SE440BX-2
Motherboard
Product Guide

Revision History

Revision	Revision History	Date
001	First release of the SE440BX-2 Motherboard Product Guide.	August 1998

If an FCC declaration of conformity marking is present on the board, the following statement applies:

FCC Declaration of Conformity

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

For questions related to the EMC performance of this product, contact:

   Intel Corporation
   5200 N.E. Elam Young Parkway
   Hillsboro, OR 97124
   1-800-628-8686

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 to an outlet on a circuit other than the one to which the receiver is connected.
* Consult the dealer or an experienced radio/TV technician for help.

Canadian Department of Communications Compliance Statement:

This digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le présent appareil numerique németpas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la classe B prescrites dans le Réglement sur le broullage radioélectrique édicté par le ministére des Communications du Canada.

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An Intel product, when used in accordance with its associated documentation, is "Year 2000 Capable" when, upon installation, it accurately stores, displays, processes, provides, and/or receives date data from, into, and between the twentieth and twenty-first centuries, including leap year calculations, provided that all other technology used in combination with said product properly exchanges date data with it.

† Third-party brands and trademarks are the property of their respective owners.

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1 Motherboard Features

This chapter gives an overview of the SE440BX-2 motherboard, including:

- Features
- Components
- Back panel I/O connectors

The remaining chapters explain how to:

- Add or upgrade components like processors or memory
- Use the BIOS Setup program to modify the motherboard's configuration
- Upgrade the BIOS

Features Summary

- ATX form factor of 12 x 7.75 inches with seven mounting screw holes
- Support for the following processors:
  - Intel® Pentium® II processor
  - Intel® Celeron™ processor
- Three DIMM sockets
  - Supports up to 384 MB of synchronous DRAM (SDRAM) memory
- Intel® 82440BX AGPset
  - PCI/AGP controller (PAC)
  - PCI ISA IDE Xcelerator (PIIX4E)
- I/O controller
- Two USB ports
- Intel/Phoenix Basic Input/Output System (BIOS)
- Single-jumper configuration
- Accelerated Graphics Port (AGP) connector

Software drivers and utilities are available from Intel.

⇒ **NOTE**

For information about Intel® motherboards, including technical product specifications, BIOS upgrades, and device drivers, see "Products" at the Intel World Wide Web site:

http://developer.intel.com/

Components

Figure 1 shows the major components on the motherboard.

A	Wake on Ring connector
B	Yamaha YMF740 (DS1-L) PCI audio controller (optional)
C	Analog Devices AD1819A SoundPort† Codec (optional)
D	Wake on LAN† technology connector (optional)
E	Legacy CD-ROM audio connector (optional)
F	CD-ROM audio connector (optional)
G	Telephony connector (optional)
H	Auxiliary Line In connector (optional)
I	Video In connector (optional)
J	Back panel connectors
K	242-contact slot connector
L	Processor active fan connector
M	Intel® 82443BX PCI/AGP controller
N	DIMM sockets
O	Fan 1 connector
P	Power supply connector
Q	Diskette drive connector
R	SCSI LED connector (optional)
S	IDE connectors
T	Front panel connectors
U	Accelerated Graphics Port (AGP) connector
V	Intel 82371EB PCI ISA IDE Xcelerator (PIIX4E)
W	PC/PCI connector
X	Battery
Y	SMSC FDC37M707 Super I/O controller
Z	Flash BIOS
AA	Configuration jumper block
BB	Integrated speaker
CC	PCI slots
DD	Fan 3
EE	ISA slots
FF	Chassis intrusion connector (optional)

Figure 1. Motherboard Components

⟹ **NOTE**

Components labeled optional do not come on all SE440BX-2 motherboards.

Back Panel I/O Connectors

Figure 2 shows the back panel I/O connectors on the motherboard.

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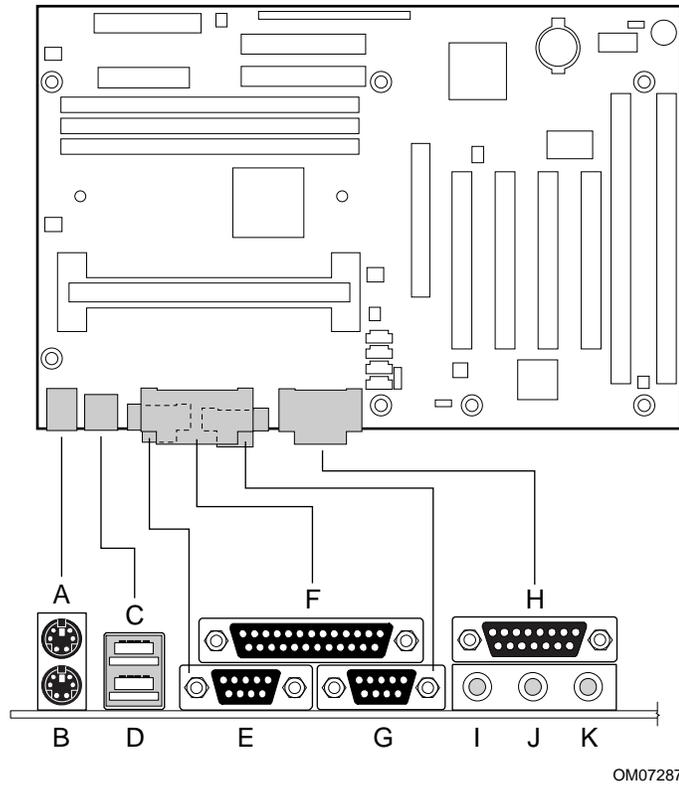
A	PS/2[†] keyboard or mouse	G	Serial Port B
B	PS/2 keyboard or mouse	H	MIDI/game Port (optional)
C	USB Port 1	I	Audio Line Out (optional)
D	USB Port 0	J	Audio Line In (optional)
E	Serial Port A	K	Audio Mic In (optional)
F	Parallel Port		

Figure 2. Back Panel I/O Connectors

Microprocessor

The motherboard supports a single Pentium II processor or a Celeron processor. Processors are not included with the SE440BX-2 motherboard and must be purchased separately.

The processor connects to the motherboard through the 242-contact slot connector. When mounted in the slot connector, the processor is secured by a retention mechanism attached to the motherboard. A passive heatsink is stabilized by the heatsink support.

The motherboard supports the following processors:

Processor Type	Processor Speed (in MHz)	Host Bus Frequency (in MHz)	Level 2 Cache (in KB)
Pentium II processor	233	66	512
	266	66	512
	300	66	512
	333	66	512
	350	100	512
	400	100	512
	450	100	512
Celeron processor	266	66	0
	300	66	0
	300A	66	128
	333	66	128

For the latest information on processor support for the SE440BX-2 motherboard, refer to the Intel boxed motherboard web site at:

http://channel.intel.com/business/ibp/boards/

Microprocessor Upgrades

The motherboard can be upgraded with any processor at speeds specified in the section above. To upgrade the processor, see Chapter 2.

Main Memory

The motherboard has three sockets for installing dual inline memory modules (DIMMs). Minimum memory size is 16 MB; maximum memory size is 384 MB. To install memory, see Chapter 2.

Second Level Cache Memory

The second level cache for the Pentium II processor includes synchronous pipelined burst static RAM (PBSRAM) and tag RAM. There are four PBSRAM components totaling 512 KB in size. All supported onboard memory is cacheable.

The Celeron processors that include an integrated 128 KB second level cache subsystem, have it implemented on the processor die. All supported onboard memory can be cached.

PCI Enhanced IDE Interface

The PCI enhanced IDE interface handles the exchange of information between the processor and peripheral devices like hard disks and add-in boards inside the computer. The interface supports:

- Up to four IDE devices (such as hard drives)
- ATAPI devices (such as CD-ROM drives)
- PIO Mode 3 and PIO Mode 4 devices
- Ultra DMA/33
- Logical block addressing (LBA) of hard drives larger than 528 MB and extended cylinder head sector (ECHS) translation modes
- Support for laser servo (LS-120) drives

Input/Output (I/O) Controller

The I/O controller handles the exchange of information between the processor and external devices like the mouse and keyboard or a printer that are connected to the computer. The controller features the following:

- Integrated keyboard and mouse controller
- Industry standard diskette drive controller
- One multimode bi-directional parallel port
  — Standard mode: Centronics-compatible operation
  — High speed mode: support for Extended Capabilities Port (ECP) and Enhanced Parallel Port (EPP)
- Two serial ports
- Flexible IRQ and DMA mapping for Windows[†] 95 and Windows 98

Real-Time Clock

The motherboard has a time-of-day clock and 100-year calendar that will rollover to 2000 at the turn of the century. A battery on the motherboard keeps the clock current when the computer is turned off.

➡ **NOTE**

The recommended method of accessing the date in systems with Intel motherboards is indirectly from the Real-Time Clock (RTC) via the BIOS. The BIOS on Intel motherboards and baseboards contains a century checking and maintenance feature that checks the least two significant digits of the year stored in the RTC during each BIOS request (INT 1Ah) to read the date and, if less than 80 (i.e., 1980 is the first year supported by the PC), updates the century byte to 20. This feature enables operating systems and applications using the BIOS date/time services to reliably manipulate the year as a four-digit value.

For more information on proper date access in systems with Intel motherboards please see
http://support.intel.com/support/year2000/paper.htm

Universal Serial Bus (USB) Support

The motherboard has two USB ports. You can connect two USB peripheral devices directly to the computer without an external hub. To attach more than two devices, connect an external hub to either of the built-in ports. The motherboard supports the standard universal host controller interface (UHCI) and takes advantage of standard software drivers written to be compatible with UHCI. The USB features the following:

- Support for hot swapping Plug and Play devices
- Support for self-identifying peripherals
- Support for up to 127 physical devices
- Guaranteed bandwidth and low latencies appropriate for telephony, audio, and other applications

➡ **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 USB device is attached to the cable. Use a shielded cable that meets the requirements for a high-speed USB device.

AGP

The AGP is a high-performance interconnect for graphics-intensive applications, such as 3D graphics. AGP is independent of the PCI bus and is intended for exclusive use with graphical display devices. AGP provides these 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 real data throughput in excess of 500 MB/sec

BIOS

The motherboard's system BIOS is contained in a flash memory device on the motherboard. The BIOS provides the power-on self test (POST), the BIOS Setup program, and the PCI and IDE auto-configuration utilities.

The BIOS is always shadowed. Shadowing allows BIOS routines to be executed from fast 64-bit onboard DRAM instead of from the slower 8-bit flash memory device.

BIOS Upgrades

Because the BIOS is stored in a flash memory device, you can upgrade the BIOS by using a software utility on a diskette or hard disk, or over a network. For information on upgrading the BIOS, see Chapter 4.

