


# PC Specialist's Handbook

## *ErgoPro* *m664-series*

First Edition, Release 1 - March 1998

  
**FUJITSU**

**FUJITSU ErgoPro m664-Series PC Specialist's Handbook****Document number PM 03320 EA**

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## General

ErgoPro m664-series are high performance Pentium II workstations based on ATX form factor system board and mechanics.

There is a new 6-slot ATX housing and a system board without on-board graphics, audio and LAN. All models are equipped with either ATI Xpert@Work AGP or ATI 3D Charger PCI graphics adapter, ATA or Ultra ATA IDE HDD and 20x IDE CD-ROM. Architectures used are AGP/PCI/ISA.

### LITHIUM BATTERY



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

Eksplodingsfare ved fejlaktig håndtering. Udskiftning må kun ske med batteri af samme fabrikat og type. Lever det brugte batteri tilbage til leverandøren.

Paristo voi räjähtää, jos se on virheellisesti asennettu. Vaihda paristo ainoastaan laitevalmistajan suositteluun tyypin. Hävitä käytetty paristo valmistajan ohjeiden mukaisesti.

Eksplodingsfare. Ved udskifting benyttes kun batteri som anbefalt av apparatfabrikanten. Brukt batteri returneres apparat leverandøren.

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

Danger d'explosion en cas de remplacement incorrect de la batterie. Remplacer uniquement avec une batterie de même type ou d'un type recommandé par le constructeur. Jeter les batteries usagées conformément aux instructions du fabricant. Explosionsgefahr bei unsachgemässigem Austausch der Batterie. Ersatz nur durch denselben oder einen vom Hersteller empfohlenen gleichwertigen Typ. Entsorgung gebrauchter Batterien nach Angaben des Herstellers.

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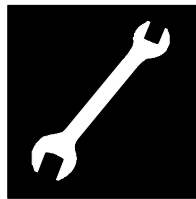
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# Section 1 :

## Disassembling the system units

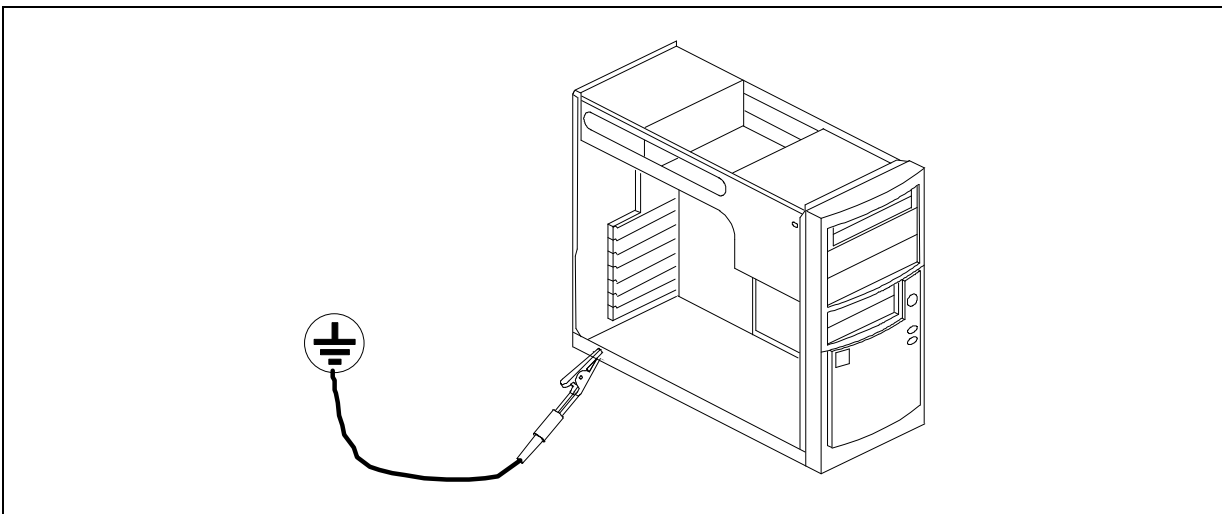
## Common procedures

### Grounding yourself

**Note** Even if the power has been turned off from the PC, as long as the mains cable is connected to the PSU (and power is provided) the +5 StandBy voltage is provided to the system for some crucial components. Therefore hardware is sensitive to static electricity.

