	Initialize PCI bus mastering devices
14h	Initialize keyboard controller
16h	BIOS ROM checksum
17h	Initialize cache before memory autosize
18h	8254 timer initialization
1Ah	8237 DMA controller initialization
1Ch	Reset programmable interrupt controller
20h	Test DRAM refresh
22h	Test keyboard controller
24h	Set ES segment register to 4 GB
26h	Enable A20 line
28h	Autosize DRAM
29h	Initialize POST memory manager
2Ah	Clear 512 KB base RAM
2Ch	RAM failure on address line *xxxx**
2Eh	RAM failure on data bits *xxxx** of low byte of memory bus
2Fh	Enable cache before system BIOS shadow
30h	RAM failure on data bits *xxxx** of high byte of memory bus
32h	Test CPU bus-clock frequency
33h	Initialize POST dispatch manager
34h	Test CMOS RAM
35h	Initialize alternate chipset registers
36h	Warm start shut down
37h	Reinitialize the chipset (MB only)
38h	Shadow system BIOS ROM
39h	Reinitialize the cache (MB only)
3Ah	Autosize cache
3Ch	Configure advanced chipset registers
3Dh	Load alternate registers with CMOS valuesnew
40h	Set Initial CPU speed new
42h	Initialize interrupt vectors
44h	Initialize BIOS interrupts
45h	POST device initialization
46h	Check ROM copyright notice
47h	Initialize manager for PCI option ROMs
48h	Check video configuration against CMOS RAM data

continued ☛

Table 37. Port 80h Codes (continued)

Code	Description of POST Operation Currently In Progress
49h	Initialize PCI bus and devices
4Ah	Initialize all video adapters in system
4Bh	Display QuietBoot screen
4Ch	Shadow video BIOS ROM
4Eh	Display BIOS copyright notice
50h	Display CPU type and speed
51h	Initialize EISA motherboard
52h	Test keyboard
54h	Set key click if enabled
56h	Enable keyboard
58h	Test for unexpected interrupts
59h	Initialize POST display service
5Ah	Display prompt "Press F2 to enter SETUP"
5Bh	Disable CPU cache
5Ch	Test RAM between 512 and 640 KB
60h	Test extended memory
62h	Test extended memory address lines
64h	Jump to UserPatch1
66h	Configure advanced cache registers
67h	Initialize multiprocessor APIC
68h	Enable external and processor caches
69h	Setup System Management Mode (SMM) area
6Ah	Display external L2 cache size
6Ch	Display shadow-area message
6Eh	Display possible high address for UMB recovery
70h	Display error messages
72h	Check for configuration errors
74h	Test real-time clock
76h	Check for keyboard errors
7Ah	Test for key lock on
7Ch	Set up hardware interrupt vectors
7Eh	Initialize coprocessor if present
80h	Disable onboard Super I/O ports and IRQs
81h	Late POST device initialization
82h	Detect and install external RS232 ports
83h	Configure non-MCD IDE controllers
84h	Detect and install external parallel ports
85h	Initialize PC-compatible PnP ISA devices

continued ☛

Table 37. Port 80h Codes (continued)

Code	Description of POST Operation Currently In Progress
86h	Re-initialize onboard I/O ports
87h	Configure motherboard configurable devices
88h	Initialize BIOS Data Area
89h	Enable Non-Maskable Interrupts (NMIs)
8Ah	Initialize extended BIOS data area
8Bh	Test and initialize PS/2 mouse
8Ch	Initialize floppy controller
8Fh	Determine number of ATA drives
90h	Initialize hard-disk controllers
91h	Initialize local-bus hard-disk controllers
92h	Jump to UserPatch2
93h	Build MPTABLE for multiprocessor boards
94h	Disable A20 address line (Rel. 5.1 and earlier)
95h	Install CD ROM for boot
96h	Clear huge ES segment register
97h	Fix up multiprocessor table
98h	Search for option ROMs
99h	Check for SMART Drive
9Ah	Shadow option ROMs
9Ch	Set up power management
9Eh	Enable hardware interrupts
9Fh	Determine number of ATA and SCSI drives
A0h	Set time of day
A2h	Check key lock
A4h	Initialize typematic rate
A8h	Erase F2 prompt
Aah	Scan for F2 key stroke
Ach	Enter SETUP
Aeh	Clear IN POST flag
B0h	Check for errors
B2h	POST done - prepare to boot operating system
B4h	One short beep before boot
B5h	Terminate QuietBoot
B6h	Check password (optional)
B8h	Clear global descriptor table
B9h	Clean up all graphics
Bah	Initialize DMI parameters
BBh	Initialize PnP Option ROMs

continued ☛

Table 37. Port 80h Codes (continued)