PCI Auto Configuration

If you install a PCI add-in board in your computer, the PCI auto-configuration utility in the BIOS automatically detects and configures the resources (IRQs, DMA channels, and I/O space) for that add-in board. You do not need to run the BIOS Setup program after you install a PCI add-in board.

However, PCI add-in boards use the same IRQ resources as ISA add-in boards. If you install both a PCI and an ISA add-in board, you must specify the IRQ used by the ISA card. The PCI auto configuration program complies with version 2.1 of the PCI BIOS specification.

IDE Auto Configuration

If you install an IDE device (e.g., a hard drive) in your computer, the IDE auto-configuration utility in the BIOS automatically detects and configures the device for your computer. You do not need to run the BIOS Setup program after installing an IDE device.

ISA Plug and Play Capability

The motherboard provides auto configuration of Plug and Play ISA cards and resource management for legacy (non-Plug and Play) ISA cards when used with the ISA Configuration Utility (ICU) or a Plug and Play compatible operating system like Windows 95 and Windows 98. To obtain the ICU, contact your computer supplier.

Security Passwords

The BIOS includes security features that restrict whether the BIOS Setup program can be accessed and who can boot the computer. A supervisor password and a user password can be set for the Setup program and for booting the computer, with the following restrictions:

- The supervisor password gives unrestricted access to view and change all the Setup options in the Setup program. This is supervisor mode.
- The user password gives restricted access to view and change Setup options in the Setup program. This is user mode.

- If only the supervisor password is set, pressing the <Enter> key at the password prompt of the Setup program gives the user restricted access to Setup.
- If both the supervisor and user passwords are set, you must enter either the supervisor password or the user password to access Setup.
- Setting a user password restricts who can boot the computer. The password prompt is displayed before the computer is booted. If only the supervisor password is set, the computer boots without asking for a password. If both passwords are set, you can enter either password to boot the computer.

Expansion Slots

The motherboard has six expansion slots for installing add-in boards, like network cards, that expand the capabilities of your computer. The expansion slots are as follows:

- One ISA slot
- One shared PCI/ISA slot
- Three PCI slots
- One AGP slot

Power Management

The motherboard supports two types of power management — Advanced Power Management (APM) and Advanced Configuration and Power Interface (ACPI).

Advanced Power Management (APM)

APM's energy saving standby mode can be initiated in the following ways:

- Specify a time-out period in Setup
- Press the suspend/resume switch connected to the front panel sleep connector
- Use an operating system option, such as the Suspend menu item in Windows 95 and Windows 98

In standby mode, the motherboard can reduce power consumption by 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 Chapter 3).

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 and Windows 98 support the power-management features upon detecting that APM is enabled in the BIOS.

Advanced Configuration and Power Interface (ACPI)

ACPI gives the operating system direct control over the power management and Plug and Play functions of a computer. ACPI requires an ACPI-aware operating system. ACPI features include:

- Plug and Play (including bus and device enumeration) and APM functionality normally contained in the BIOS
- Power management control of individual devices, add-in boards (some add-in boards may require an ACPI-aware driver), video monitor, and hard disk drives
- Methods for achieving less than 30-watt system operation in the Power On Suspend sleeping state, and less than 5-watt system operation in the Suspend to Disk sleeping state
- A Soft-off feature that enables the operating system to power off the computer
- Support for multiple wake up events
- Support for a front panel power and sleep mode switch

Battery

A battery on the motherboard keeps the clock and the values in CMOS RAM current when your computer is turned off. To replace the battery, see Chapter 2.

Wake on Ring

Wake on Ring enables the computer to wake from sleep or soft-off mode when a call is received on a telephony device, such as a modem, configured for operation on Serial Port A. The first incoming call powers up the computer. A second call must be made to access the computer. To access this feature use the Wake on Ring connector. See Chapter 5 for the location and pinouts of the Wake on Ring connector.

Wake on LAN Technology (Optional)

Wake on LAN technology enables remote wakeup of the computer through a network. Wake on LAN technology requires a PCI add-in network interface card (NIC) with remote wakeup capabilities. The remote wakeup connector on the NIC must be connected to the onboard Wake on LAN technology connector. The NIC monitors network traffic at the MII interface; upon detecting a Magic Packet[†], the NIC asserts a wakeup signal that powers up the computer. To access this feature use the Wake on LAN technology connector. See Chapter 5 for the location and pinouts of the Wake on LAN technology connector.

⚠ CAUTION

For Wake on LAN, the 5-V standby line for the power supply must be capable of delivering +5 V ± 5 % at 720 mA. Failure to provide adequate standby current when implementing Wake on LAN, can damage the power supply.

Hardware Monitor (Optional)

The optional hardware monitor subsystem provides low-cost instrumentation capabilities. The features of the hardware monitor subsystem include:

- Support for an optional chassis intrusion connector
- An integrated ambient temperature sensor
- Fan speed sensors that monitor the fan 1 and processor active fan connectors (see Figure 15 for the location of these connectors on the motherboard)
- Power supply voltage monitoring to detect levels above or below acceptable values

When suggested ratings for temperature, fan speed, or voltage are exceeded, an interrupt is activated. The hardware monitor component connects to the system management (SM) bus.

Audio Subsystem (Optional)

The optional audio subsystem consists of the following:

- Analog Devices AD1819A SoundPort Codec
- Yamaha YMF740 (DS1-L) PCI audio controller
- Back panel and onboard audio connectors

Analog Devices AD1819A SoundPort Codec

The AC '97 analog codec features:

- 16-bit stereo full-duplex codec with up to 48 kHz sampling rate
- Variable 7 kHz to 48 kHz sampling rate with 1 Hz resolution
- Phat[†] 3D stereo enhancement

Yamaha YMF740 (DS1-L) PCI Audio Controller

The features include:

- PCI 2.1 compliant
- PC '97/PC '98 specification compliant
- PCI bus Power Management rev. 1.0 compliant
- PCI bus master for PCI audio
- 32 voice XG wavetable synthesizer
- DirectX support
- PC/PCI support for legacy DMAC emulation
- True full duplex playback and capture with different sampling rates

Audio Connectors

The audio connectors include the following:

- Stacked backpanel connectors with Line In, Line Out, MIC, and MIDI Game Port
- Optional legacy CD-ROM audio connector
- Optional CD-ROM audio connectors (black)
- Optional telephony connector (green)
- Optional auxiliary Line In connector (white)
- Optional Video In connector (blue)

See Chapter 5 for the location and pinouts of the audio connectors.

Speaker (Optional)

A piezoelectric speaker is mounted on the motherboard. The speaker provides audible error code (beep code) information during the POST.

The motherboard also has a front panel connector for an offboard speaker.

Motherboard Features

2 Installing and Replacing Motherboard Components

This chapter describes the following:

- How to install and remove the motherboard
- How to install a processor
- How to prepare the motherboard for a boxed Pentium II processor
- How to install and remove memory
- How to replace the battery
- How to use the configuration jumper to set processor speed and clear passwords

Before You Begin

⚠ **CAUTION**

Before you install this motherboard in a chassis, see Appendix B for regulatory requirements and precautions.

- Always follow the steps in each procedure in the correct order.
- Set up a log to record information about your computer, such as model, serial numbers, installed options, and configuration information.
- Use an antistatic wrist strap and a conductive foam pad when working on the motherboard.

⚠ **WARNINGS**

The procedures in this chapter assume familiarity with the general terminology associated with personal computers and with the safety practices and regulatory compliance required for using and modifying electronic equipment.

Disconnect the computer from its power source and from any telecommunications links, networks, or modems before performing any of the procedures described in this chapter. Failure to disconnect power, telecommunications links, networks, or modems before you open the computer or perform any procedures can result in personal injury or equipment damage. Some circuitry on the motherboard can continue to operate even though the front panel power button is off.

⚠ **CAUTION**

Electrostatic discharge (ESD) can damage components. Perform the procedures described in this chapter only at an ESD workstation. If such a station is not available, you can provide some ESD protection by wearing an antistatic wrist strap and attaching it to a metal part of the computer chassis.

How to Install and Remove the Motherboard

Refer to your chassis manual for instructions on installing and removing the motherboard. The motherboard is secured to the chassis by seven screws. Figure 3 shows the locations of the mounting screw holes.

⇒ **NOTES**

You will need a Phillips (#2 bit) screwdriver.

Refer to Appendix B for regulatory requirements and installation instructions and precautions.

⚠ **WARNING**

This procedure should be done only by qualified technical personnel. Disconnect the computer from its power source before doing the procedures described here. Failure to disconnect the power before you open the computer can result in personal injury or equipment damage.
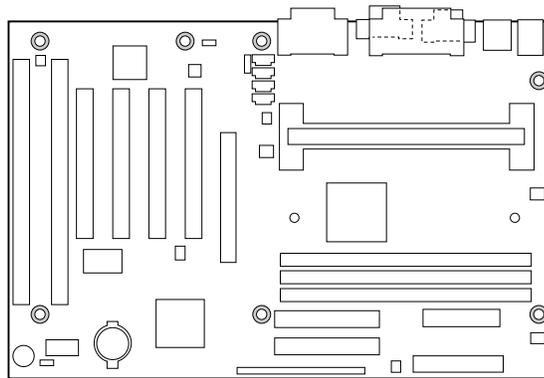
OM07170

Figure 3. Mounting Screw Holes

How to Install a Processor

To install a processor, in brief you must:
1. Install the universal retention mechanism (URM).
2. Install the processor.
3. Set the processor speed.

Detailed instructions follow for each of these procedures.

⇒ **NOTE**

If you are installing a boxed Intel Pentium II processor, see the instructions on page 25.

Install the Universal Retention Mechanism

To install the universal retention mechanism, follow these steps:

1. Observe the precautions in "Before You Begin" (see page 19).
2. Find the 242-contact slot connector on the motherboard (see Figure 4).
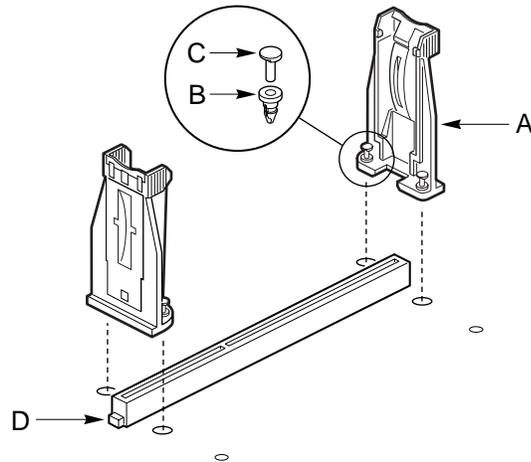
OM07176

A	Retention bracket	C	Fastener retainer pins
B	Press-fit fasteners	D	242-contact slot connector

Figure 4. Installing the Universal Retention Mechanism

3. Orient the retention bracket so the tab of the processor connector matches the corresponding cutout in the retention bracket, then position the retention bracket on the motherboard.
4. Push each of the four fasteners through its mounting hole in the retention bracket, and then through the motherboard mounting hole until you feel it snap into place.
5. Push a fastener retainer pin into the through hole of fastener until it is fully seated against the top of the fastener. Repeat this step for each of the four fasteners.