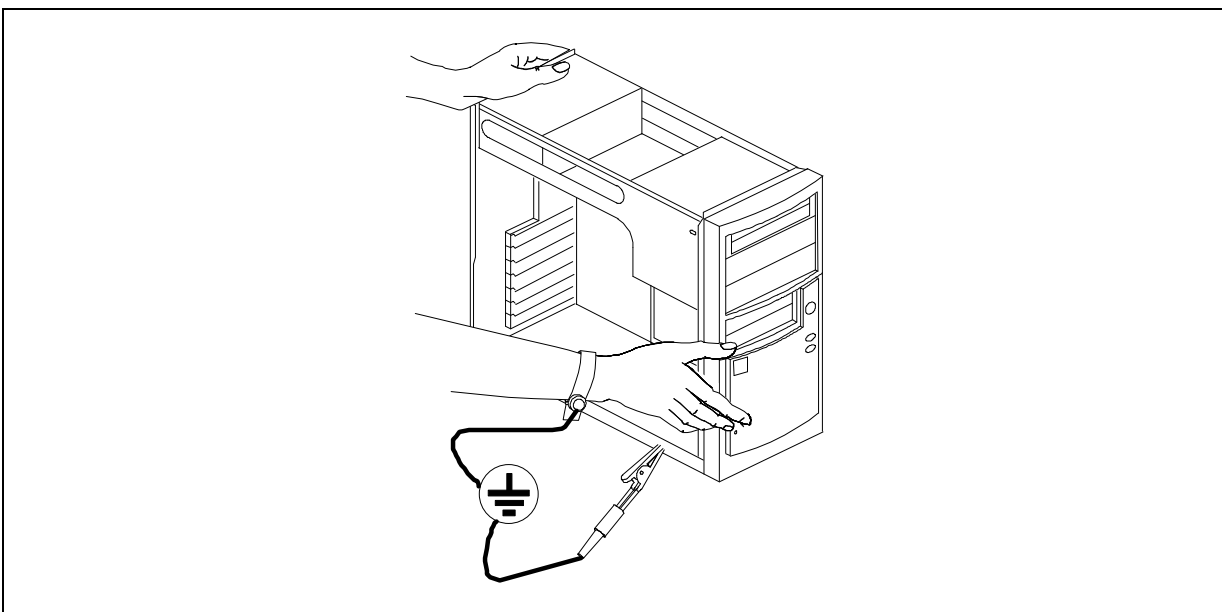
Before touching circuit boards or other devices inside the system unit, be sure to get rid of any static charge you may have by grounding yourself properly. At a minimum, before touching a circuit board, first touch the metal part of the chassis. However, there is a safer way to do this, and the following describes how you should ideally ground yourself :

1. Connect the metal chassis of your computer to a grounded metal object such as a radiator:



Picture 1 : Grounding the unit

2. Ground yourself to any grounded metal object by first attaching a wrist strap made for this purpose around your wrist and then to the metal object:



Picture 2 : Grounding yourself

3. Now you can touch the devices inside your system unit.

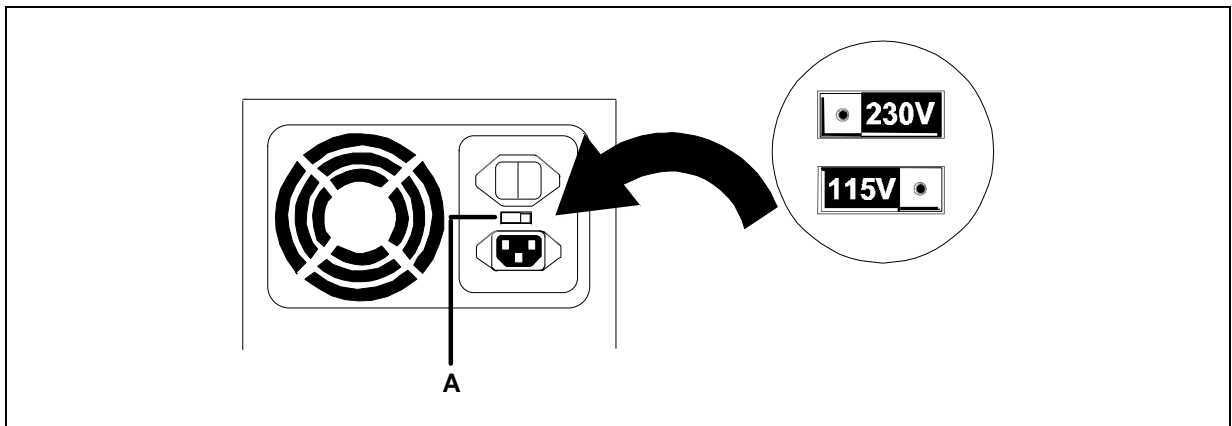
## Checking the Input Voltage Setting

A 235 W in m664-series power supply is integrated into the chassis to provide power for the system board, add-in cards, and peripheral devices. A switch (A) on the system rear panel can be used to set the power supply to operate at:

115 V AC (in the range of 90 - 135 V AC), or

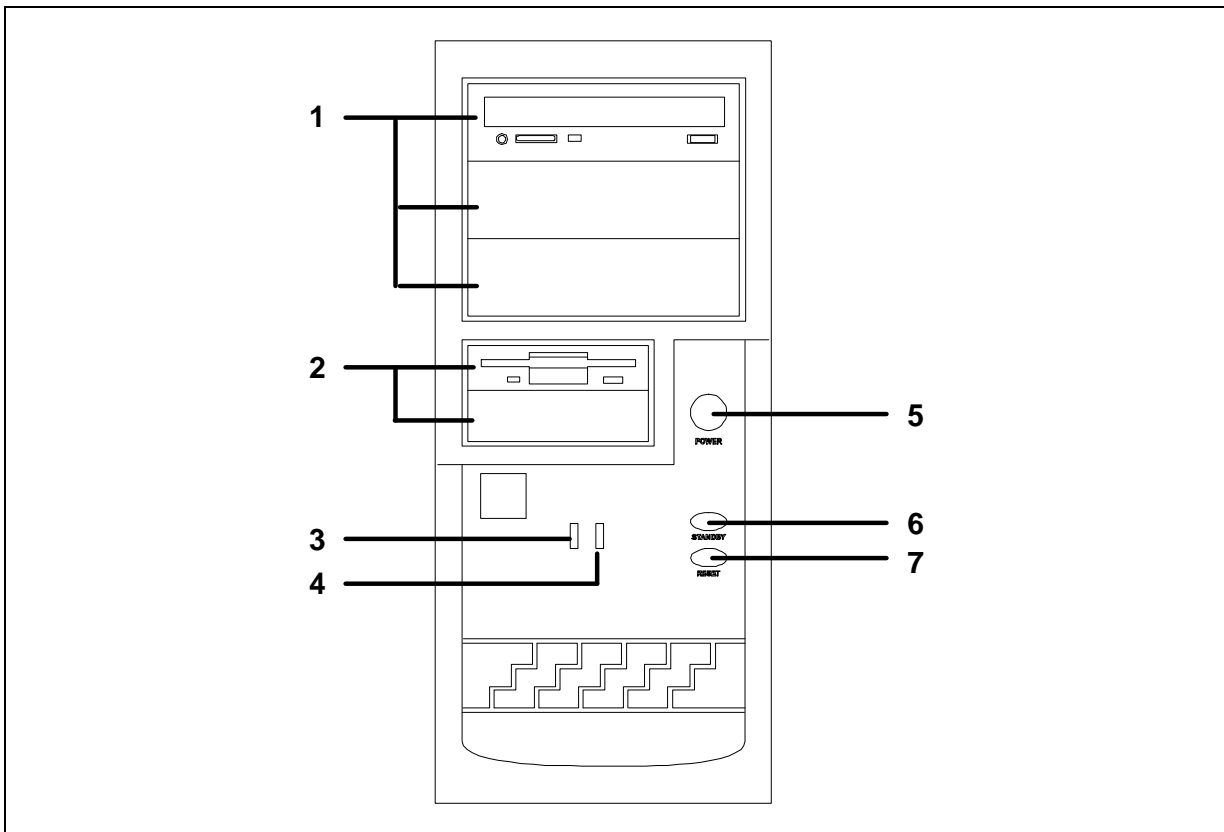
230 V AC (in the range of 180 - 265 V AC)

To verify that your system has the correct setting for your environment, check the input power selection switch.