Code	Description of POST Operation Currently In Progress
BCh	Clear parity checkers
BDh	Display MultiBoot menu
Beh	Clear screen (optional)
BFh	Check virus and backup reminders
C0h	Try to boot with INT 19
C1h	Initialize POST Error Manager (PEM)
C2h	Initialize error logging
C3h	Initialize error display function
C4h	Initialize system error handler
E0h	Initialize the chipset
E1h	Initialize the bridge
E2h	Initialize the processor
E3h	Initialize system timer
E4h	Initialize system I/O
E5h	Check force recovery boot
E6h	Checksum BIOS ROM
E7h	Go to BIOS
E8h	Set huge segment
E9h	Initialize multiprocessor
Eah	Initialize OEM special code
Ebh	Initialize PIC and DMA
Ech	Initialize memory type
Edh	Initialize memory size
Eeh	Shadow boot block
Efh	System memory test
F0h	Initialize interrupt vectors
F1h	Initialize runtime clock
F2h	Initialize video
F3h	Initialize beeper
F4h	Initialize boot
F5h	Clear huge segment
F6h	Boot to mini-DOS
F7h	Boot to full DOS

5.3 BIOS Beep Codes

Beeps codes represent a terminal error. If the BIOS detects a terminal error condition, it outputs an error beep code, halts the POST, and attempts to display a port 80h code on the POST card's LED display.

Table 38. Beep Codes

Beeps	80h Code	Description
1	B4h	One short beep before boot
1-2	98h	Search for option ROMs
1-2-2-3	16h	BIOS ROM checksum
1-3-1-1	20h	Test DRAM refresh
1-3-1-3	22h	Test 8742 keyboard controller
1-3-4-1	2Ch	RAM failure on address line *xxxx**
1-3-4-3	2Eh	RAM failure on data bits *xxxx** of low byte of memory bus
1-4-1-1	30h	RAM failure on data bits *xxxx** of high byte of memory bus
2-1-2-3	46h	Check ROM copyright notice
2-2-3-1	58h	Test for unexpected interrupts

6 Specifications and Customer Support

6.1 Online Support

Find information about Intel boards under “Product Info” or “Customer Support” at this World Wide Web site:

http://www.intel.com/

6.2 Specifications

The motherboard complies with the following specifications:

Table 39. Compliance with Specifications

Specification	Description	Revision Level
A.G.P.	Accelerated Graphics Port Interface Specification	Revision 1.0, July, 1996, Intel Corporation. The specification is available through the Accelerated Graphics Implementers Forum at: http://www.agpforum.org/.
APM	Advanced Power Management BIOS interface specification	Revision 1.2, February, 1996 Intel Corporation, Microsoft Corporation
ATA-3	Information Technology - AT Attachment-3 Interface	X3T10/2008D Revision 6 ATA Anonymous FTP Site: fission.dt.wdc.com
ATAPI	ATA Packet Interface for CD-ROMs	SFF-8020i Revision 2.5 (SFF) Fax Access: (408) 741-1600
DMI	Desktop Management Interface BIOS specification	Version 2.0, October 16, 1995 American Megatrends Inc., Award Software International Inc., Dell Computer Corporation, Intel Corporation, Phoenix Technologies Ltd., SystemSoft Corporation
El Torito	Bootable CD-ROM format specification	Version 1.0, January 25, 1995 Phoenix Technologies Ltd., IBM Corporation. The El Torito specification is available on the Phoenix Web site http://www.ptltd.com/techs/specs.html.
EPP	Enhanced Parallel Port	IEEE 1284 standard, Mode [1 or 2], v1.7

continued ☛

Table 40. Compliance with Specifications (continued)

IrDA	Serial Infrared Physical Layer Link specification	Version 1.1, October 17, 1995 Infrared Data Association.
Management extension hardware	LM79 Microprocessor System Hardware Monitor	Current Web site: http://www.national.com/pf/LM/LM78.html
NLX	NLX form factor specification	Revision **TBD**, February 1997 Intel Corporation, The specification is available at: http://www.intel.com/
PCI	PCI Local Bus specification	Revision 2.1, June 1, 1995, PCI Special Interest Group
Phoenix BIOS	PhoenixBIOS	Revision 4.0, February 27, 1997, Phoenix Technologies Ltd.
Plug and Play	Plug and Play BIOS specification	Version 1.0a, May 5, 1994 Compaq Computer Corporation, Phoenix Technologies Ltd., Intel Corporation
SDRAM DIMMs (64-bit)	4-Clock, 66 MHz, 64-bit Unbuffered DIMM specification	Revision 1.0, January 27, 1997, Intel Corporation
SDRAM DIMMs (72-bit)	4-Clock 66 MHz 72-bit Unbuffered DIMM specification	Revision 1.0, January 27, 1997, Intel Corporation
USB	Universal serial bus specification	Revision 1.0, January 15, 1996 Compaq Computer Corporation, Digital Equipment Corporation, IBM PC Company, Intel Corporation, Microsoft Corporation, NEC, Northern Telecom

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