Install the Processor

To install the processor, follow these steps:

1. Insert the processor in the retention mechanism as shown in Figure 5.
2. Press down on the processor until it is firmly seated in the processor connector and the latches on the processor lock into place.
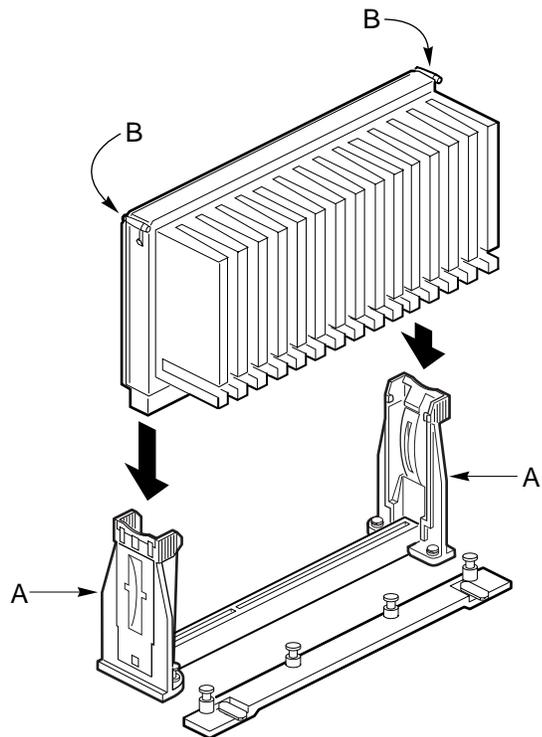
OM07178

A   Universal retention mechanism

B   Latches

Figure 5. Installing the Processor

3. Slide the top heatsink support bar onto the retaining pins of the support's base as shown in Figure 6.
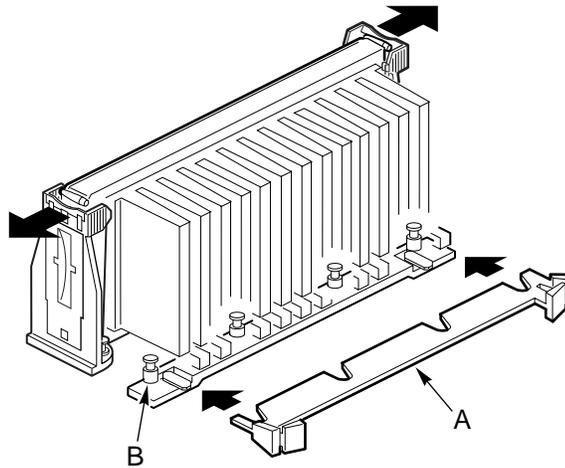
OM07179

A   Heatsink support bar
B   Retaining pins

Figure 6. Installing the Heatsink Support Top Bar

How to Set the Processor Speed

Set the processor speed after you have installed or upgraded the processor. This procedure assumes that the motherboard is installed in the computer and the configuration jumper block is set to normal mode.

Figure 7 shows the location of the configuration jumper block on the motherboard. The jumper is set to normal mode at the factory.
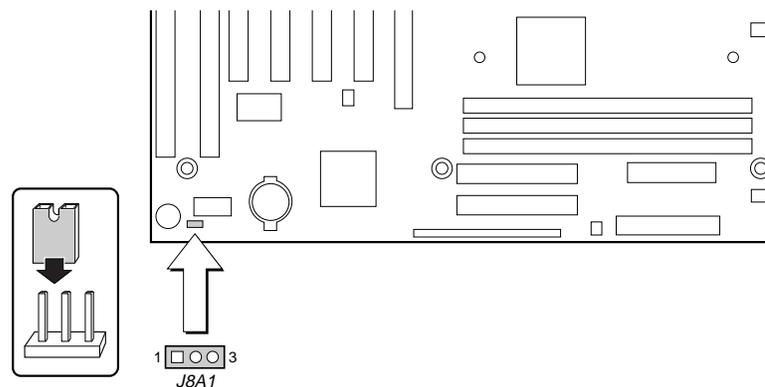
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Figure 7. Location of the Configuration Jumper Block

⚠ **CAUTION**

To avoid bending or breaking pins, use caution when removing or installing a jumper.

To set the processor speed, follow these steps:

1. Observe the precautions in "Before You Begin" (see page 19).
2. Turn off all peripheral devices connected to the computer. Turn off the computer.
3. Remove the computer cover.
4. Find the configuration jumper block (see Figure 7).
5. Place the jumper on pins 2-3 as shown below.

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1 ▢●● 3

OM07071

6. Replace the cover, turn on the computer, and allow it to boot.
7. The computer starts the Setup program. Setup displays the Maintenance menu.
8. Use the arrow keys to select the Processor Speed feature and press <Enter>. Setup displays a popup screen with the available processor speeds.
9. Use the arrow keys to select the processor speed. For example, select 266 for a 266 MHz Pentium II processor. Press <Enter> to confirm the speed. This Maintenance menu reappears again.
10. Press <F10> to save the current values and exit Setup.
11. Turn off the computer.
12. Remove the computer cover.
13. To restore normal operation, place the jumper on pins 1-2 as shown below.

J8A1

1 ●●○ 3

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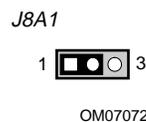
14. Replace the cover and turn on the computer.
15. Verify the processor speed during POST.

How to Upgrade to a Boxed Pentium® II Processor

Use the instructions in this section to prepare the motherboard for a boxed Pentium II processor upgrade.

To prepare for a boxed Pentium II processor upgrade, in brief you must:
1. Remove the heatsink support top bar and the installed processor.
2. Remove the heatsink support base.
3. Upgrade the processor.

Detailed instructions follow for each of these procedures.

Remove the Installed Processor

To remove the installed processor, follow these steps:
1. Observe the precautions in "Before You Begin" (see page 19).
2. Turn off all peripheral devices connected to the computer. Turn off the computer.
3. Remove the computer cover.
4. Remove the motherboard from the computer chassis. (See "How to Install and Remove the Motherboard.")
5. Place the motherboard on a flat work surface and remove any components that block access to the installed processor.

6. Remove the top bar of the heatsink support from the base as shown in Figure 8. Press in on the latches to release the top bar.
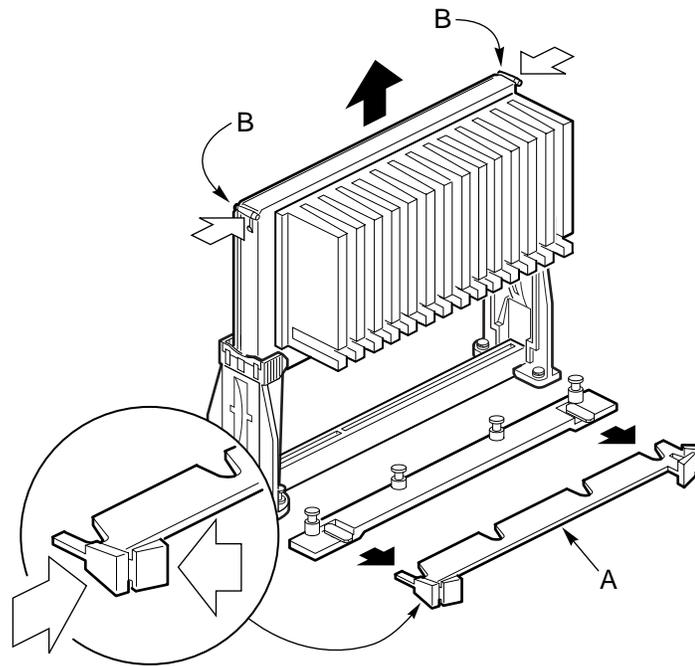
OM07180

A   Heatsink support top bar
B   Latches

Figure 8. Removing the Heatsink Support Top Bar and the Processor

⚠ **CAUTION**

Pressing on the motherboard or components while removing the processor can cause damage. If necessary, you can safely press on the motherboard's plastic connectors to gain leverage while removing the processor.

7. Remove the processor by pressing in on the latches and pulling the processor straight up as shown in Figure 8. Place the processor aside.

Remove the Heatsink Support Base

⇒ **NOTE**

To remove the heatsink support base from the motherboard, you need a special removal tool (MID #58982) that is available from Dexter Design (call 503-648-7000 for ordering information).

To remove the heatsink support base, follow these steps:

1. With your fingers, remove the two retention pins from the heatsink support base as shown in Figure 9.
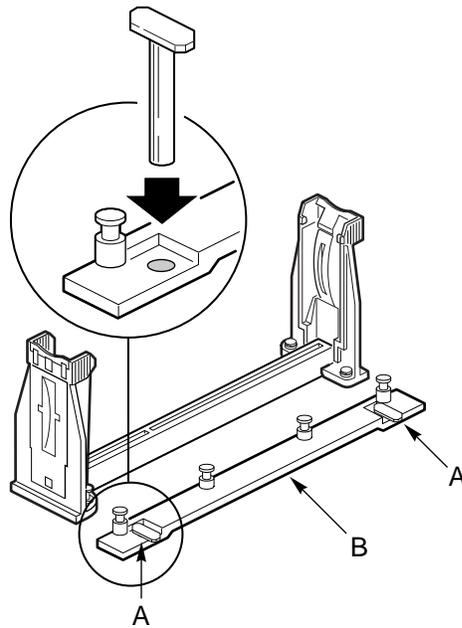
OM07177

A   Retention pins
B   Heatsink support base

Figure 9. Removing the Heatsink Support Retention Pins

2. Place the heatsink support removal tool over the two outside posts of the heatsink support base as shown in Figure 10. Make sure the tool completely engages the posts.
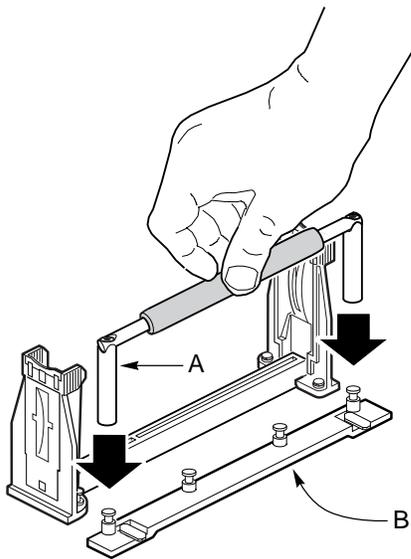
OM07181

A	Heatsink support removal tool
B	Heatsink support base

Figure 10. Placing the Heatsink Support Base Removal Tool on the Retention Pins

3. Carefully rock the tool back and forth until the heatsink support base disengages from the holes in the motherboard (as shown in Figure 11). There is an audible click when the base disengages from the motherboard.
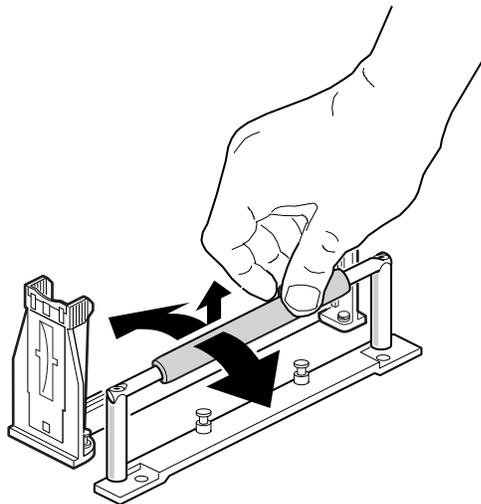
OM07182

Figure 11. Using the Heatsink Support Base Removal Tool

4. Remove the tool and the heatsink support base from the motherboard.

Upgrade the Processor

See the documentation that came with the boxed Intel Pentium II processor.