Picture 3 : Checking the Input Voltage Setting

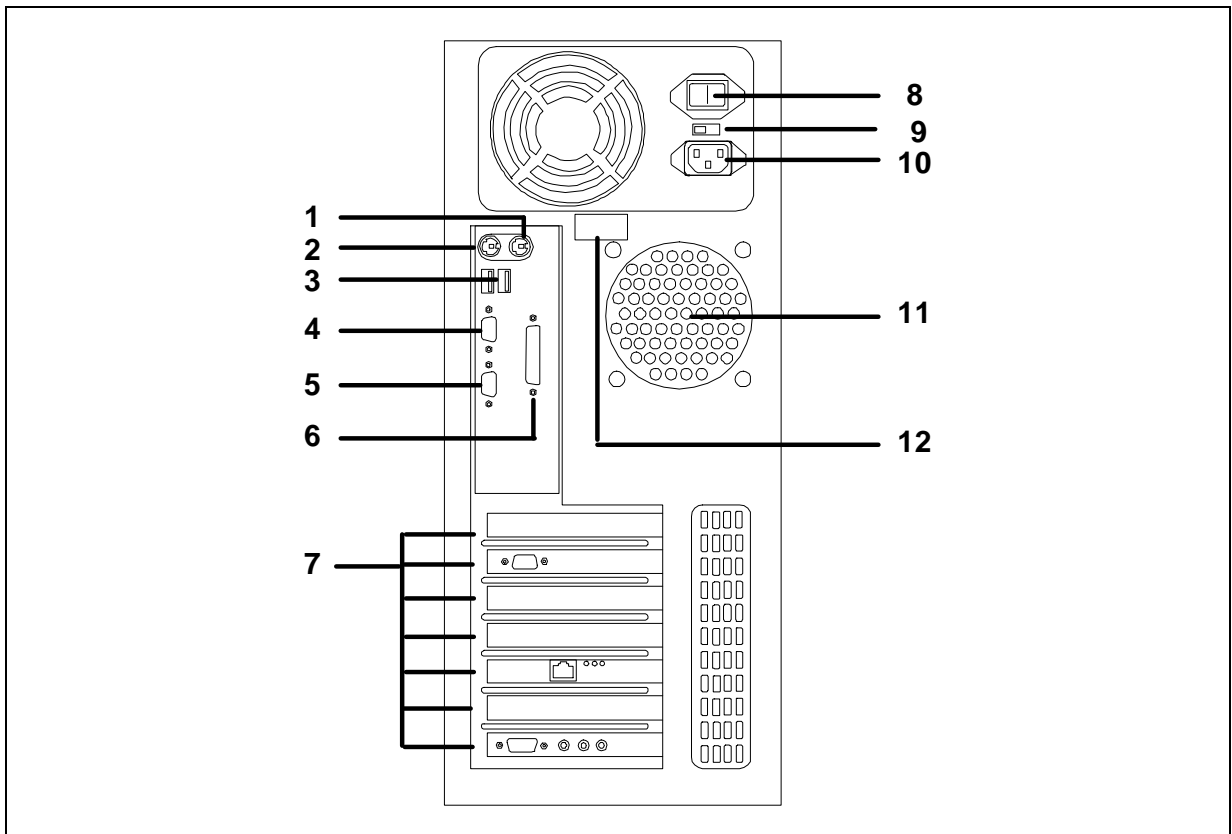
## Unit features (front)



Picture 4 : m664-series Unit features (front)

- |   |                                 |   |                       |
|---|---------------------------------|---|-----------------------|
| 1 | 5,25" device bay                | 5 | Power On/Off switch   |
| 2 | 3,5" device bay                 | 6 | Suspend/resume switch |
| 3 | Power On/Power save LED (green) | 7 | Reset button          |
| 4 | HDD activity LED (orange)       |   |                       |