How to Install Memory

You can install from 16 MB to 384 MB of memory in the motherboard DIMM sockets. The board has DIMM sockets arranged as banks 0, 1, and 2. The motherboard supports the following memory features:

- 168-pin DIMMs with gold-plated contacts
- 66 or 100 MHz SDRAM
- Non-ECC (64-bit) and ECC (72-bit) memory
- 3.3 V memory only
- Single- or double-sided DIMMs in the following sizes:

DIMM Capacity	DIMM Organization*	SDRAM Density	SDRAM Organization	Number of SDRAMs
16 MB	2M X 64	16 Mbit	1M X 16	8
16 MB	2M X 64	16 Mbit	2M X 8	8
16 MB	2M X 64	64 Mbit	2M X 32	2
32 MB	4M X 64	16 Mbit	2M X 8	16**
32 MB	4M X 64	64 Mbit	2M X 32	4
32 MB	4M X 64	64 Mbit	4M X 16	4
64 MB	8M X 64	64 Mbit	4M X 16	8
64 MB	8M X 64	64 Mbit	8M X 8	8
128 MB	16M X 64	64 Mbit	8M X 8	16**

* ECC DIMM organization will be X 72 and one additional component will be used on each side of DIMM.

** If number of SDRAMs is greater than nine, the DIMM will be double sided.

When adding memory, follow these guidelines:

- You can install DIMMs in any of the three banks.
- You can use different sizes of DIMMs in different banks.
- The BIOS detects the size and type of installed memory.
- For ECC operation to be available, all installed memory must be ECC and you must enable the ECC Configuration feature in the Setup program (see Chapter 3).

⚠ **CAUTION**

To be fully compliant with all applicable Intel® SDRAM memory specifications, the motherboard should be populated with DIMMs that support the Serial Presence Detect (SPD) data structure. If your memory modules do not support SPD, you will see a notification to this effect on the screen at power up. The BIOS will attempt to configure the memory controller for normal operation. However, DIMMs may not function under the determined frequency. You can access the PC Serial Presence Detect Specification at:

http://www.intel.com/design/pcisets/memory/

⇒ **NOTE**

All memory components and DIMMs used with the SE440BX-2 motherboard must comply with the PC SDRAM specifications. These include: the PC SDRAM Specification (memory component specific), the PC100 SDRAM Component Testing Summary, the PC Unbuffered DIMM Specification, and the PC Registered DIMM Specification. You can access these documents through the Internet at:

http://www.intel.com/design/pcisets/memory/

Figure 12 shows the location of the DIMM sockets.
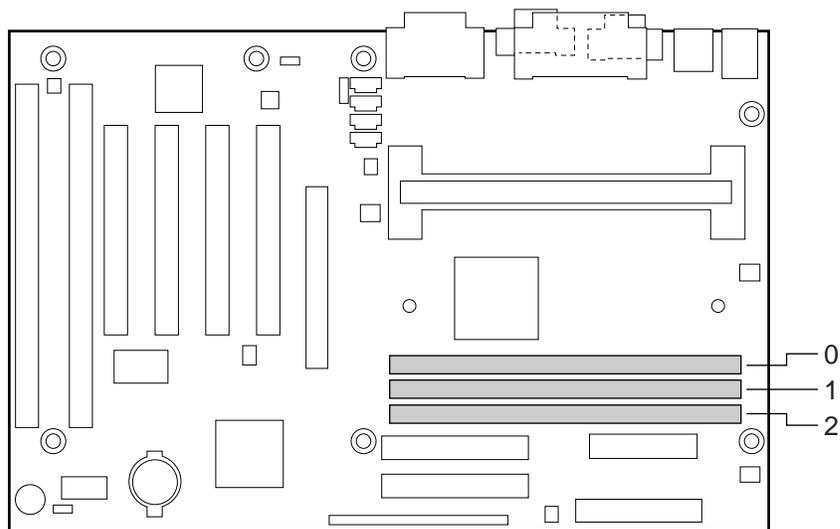
OM07171

Figure 12. Location of DIMM Sockets

To install DIMMs, follow these steps:

1. Observe the precautions in "Before You Begin" (see page 19).
2. Turn off all peripheral devices connected to the computer. Turn off the computer.
3. Remove the computer cover and locate the DIMM sockets.
4. Holding the DIMM by the edges, remove it from its antistatic package.
5. Make sure the clips at either end of the socket are pushed away from the socket.

6. Position the DIMM above the socket. Align the two small notches in the bottom edge of the DIMM with the keys in the socket.
7. Insert the bottom edge of the DIMM into the socket (see Figure 13).
8. When the DIMM is seated, push down on the top edge of the DIMM until the retaining clips snap into place. Make sure the clips are firmly in place.
9. Replace the computer cover.
10. If you installed a DIMM with ECC memory, turn on the computer and use the ECC Configuration feature in Setup to enable ECC (see Chapter 3).
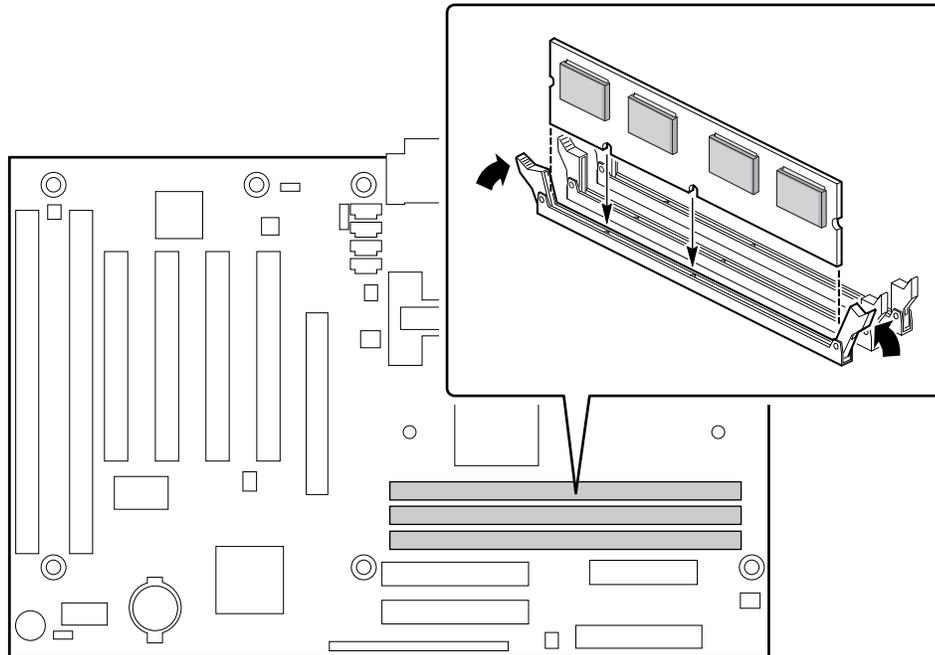
OM07172

Figure 13. Installing a DIMM

How to Remove Memory

To remove a DIMM, follow these steps:

1. Observe the precautions in "Before You Begin" (see page 19).
2. Turn off all peripheral devices connected to the computer. Turn off the computer.
3. Remove the computer cover.
4. Gently spread the retaining clips at each end of the socket. The DIMM pops out of the socket.
5. Hold the DIMM by the edges, lift it away from the socket, and store it in an antistatic package.
6. Reinstall and reconnect any parts you removed or disconnected to reach the DIMM sockets.

How to Replace the Battery

When your computer is turned off, a lithium battery maintains the current time-of-day clock and the values in CMOS RAM current. Figure 14 shows the location of the battery.

The battery should last about seven years. When the battery begins to die, it loses voltage; when the voltage drops below a certain level, the Setup program settings stored in CMOS RAM (for example, the date and time) might not be accurate. Replace the battery with an equivalent one.

⚠ **WARNING**

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

⚠ **ATTENTION**

Il y a danger d'explosion s'il y a remplacement incorrect de la batterie. Remplacer uniquement avec une batterie du méme type ou d'un type recommandé par le constructeur. Mettre au rébut les batteries usagées conformément aux instructions du fabricant.

⚠ **ADVARSEL!**

Lithiumbatteri - Eksplosionsfare ved fejlagtig håndtering. Udskiftning må kun ske med batteri af samme fabrikat og type. Levér det brugte batteri tilbage til leverandøren.

⚠ **ADVARSEL**

Lithiumbatteri - Eksplosjonsfare. Ved utskifting benyttes kun batteri som anbefalt av apparatfabrikanten. Brukt batteri returneres apparatleverandøren.

⚠ **VARNING**

Explosionsfara vid felaktigt batteribyte. Använd samma batterityp eller en ekvivalent typ som rekommenderas av apparattillverkaren. Kassera använt batteri enligt fabrikantens instruktion.

⚠ **VAROITUS**

Paristo voi räjähtää, jos se on virheellisesti asennettu. Vaihda paristo ainoastaan laitevalmistajan suosittelemaan tyyppiin. Hävitä käjtetty paristo valmistajan ohjeiden mukaisesti.