### Unit features (rear)



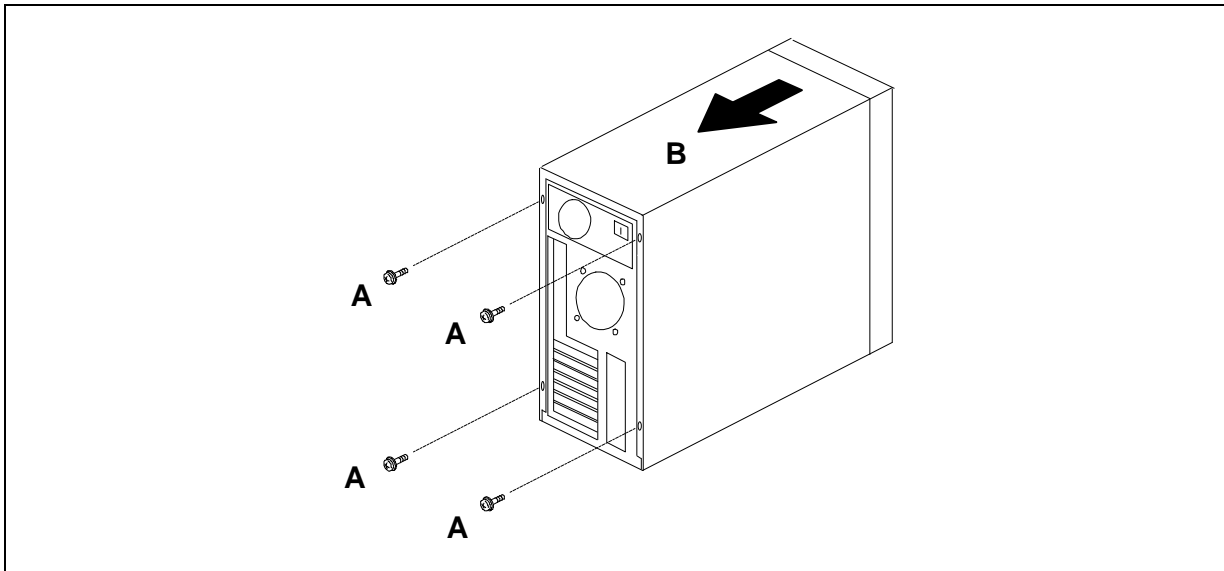
Picture 5: m664-series Unit features (rear)

- |   |                     |    |                                     |
|---|---------------------|----|-------------------------------------|
| 1 | PS/2 Mouse port     | 7  | Expansion slots                     |
| 2 | PS/2 Keyboard port  | 8  | Power switch Main                   |
| 3 | USB rear connectors | 9  | Voltage selection                   |
| 4 | Serial port 1       | 10 | Main In                             |
| 5 | Serial port 2       | 11 | Fan (Airflow direction : blows out) |
| 6 | Parallel port       | 12 | Configuration label                 |

## Opening & closing the system unit cover

To open the system unit cover, do as follows:

1. Remove any diskette(s) and CD-media(s) from the drive(s).
2. Turn off the display unit, system unit (shutting down the Operating System properly before), and all other separately powered attached units.
3. Unplug the power cables of the system unit and other attached cables from their outlets.
4. Remove the four screws (A) at the rear.
5. Slide the cover about 30mm (B) backwards from the front panel of the system unit, and lift it straight up.



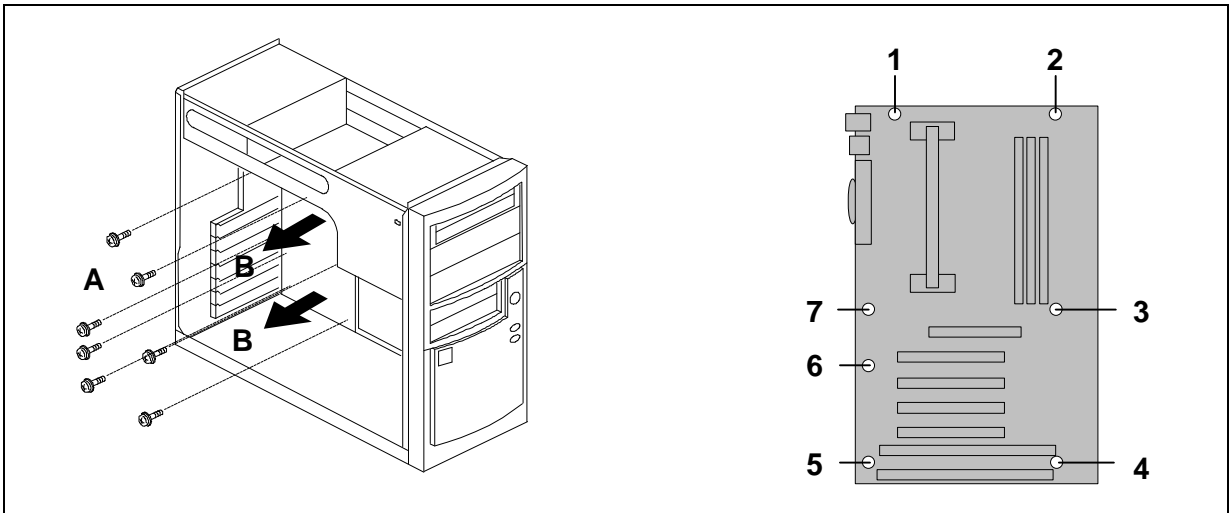
Picture 6 : Open and closing the system cover