To replace the battery, follow these steps:

1. Observe the precautions in "Before You Begin" (see page 19).
2. Turn off all peripheral devices connected to the computer. Turn off the computer.
3. Remove the computer cover.
4. Locate the battery on the motherboard (see Figure 14).
5. With a medium flat-bladed screwdriver, gently pry the battery free from its socket. Note the orientation of the "+" and "-" on the battery.
6. Install the new battery in the socket, orienting the "+" and "-" correctly.
7. Replace the computer cover.
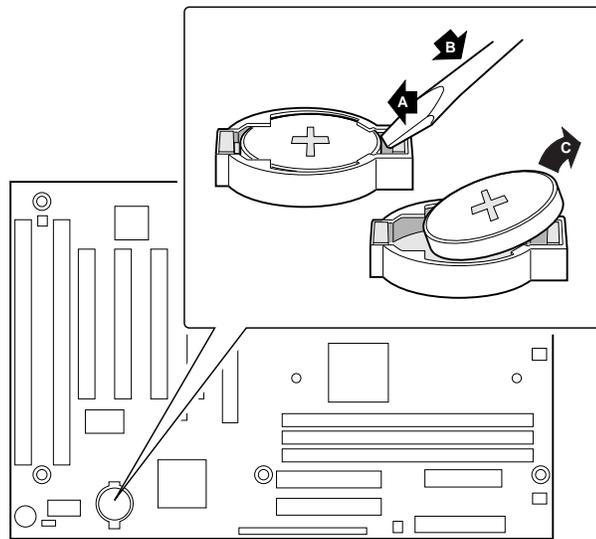
OM07173

Figure 14. Replacing the Battery

⇒ **NOTE**

If your local ordinances permit, you may dispose of individual batteries as normal trash. Do not expose batteries to excessive heat or fire. Keep all batteries away from children.

How to Clear the Passwords

This procedure assumes that the motherboard is installed in the computer and the configuration jumper block is set to normal mode.

1. Observe the precautions in "Before You Begin" (see page 19).
2. Turn off all peripheral devices connected to the computer. Turn off the computer.
3. Remove the computer cover.
4. Find the configuration jumper block (see Figure 7).
5. Place the jumper on pins 2-3 as shown below.

   J8A1

   1 ▢●● 3

   OM07071
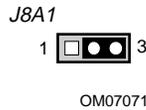
6. Replace the cover, turn on the computer, and allow it to boot.
7. The computer starts the Setup program. Setup displays the Maintenance menu.
8. Use the arrow keys to select Clear Passwords. Press <Enter> and Setup displays a pop-up screen requesting that you confirm clearing the password. Select Yes and press <Enter>. Setup displays the Maintenance menu again.
9. Press <F10> to save the current values and exit Setup.
10. Turn off the computer.
11. Remove the computer cover.
12. To restore normal operation, place the jumper on pins 1-2 as shown below.

    J8A1

    1 ●●○ 3

    OM07072
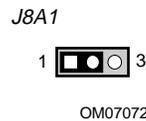
13. Replace the cover and turn on the computer.

3 Using the Setup Program

This chapter provides an overview of the Setup program. You can use the Setup program to change the configuration information and boot sequence for the computer.

⇒ **NOTE**

For reference purposes, you should write down the current Setup settings. When you make changes to the settings, update this record.

Setup Program Modes

The Setup program has three modes of operation:
- Normal mode for normal operations
- Configure mode for configuring the processor speed and clearing passwords (see Chapter 2 for how to do both tasks)
- Recovery mode for recovering the BIOS data

The Setup program operating mode is controlled by the setting of the configuration jumper block J8A1 (see Figure 7). The jumper is set to normal mode at the factory.

Table 1 shows jumper settings for the different Setup modes.

Table 1.   Jumper Settings for Setup Program Modes

Mode	Jumper	Description
Normal	1-2	BIOS uses current configuration and passwords for booting.
Configure	2-3	After the POST runs, Setup starts and displays the Maintenance menu. This menu displays options for setting the processor speed and clearing passwords.
Recovery	None	BIOS recovers data from a recovery diskette. Refer to Chapter 4 for information on recovering the BIOS data during an upgrade.

Setup Menus

To enter the Setup program, turn the computer on and press <F2> when you see the message:

```
Press <F2> Key if you want to run SETUP
```

Table 2 is an overview of the menu screens in the Setup program.

Table 2.   Setup Menu Bar

Setup Menu Screen	Description
Maintenance	Specifies the processor speed and clears the Setup passwords. This menu is only available in configure mode. See Setup Program Modes (page 35).
Main	Allocates resources for hardware components.
Advanced	Specifies advanced features available through the chipset.
Security	Specifies passwords and security features.
Power	Specifies power management features.
Boot	Specifies boot options and power supply controls.
Exit	Saves or discards changes to the Setup program options.

Function Keys

Table 3 shows the function keys available for menu screens.

Table 3.   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.

Maintenance Menu

This menu is for setting the processor speed and clearing the Setup passwords. Setup only displays this menu in configure mode. To set the processor speed, see "How to Set the Processor Speed" on page 23. To clear the password, see "How to Clear the Passwords" on page 34.

Table 4.   Maintenance Menu

Feature	Options	Description
Processor Speed	• 233 • 266 • 300 • 333 • 350 • 400 • 450	Specifies the processor speed in megahertz. This setup screen will only show speeds up to and including the maximum speed of the processor installed on the motherboard. • With a host bus operating at 66 MHz, the board supports processors at the following speeds: 233, 266, 300, and 333 MHz. • With a host bus operating at 100 MHz, the board supports processors at the following speeds: 350, 400, and 450 MHz.
Clear All Passwords	No options	Clears the user and supervisor passwords.

Main Menu

This menu reports processor and memory information and is for configuring the system date and system time.

Table 5.   Main Menu

Feature	Options	Description
BIOS Version	No options	Displays the version of the BIOS.
Processor Type	No options	Displays processor type.
Processor Speed	No options	Displays processor speed.
System Memory	No options	Displays the total amount of RAM on the motherboard.
Memory Bank 0 Memory Bank 1 Memory Bank 2	No options	Displays size and type of DIMM installed in each memory bank.
Language	• **English (US) (default)** • Italian • Francais • Deutch • Espanol	Selects the default language used by the BIOS.
ECC Configuration	• **Non-ECC (default)** • ECC	Specifies ECC memory operation.
System Time	Hour, minute, and second	Specifies the current time.
System Date	Month, day, and year	Specifies the current date.

Advanced Menu

This menu is for setting advanced features that are available through the chipset.

Table 6.   Advanced Menu

Feature	Options	Description
Plug & Play O/S	• **No (default)** • Yes	Specifies if a Plug and Play operating system is being used. *No* lets the 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.
Numlock	• **Auto (default)** • On • Off	Specifies the power on state of the Num Lock feature on the numeric keypad of the keyboard.
Peripheral Configuration	No options	Configures peripheral ports and devices. When selected, displays the Peripheral Configuration submenu.
IDE Configuration	No options	Specifies type of connected IDE device.
Floppy Configuration	No options	When selected, displays the Floppy Options submenu.
DMI Events Logging	No options	Configures DMI Events Logging. When selected, displays the DMI Events Logging submenu.
Video Configuration	No options	Configures video features. When selected, displays the Video Configuration submenu.
Resource Configuration	No options	Configures memory blocks and IRQs for legacy ISA devices. When selected, displays the Resource Configuration submenu.

Peripheral Configuration Submenu

This submenu is for the configuring the computer peripherals.

Table 7.   Peripheral Configuration Submenu

Feature	Options	Description
Serial port A	• Disabled • Enabled • **Auto (default)**	Configures serial port A. *Auto* assigns the first free COM port, normally COM1, the address 3F8h and the interrupt IRQ4. An * (asterisk) displayed next to an address indicates a conflict with another device.
Base I/O address	• 3F8 • 2F8 • 3E8 • 2E8	Specifies the base I/O address for serial port A.
Interrupt	• IRQ 3 • **IRQ 4 (default)**	Specifies the interrupt for serial port A.
Serial port B	• Disabled • Enabled • **Auto (default)**	Configures serial port B. *Auto* assigns the first free COM port, normally COM2, the address 2F8h and the interrupt IRQ3. An * (asterisk) displayed next to an address 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[†]	Specifies the mode for serial port B for normal (COM 2) or infrared applications.
Base I/O address	• 3F8 • **2F8 (default)** • 3E8 • 2E8	Specifies the base I/O address for serial port B.
Interrupt	• **IRQ 3 (default)** • IRQ 4	Specifies the interrupt for serial port B.
Parallel port	• Disabled • Enabled • **Auto (default)**	Configures the parallel port. *Auto* assigns LPT1 the address 378h and the interrupt IRQ7. An * (asterisk) displayed next to an address indicates a conflict with another device.

Table 7.   Peripheral Configuration Submenu (continued)

Feature	Options	Description
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.
Base I/O address	• 378 • 278 • 228	Specifies the base I/O address for the parallel port.
Interrupt	• IRQ 5 • IRQ 7	Specifies the interrupt for the parallel port.
Audio	• Disabled • **Enabled (default)**	Enables or disables the onboard audio subsystem.
Legacy USB Support	• **Disabled (default)** • Enabled	Enables or disables USB legacy support.

IDE Configuration

Table 8.   IDE Configuration

Feature	Options	Description
IDE Controller	• Disabled • Primary • Secondary • **Both (default)**	Specifies the integrated IDE controller. *Primary* enables only the Primary IDE Controller. *Secondary* enables only the Secondary IDE Controller. *Both* enables both IDE controllers.
Hard Disk Pre-Delay	• **Disabled (default)** • 3 Seconds • 6 Seconds • 9 Seconds • 12 Seconds • 15 Seconds • 21 Seconds • 30 Seconds	Specifies the hard disk drive pre-delay.
Primary IDE Master	No options	Reports type of connected IDE device. When selected, displays the Primary IDE Master submenu.
Primary IDE Slave	No options	Reports type of connected IDE device. When selected, displays the Primary IDE Slave submenu.
Secondary IDE Master	No options	Reports type of connected IDE device. When selected, displays the Secondary IDE Master submenu.
Secondary IDE Slave	No options	Reports type of connected IDE device. When selected, displays the Secondary IDE Slave submenu.

IDE Configuration Submenus

This submenu is for configuring IDE devices, including:

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

Table 9.   IDE Configuration Submenus

Feature	Options	Description
Type	• None • **Auto (default)**	Specifies the IDE configuration mode for IDE devices. *Auto* automatically fills in the transfer mode values.
Maximum Capacity	No options	Reports the maximum capacity for the hard disk.
Multi-Sector Transfers	• **Disabled (default)** • 2 Sectors • 4 Sectors • 8 Sectors • 16 Sectors	Specifies number of sectors per block for transfers from the hard drive to memory. Check the hard drive's specifications for optimum setting.
LBA Mode Control	• Disabled • **Enabled (default)**	Enables or disables the LBA mode control.
Transfer Mode	• **Standard (default)** • Fast PIO 1 • Fast PIO 2 • Fast PIO 3 • Fast PIO 4 • FPIO 3 / DMA 1 • FPIO 4 / DMA 2	Specifies the method for moving data to/from the drive.
Ultra DMA	• **Disabled (default)** • Mode 0 • Mode 1 • Mode 2	Specifies the Ultra DMA mode for the drive.

Diskette Options

This submenu is for configuring diskette drives.

Table 10.   Diskette Options

Feature	Options	Description
Diskette Controller	• Disabled • **Enabled (default)**	Disables or enables the integrated diskette controller.
Diskette A:	• Disabled • 360 KB, 5¼″ • 1.2 MB, 5¼″ • 720 KB, 3½″ • **1.44/1.25 MB, 3½″ (default)** • 2.88 MB, 3½″	Specifies the capacity and physical size of diskette drive A.
Diskette Write Protect	• **Disabled (default)** • Enabled	Disables or enables write protect for the diskette drive(s).

DMI Event Logging

This submenu is for configuring the DMI event logging features.

Table 11.   DMI Event Logging Submenu

Feature	Options	Description
Event log capacity	No options	Indicates if there is space available in the event log.
Event log validity	No options	Indicates if the contents of the event log are valid.
View DMI event log	No options	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 • **Enabled (default)**	Enables logging of ECC events.
Mark DMI events as read	No options	Marks all DMI events as read.

Video Configuration Submenu

This submenu is for configuring video features.

Table 12. 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.
AGP Aperture Size	• **64 MB (default)** • 256 MB	Specifies the aperture size for the AGP video controller.
Default Primary Video Adapter	• PCI • **AGP (default)**	Selects the type of video card used for the boot display device.

Resource Configuration Submenu

This submenu is for configuring the memory and interrupts.

Table 13. Resource Configuration Submenu

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

Security Menu

This menu is for setting passwords and security features.

Table 14.   Security Menu

Feature	Options	Description
User Password Is	No options	Reports if there is a user password set.
Supervisor Password Is	No options	Reports if there is a supervisor password set.
Set User Password	Password can be up to seven alphanumeric characters.	Specifies the user password.
Set Supervisor Password	Password can be up to seven alphanumeric characters.	Specifies the supervisor password.
Clear User Password	No Options	Clears the user password.
User Setup Access	- None - View Only - Limited Access **Full Access (default)**	Enables or disables User Setup Access. *None* prevents the user from accessing Setup.
Unattended Start	**Disabled (default)** - Enabled	Enables the unattended start feature. When enabled, the computer boots, but the keyboard is locked. The user must enter a password to unlock the computer or boot from a floppy diskette.

Power Menu

This menu is for setting power management features.

Table 15.   Power Menu

Feature	Options	Description
Power Management	- Disabled **Enabled (default)**	Enables or disables the BIOS power management feature.
Inactivity Timer	**Off (default)** 1 Minute 5 Minutes 10 Minutes 20 Minutes 30 Minutes 60 Minutes 120 Minutes	Specifies the amount of time before the computer enters standby mode.
Hard Drive	- Disabled **Enabled (default)**	Enables power management for hard disks during standby and suspend modes.
VESA Video Power Down	- Disabled **Standby (default)** - Suspend - Sleep	Specifies power management for video during standby and suspend modes.
Fan Always On	**No (default)** - Yes	Select *Yes* to force the fan to remain on when the system is in a power managed state.

Boot Menu

This menu is for setting the boot features and the boot sequence.

Table 16.   Boot Menu

Feature	Options	Description
Boot-Time Diagnostic Screen	• **Disabled (default)** • Enabled	Displays the diagnostics screen during boot.
QuickBoot Mode	• Disabled • **Enabled (default)**	Enables the computer to boot without showing the diagnostic screen and POST tests.
Scan User Flash Area	• **Disabled (default)** • Enabled	Enables the BIOS to scan the flash memory for user binary files that are executed at boot time.
After Power Failure	• Stay Off • **Last State (default)** • Power On	Specifies the mode of operation if an AC/Power loss occurs. *Stay Off* keeps the power off until the power button is pressed. *Last State* restores the previous power state before power loss occurred. *Power On* restores power to the computer.
On Modem Ring	• Stay Off • **Power On (default)**	Specifies how the computer responds to an incoming call on an installed modem when the power is off.
On LAN	• Stay Off • **Power On (default)**	Specifies how the computer responds to a LAN wakeup event when the power is off.
On PME	• **Stay Off (default)** • Power On	Specifies how the computer responds to a PME wakeup event when the power is off.
First Boot Device Second Boot Device Third Boot Device Fourth Boot Device	• Removable devices • Hard Drive • 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 a drive letter to each boot device in the order listed. Changing the order of the devices changes the drive lettering.
Hard Drive	No options	Lists available hard drives. When selected, displays the Hard Drive submenu.
Removable Devices	No options	Lists available removable devices. When selected, displays the Removable Devices submenu.

Hard Drive Submenu

This submenu is for configuring the boot sequence for hard drives.

Table 17.   Hard Drive Submenu

Options	Description
• Bootable Add in Card	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 a drive letter to each device in the order listed. Changing the order of the devices changes the drive lettering.

Removable Devices Submenu

This submenu is for configuring the boot sequence for removable devices.

Table 18.   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 a drive letter to each device in the order listed. Changing the order of the devices changes the drive lettering.

Exit Menu

This menu is for exiting the Setup program, saving changes, and loading and saving defaults.

Table 19.   Exit Menu

Feature	Description
Exit Saving Changes	Exits and saves the changes in CMOS RAM.
Exit Discarding Changes	Exits without saving any changes made in Setup.
Load Setup Defaults	Loads the factory default values for all the Setup options.
Load Custom Defaults	Loads the custom defaults for Setup options.
Save Custom Defaults	Saves the current values as custom defaults. Normally, the BIOS reads the Setup values from flash memory. If this memory is corrupted, the BIOS reads the custom defaults. If no custom defaults are set, the BIOS reads the factory defaults.
Discard Changes	Discards changes without exiting Setup. The option values present when the computer was turned on are used.

4 Upgrading the BIOS

This chapter describes how to upgrade the BIOS and how to recover the BIOS if an upgrade fails.

Preparing for the Upgrade

Before you upgrade the BIOS, prepare by:
- Obtaining the BIOS upgrade file
- Recording the current BIOS settings
- Creating a bootable diskette
- Creating the BIOS upgrade diskette

Obtaining the BIOS Upgrade File

You can upgrade to a new version of the BIOS by using the BIOS upgrade file. The BIOS upgrade file is a compressed self-extracting archive that contains all the files you need to upgrade the BIOS. The BIOS upgrade file contains:
- New BIOS files
- BIOS recovery files
- Intel Flash Memory Update Utility

You can obtain the BIOS upgrade file through your computer supplier or from the Intel World Wide Web site:

http://support.intel.com/support/motherboards/desktop/

⟹ **NOTE**

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

The Intel Flash Memory Update Utility allows you to:
- Upgrade the BIOS in flash memory.
- Update the language section of the BIOS.

Recording the Current BIOS Settings

1. Boot the computer and press <F2> when you see the message:

        Press <F2> Key if you want to run SETUP

▭⟩ **NOTE**

Do not skip step 2. You will need these settings to configure your computer at the end of the upgrade procedure.

2. Write down the current settings in the BIOS Setup program.

Creating a Bootable Diskette

⟹ **NOTE**

If your drive A is an LS-120 diskette drive, you must use a 1.44-MB diskette as the bootable BIOS upgrade diskette. The computer is unable to recover a BIOS from an LS-120 diskette.

1. Use a DOS, Windows 95, or Windows 98 system to create the diskette.
2. Insert a diskette in diskette drive A.
3. At the C:\ prompt, for an unformatted diskette, type:

    ```
    format a:/s
    ```

    or, for a formatted diskette, type:

    ```
    sys a:
    ```
4. Press <Enter>.

Creating the BIOS Upgrade Diskette

Obtain the BIOS upgrade file as described in "Obtaining the BIOS Upgrade File" and then:

1. Then copy the BIOS upgrade file to a temporary directory on your hard disk.
2. From the C:\ prompt, change to the temporary directory.
3. To extract the file, type the name of the BIOS upgrade file, for example:

    ```
    10006BI1.EXE
    ```
4. Press <Enter>. The extracted file contains the following files:

    ```
    LICENSE.TXT

    BIOINSTR.TXT

    BIOS.EXE
    ```
5. Read the LICENSE.TXT file, which contains the software license agreement, and the BIOINSTR.TXT file, which contains the instructions for the BIOS upgrade.
6. Insert the bootable diskette into drive A.
7. To extract the BIOS.EXE file to the diskette, change to the temporary directory that holds the BIOS.EXE file and type:

    ```
    BIOS A:
    ```
8. Press <Enter>.
9. The diskette now holds the new BIOS files, the Intel® Flash Update Utility, and the recovery files.

Upgrading the BIOS

1. Boot the computer with the BIOS upgrade diskette in drive A. The flash memory update utility screen appears.
2. Select `Update Flash Memory From a File`.
3. Select `Update System BIOS`. Press `<Enter>`.
4. Use the arrow keys to select the correct `.bio` file. Press `<Enter>`.
5. When the utility asks for confirmation that you want to flash the new BIOS into memory, select `Continue with Programming`. Press `<Enter>`.
6. When the utility displays the message `upgrade is complete`, remove the diskette. Press `<Enter>`.
7. As the computer boots, check the BIOS identifier (version number) to make sure the upgrade was successful.
8. To enter the BIOS Setup program, press `<F2>` when you see the message:

        Press <F2> Key if you want to run SETUP

9. For proper operation, load the BIOS Setup program defaults. To load the defaults, press `<F9>`.
10. To accept the defaults, press `<Enter>`.
11. In Setup, set the options to the settings you wrote down before beginning the BIOS upgrade.
12. To save the settings, press `<F10>`.
13. To accept the settings, press `<Enter>`.
14. Turn off the computer and reboot.

Recovering the BIOS

It is unlikely that anything will interrupt the BIOS upgrade; however, if an interruption occurs, the BIOS could be damaged. The following steps explain how to recover the BIOS if an upgrade fails. The following procedure uses recovery mode for the Setup program. See Chapter 3 for more information on Setup modes.

✏ **NOTE**

Because of the small amount of code available in the non-erasable boot block area, there is no video support. You will not see anything on the screen during this procedure. Monitor the procedure by listening to the speaker and looking at the diskette drive LED.

1. Turn off the computer, disconnect the computer's power cord, and disconnect all external peripherals.
2. Remove the computer cover and locate the configuration jumper block (J8A1) (see Figure 7).
3. Remove the jumper from all pins as shown below to set recovery mode for Setup.

J8A1

1 ☐ ○ ○ 3

OM07073

4. Insert the bootable BIOS upgrade diskette into diskette drive A.

5. Replace the computer cover, connect the power cord, turn on the computer, and allow it to boot. The recovery process will take a few minutes.
6. Listen to the speaker.

   - Two beeps and the end of activity in drive A indicate successful BIOS recovery.
   - A series of continuous beeps indicates failed BIOS recovery.

7. If recovery fails, return to step 1 and repeat the recovery process.
8. If recovery is successful, turn off the computer and disconnect its power cord.
9. Remove the computer cover and continue with the following steps.
10. On the jumper block (J8A1), move the jumper back to pins 1-2 as shown below to set normal mode for Setup.

J8A1

1 ◼◼◯ 3

OM07072
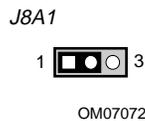
11. Leave the upgrade diskette in drive A, replace the computer cover, and connect the computer's power cord.
12. Turn on the computer and continue with the BIOS upgrade (see page 49).

Changing the BIOS Language

You can use the BIOS upgrade utility to change the language the BIOS uses for messages and the Setup program. Use a bootable diskette containing the Intel Flash Memory Update Utility and language files (see "Upgrading the BIOS" on page 49).

1. Boot the computer with the bootable diskette in drive A. The BIOS upgrade utility screen appears.
2. Select Update Flash Memory From a File.
3. Select Update Language Set. Press <Enter>.
4. Select drive A and use the arrow keys to select the correct .lng file. Press <Enter>.
5. When the utility asks for confirmation that you want to flash the new language into memory, select Continue with Programming. Press <Enter>.
6. When the utility displays the message upgrade is complete, remove the diskette. Press <Enter>.
7. The computer will reboot and the changes will take effect.

5 Technical Reference

Motherboard Connectors

Figure 15 shows the location of some of the motherboard connectors.
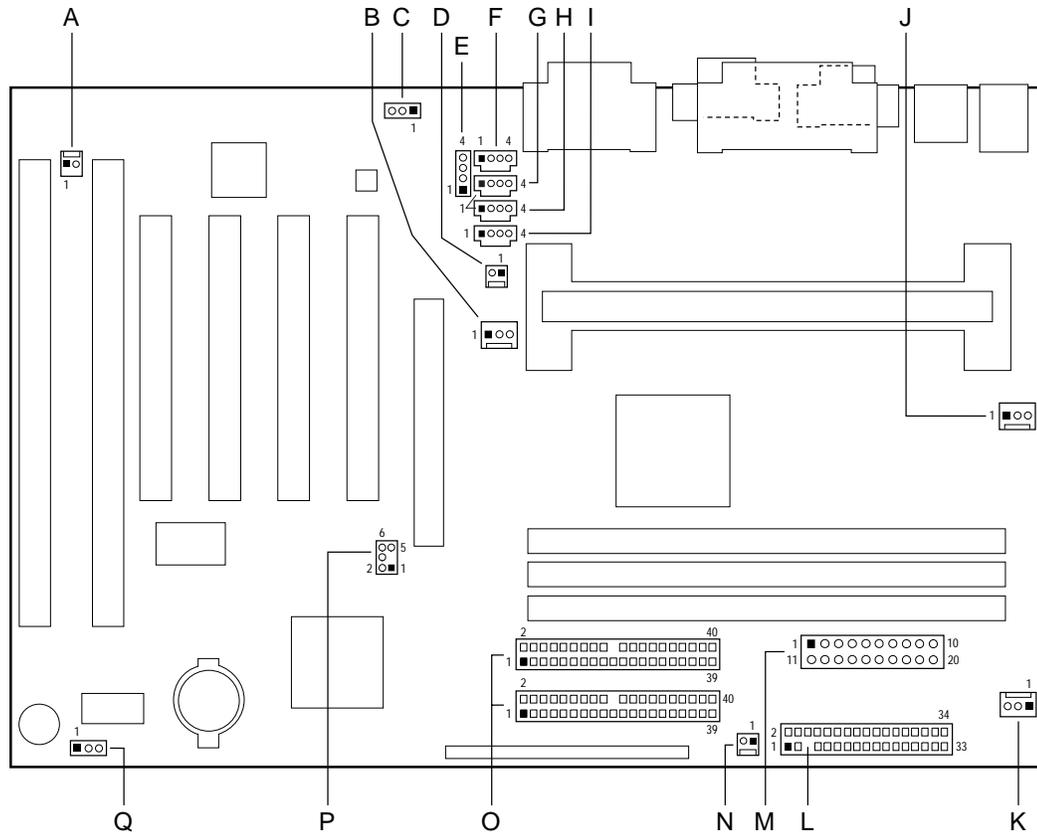
OM07175

A	Wake on Ring	I	Video In (optional)
B	Fan 3	J	Processor active fan
C	Wake on LAN technology (optional)	K	Fan 1
D	Chassis intrusion (optional)	L	Diskette drive
E	Legacy CD-ROM audio	M	Power supply
F	CD-ROM audio (optional)	N	SCSI LED (optional)
G	Telephony (optional)	O	IDE connectors
H	Auxiliary Line In (optional)	P	PC/PCI
		Q	Configuration jumper block

Figure 15. Motherboard Connectors

Table 20.   Wake on Ring Connector

Pin	Signal Name
1	Ground
2	RINGA#

Table 21.   Fan 3 Connector

Pin	Signal Name
1	Ground
2	+12 V
3	Ground

Table 22.   Wake on LAN Technology Connector

Pin	Signal Name
1	+5 VSB
2	Ground
3	WOL

Table 23.   Chassis Intrusion Connector

Pin	Signal Name
1	Ground
2	CHS_SEC

Table 24.   Legacy CD-ROM Audio Connector (Optional)

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

Table 25.   Optional CD-ROM Audio Connector (black)

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

Table 26. Optional Telephony Connector (green)

Pin	Signal Name
1	Audio In (monaural)
2	Ground
3	Ground
4	Mic preamp Out (to modem)

Table 27. Optional Auxiliary Line In Connector (white)

Pin	Signal Name
1	Left Line In
2	Ground
3	Ground
4	Right Line In (monaural)

Table 28. Optional Video In Connector (blue)

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

Table 29. Processor Active Fan Connector

Pin	Signal Name
1	Ground
2	FAN_CTRL (+12 V)
3	FAN_SEN*

* If the optional hardware monitor is not available, pin 3 is ground.

Table 30. Fan 1 Connector

Pin	Signal Name
1	Ground
2	FAN_CTRL (+12 V)
3	FAN_SEN*

* If the optional hardware monitor is not available, pin 3 is ground.

Table 31.   Power Supply Connector

Pin	Signal Name	Pin	Signal Name
1	+3.3 V	11	+3.3 V
2	+3.3 V	12	-12 V
3	Ground	13	Ground
4	+5 V	14	PS-ON# (power supply remote on/off control)
5	Ground	15	Ground
6	+5 V	16	Ground
7	Ground	17	Ground
8	PWRGD (Power Good)	18	-5 V
9	+5 VSB	19	+5 V
10	+12 V	20	+5 V

Table 32.   SCSI LED Connector (Optional)

Pin	Signal Name
1	DRV_ACT#
2	No connect

Table 33.   PC/PCI Connector

Pin	Signal Name	Pin	Signal Name
1	P_PCIGNTA#	2	Ground
3	No connect	4	P_PCIREQA#
5	Ground	6	SER_IRQ

Front Panel Connectors

The motherboard has connectors for controls and indicators typically located on the front panel of the computer.
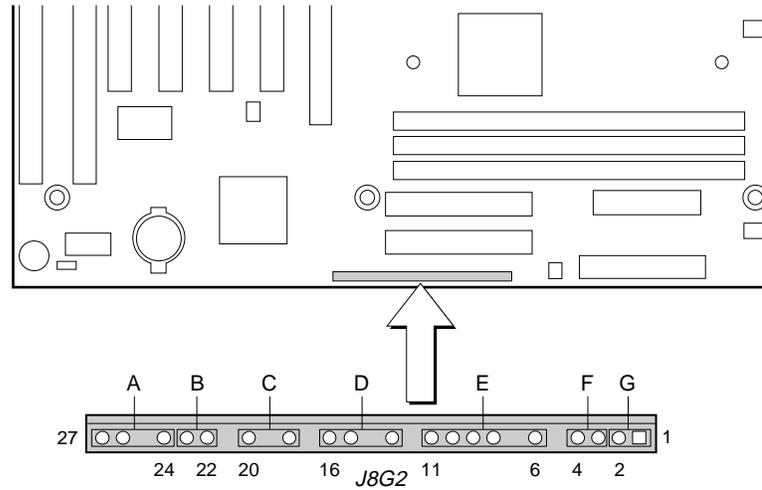
Figure 16. Front Panel Connectors

Table 34.   Front Panel I/O Connectors

Connector	Pin	Signal Name	Connector	Pin	Signal Name
A. Offboard Speaker	27	SPKR		13	HD_PWR +5 V (5 V, 15mA max)
(SPEAKER)	26	SPKR	none	12	Key
	25	Key	E. Infrared (IrDA)	11	+5 V
	24	Ground	(INFRARED)	10	IR_TX
B. Reset	23	FP_RESET#		9	Ground
(RESET)	22	Ground		8	IR_RX
none	21	Key		7	Key
C. Sleep/Power LED	20	PWR_LED1 (green)		6	+5 V
(PWR/LED)	19	Key	none	5	Key
	18	PWR_LED0 (yellow)	F. Sleep/Resume	4	Ground
none	17	Key	(SLEEP)	3	SLEEP_REQ#
D. Hard Drive LED	16	HD_PWR (5 V, 15 mA max.)	G. Power On	2	Ground
(HD LED)	15	HD Active#	(PWR ON)	1	SW_ON#
	14	Key			

Motherboard Resources

Memory Map

Table 35.   Memory Map

Address Range (decimal)	Address Range (hex)	Size	Description
1024 K - 393216 K	100000 - 18000000	383 MB	Extended memory
928 K - 1024 K	E8000 - FFFFF	96 KB	System BIOS
896 K - 928 K	E0000 - E7FFF	32 KB	System BIOS (available as UMB)
800 K - 896 K	C8000 - DFFFF	96 KB	Available high DOS memory (open to ISA and PCI buses)
640 K - 800 K	A0000 - C7FFF	160 KB	Video memory and BIOS
0 K - 640 K	00000 - 9FFFF	640 KB	Conventional memory

DMA Channels

Table 36.   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	Diskette drive
3	8- or 16-bits	Parallel port (for ECP)/audio
4		Reserved - cascade channel
5	16-bits	Open
6	16-bits	Open
7	16-bits	Open

I/O Map

Table 37.   I/O Map

Address (hex)	Size	Description
0000 - 000F	16 bytes	DMA controller 1
0020 - 0021	2 bytes	Interrupt controller 1
002E - 002F	2 bytes	Super I/O controller configuration registers
0040 - 0043	4 bytes	Counter/Timer 1
0048 - 004B	4 bytes	Counter/Timer 2
0060	1 byte	Keyboard controller
0061	1 byte	NMI, speaker control
0064	1 byte	Keyboard controller
0070 - 0071	2 bytes	Real time clock controller
0080 - 008F	16 bytes	DMA page registers
00A0 - 00A1	2 bytes	Interrupt controller 2
00B2 - 00B3	2 bytes	APM control
00C0 - 00DE	31 bytes	DMA controller 2
00F0 - 00FF	16 bytes	Numeric processor
0120 - 0127	8 bytes	Audio controller
0170 - 0177	8 bytes	Secondary IDE controller
01F0 - 01F7	8 bytes	Primary IDE controller
0201	1 byte	Audio / game port / joy stick
0202	1 byte	Audio / game port / joy stick
0204	1 byte	Audio / game port / joy stick
0205	1 byte	Audio / game port / joy stick
0220 - 022F	16 bytes	Audio (Sound Blaster[†] compatible)
0228 - 022F	8 bytes	LPT3
0240 - 024F	16 bytes	Audio (Sound Blaster compatible)
0260 - 026F	16 bytes	Audio (Sound Blaster compatible)
0274 - 0277	4 bytes	I/O read data port for ISA Plug and Play enumerator
0278 - 027F	8 bytes	LPT2
0280 - 028F	16 bytes	Audio (Sound Blaster compatible)
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 - 0377	2 bytes	Secondary IDE controller
0378 - 037F	8 bytes	LPT1
0388 - 038B	4 bytes	AdLib[†] (FM synthesizer)
0398 - 039B	4 bytes	AdLib (FM synthesizer)
03A0 - 03A3	4 bytes	AdLib (FM synthesizer)
03A8 - 03AB	4 bytes	AdLib (FM synthesizer)
03B0 - 03BB	12 bytes	Video (monochrome)
03C0 - 03DF	32 bytes	Video (VGA[†])
03E8 - 03EF	8 bytes	COM3

Table 37.   I/O Map (continued)

Address (hex)	Size	Description
03F0 - 03F5, 03F7	7 bytes	Diskette controller
03F6	1 byte	Primary IDE controller
03F8 - 03FF	8 bytes	COM1
04D0 - 04D1	2 bytes	Edge/level triggered PIC
0530 - 0537	8 bytes	Windows Sound System
LPT*n* + 400h	8 bytes	ECP port, LPT*n* base address + 400h
0CF8 - 0CFF*	8 bytes	PCI configuration registers
0CF9**	1 byte	Turbo and reset control register

*   DWORD access only

**   Byte access only

PCI Configuration Space Map

Table 38.   PCI Configuration Space Map

Bus Number (hex)	Device Number (hex)	Function Number (hex)	Description
00	00	00	Intel 82443BX (PAC)
00	01	00	Intel 82443BX (PAC) AGP bus
00	07	00	Intel 82371EB (PIIX4E) PCI/ISA bridge
00	07	01	Intel 82371EB (PIIX4E) IDE bus master
00	07	02	Intel 82371EB (PIIX4E) USB
00	07	03	Intel 82371EB (PIIX4E) power management
00	0C	00	Audio/multimedia controller
00	0D	00	PCI expansion slot 1 (J4D2)
00	0E	00	PCI expansion slot 2 (J4D1)
00	0F	00	PCI expansion slot 3 (J4C1)
00	10	00	PCI expansion slot 4 (J4B1)

Interrupts

Table 39.   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	Diskette drive controller
7	LPT1*
8	Real time clock
9	Reserved
10	USB/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

Technical Reference

A Error Messages

BIOS Beep Codes

One long beep followed by several short beeps indicates a video problem.

Table 40.   Beep Codes

Beeps	Port 80h Code	Explanation
1-2-2-3	16h	BIOS ROM checksum
1-3-1-1	20h	Test DRAM refresh
1-3-1-3	22h	Test Keyboard Controller
1-3-3-1	28h	Autosize DRAM
1-3-3-2	29h	Initialize POST Memory Manager
1-3-3-3	2Ah	Clear 512 KB base RAM
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
2-1-2-2	45h	POST device initialization
2-1-2-3	46h	Check ROM copyright notice
2-2-3-1	58h	Test for unexpected interrupts
2-2-4-1	5Ch	Test RAM between 512 and 640 KB
1-2	98h	Search for option ROMs. One long, two short beeps on checksum failure

BIOS Error Messages

Table 41.   BIOS Error Messages

Error Message	Explanation
Diskette drive A error	Drive A 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 hexadecimal 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 to be sure the fixed-disk type is correctly identified.
Incorrect Drive A type - run SETUP	Type of diskette drive for drive A 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 displayed 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.
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.

nnnn = hexadecimal number

B Regulatory and Integration Information

This appendix contains:

* Safety standards, electromagnetic compatibility regulations, and product certification markings for this motherboard
* Instructions and precautions for integrators who are installing this motherboard in a chassis

Regulatory Compliance

This motherboard complies with the following safety and EMC regulations when correctly installed in a compatible host system.

Table 42. Safety Regulations

Regulation	Title
UL 1950 - CSA 950-95, 3rd edition, Dated 07-28-95	The Standard for Safety of Information Technology Equipment including Electrical Business Equipment. (USA and Canada)
EN 60 950, 2nd Edition, 1992 (with Amendments 1, 2, and 3)	The Standard for Safety of Information Technology Equipment including Electrical Business Equipment. (European Union)
IEC 950, 2nd edition, 1991 (with Amendments 1, 2, 3, and 4)	The Standard for Safety of Information Technology Equipment including Electrical Business Equipment. (International)
EMKO-TSE (74-SEC) 207/94	Summary of Nordic deviations to EN 60 950. (Norway, Sweden, Denmark and Finland)

Table 43. EMC Regulations

Regulation	Title
FCC Class B	Title 47 of the Code of Federal Regulations, Parts 2 and 15, Subpart B, pertaining to unintentional radiators. (USA)
CISPR 22, 2nd Edition, 1993	Limits and methods of measurement of Radio Interference Characteristics of Information Technology Equipment. (International)
EN 55 022, 1995	Limits and methods of measurement of Radio Interference Characteristics of Information Technology Equipment. (Europe)
EN 50 082-1 (1992)	Generic Immunity Standard; Currently compliance is determined via testing to IEC 801-2, -3, and -4. (Europe)
VCCI Class B (ITE)	Implementation Regulations for Voluntary Control of Radio Interference by Data Processing Equipment and Electronic Office Machines. (Japan)
ICES-003, Issue 2	Interference-Causing Equipment Standard, Digital Apparatus. (Canada)

Product Certification Markings

This printed circuit board 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.
- Each board will be marked with an FCC Declaration of Conformity.
- Canadian Compliance: Consists of small c followed by a stylized backward UR on component side of the board.

Installation Precautions

When you install and test the motherboard, observe all warnings and cautions in the installation instructions.

To avoid injury, be careful of:

- Sharp pins on connectors
- Sharp pins on printed circuit assemblies
- Rough edges and sharp corners on the chassis
- Hot components (like processors, voltage regulators, and heat sinks)
- Damage to wires that could cause a short circuit

Observe all warnings and cautions that instruct you to refer computer servicing to qualified technical personnel.

⚠ WARNING

Do not open the power supply. Risk of electric shock and burns from high voltage and rapid overheating. Refer servicing of the power supply to qualified technical personnel.

Installation Instructions

⚠ CAUTION

Follow these guidelines to meet safety and regulatory requirements when installing this board assembly.

Read and adhere to all of these instructions and the instructions supplied with the host computer and associated modules. If the instructions for the host computer are inconsistent with these instructions or the instructions for associated modules, contact the supplier's technical support to find out how you can ensure that your computer meets safety and regulatory requirements. If you do not follow these instructions and the instructions provided by host computer and module suppliers, you increase safety risk and the possibility of noncompliance with regional laws and regulations.

Ensure Electromagnetic Compatibility (EMC)

Before computer integration, make sure that the power supply and other modules have passed EMC testing using a motherboard with a microprocessor from the same family and operating at the same (or higher) speed as the microprocessor on this motherboard.

In the installation instructions for the host chassis, power supply, and other modules pay close attention to the following:

- Certifications
- External I/O cable shielding and filtering
- Mounting, grounding, and bonding requirements
- Keying connectors when mismating of connectors could be hazardous

If the power supply and other modules have not passed applicable EMC testing before integration, EMC testing must be conducted on a representative sample of the newly completed computer.

Ensure Host Computer and Accessory Module Certifications

Make sure that the host computer, any added subassembly, such as a board or drive assembly, and internal or external wiring, are certified for the region(s) where the end-product will be used. Marks on the product are proof of certification. Certification marks are as follows:

In Europe

The CE marking signifies compliance with all relevant European requirements. If the host computer does not bear the CE marking, obtain a supplier's Declaration of Conformity to the appropriate standards required by the European EMC Directive and Low Voltage Directive. Other directives, such as the Machinery and Telecommunications Directives, may also apply depending on the type of product. No regulatory assessment is necessary for low voltage DC wiring used internally or wiring used externally when provided with appropriate overcurrent protection. Appropriate protection is provided by a maximum 8-Amp current limiting circuit or a maximum 5-Amp fuse or positive temperature coefficient (PTC) resistor. All Intel motherboards now have PTCs on all external ports that provide DC power externally.

In the United States

A certification mark by a Nationally Recognized Testing Laboratory (NRTL) such as UL, CSA, or ETL signifies compliance with safety requirements. External wiring must be UL Listed and suitable for the intended use. Internal wiring must be UL Listed or Recognized and rated for applicable voltages and temperatures. The FCC mark (Class A for commercial or industrial only or Class B for residential) signifies compliance with electromagnetic interference requirements.

In Canada

A nationally recognized certification mark such as CSA or cUL signifies compliance with safety requirements. No regulatory assessment is necessary for low voltage DC wiring used internally or wiring used externally when provided with appropriate overcurrent protection. Appropriate protection is provided by a maximum 8-Amp current limiting circuit or a maximum 5-Amp fuse or positive temperature coefficient (PTC) resistor. All Intel motherboards now have PTCs on all external ports that provide DC power externally.

Prevent Power Supply Overload

Unless the power supply has inherent overcurrent protection, do not overload the power supply output. To avoid overloading the power supply, make sure that the calculated total current load of all the modules within the computer is less than the output current rating of the power supply. If you do not do this, the power supply could overheat, catch fire, or damage the insulation that separates hazardous AC line circuitry from low-voltage user accessible circuitry. If the load drawn by a module cannot be determined by the markings and instructions supplied with the module, contact the module supplier's technical support.

Place Battery Marking on the Computer

There is insufficient space on this motherboard to provide instructions for replacing and disposing of the battery. The following warning must be placed permanently and legibly on the host computer as near as possible to the battery.

⚠ **WARNING**

Danger of explosion if battery is incorrectly replaced.

Replace with only the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions.

Use Only for Intended Applications

This product was evaluated for use in computers that will be installed in offices, homes, schools, computer rooms, and similar locations. The suitability of this product for other applications, (such as medical, industrial, alarm systems, and test equipment) may require further evaluation.