## Removing and installing the System board

There are two ways to remove the System board, primary and optional ways.

### Primary:

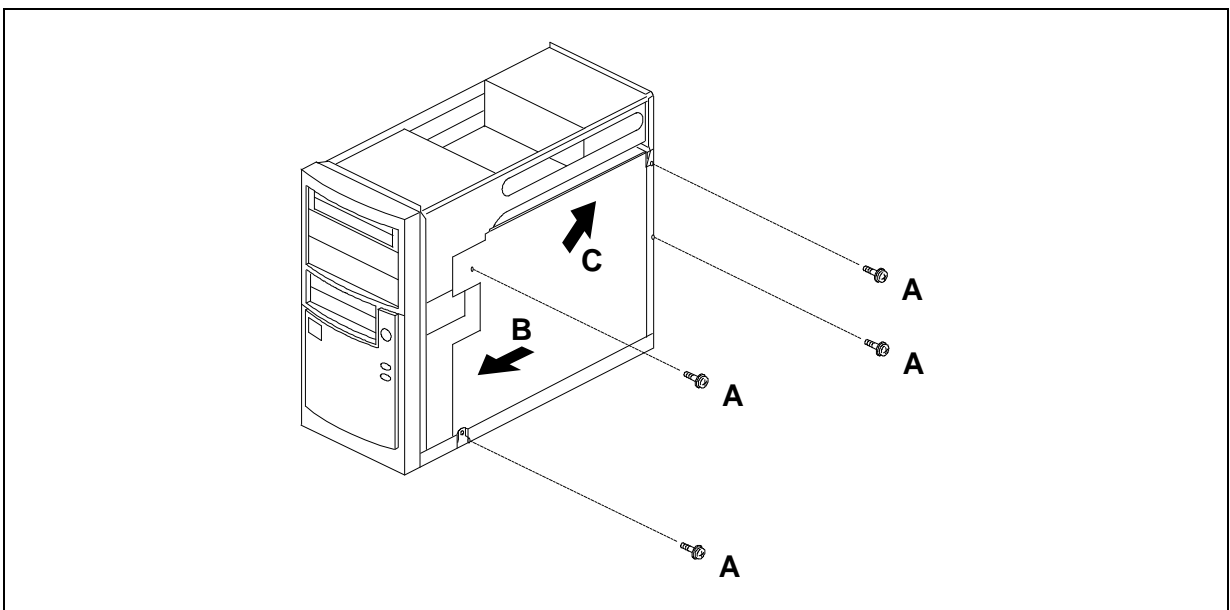
1. Remove the system unit cover (see page 1-6)
2. Disconnect all data, fan and power cables from System board.
3. Disconnect all cables from additional adapter cards.
4. Remove all additional adapter cards from expansion slots (see page 1-10).
5. Remove 7 screws (See picture for location) that holds System board on backplate (A).
6. Take System board out of the chassis with care (B).



Picture 7 : Removing the System board

### Optional:

1. Follow steps 1-4 as mentioned above.
2. Remove 4 screws from backplate of System board on the right side of the System unit (A).
3. Slide backplate about 20mm towards to the front panel of the System unit (B).
4. Lift backplate and take it out of the chassis with care (C).
5. Remove 7 screws that holds System board on backplate (see picture 4).

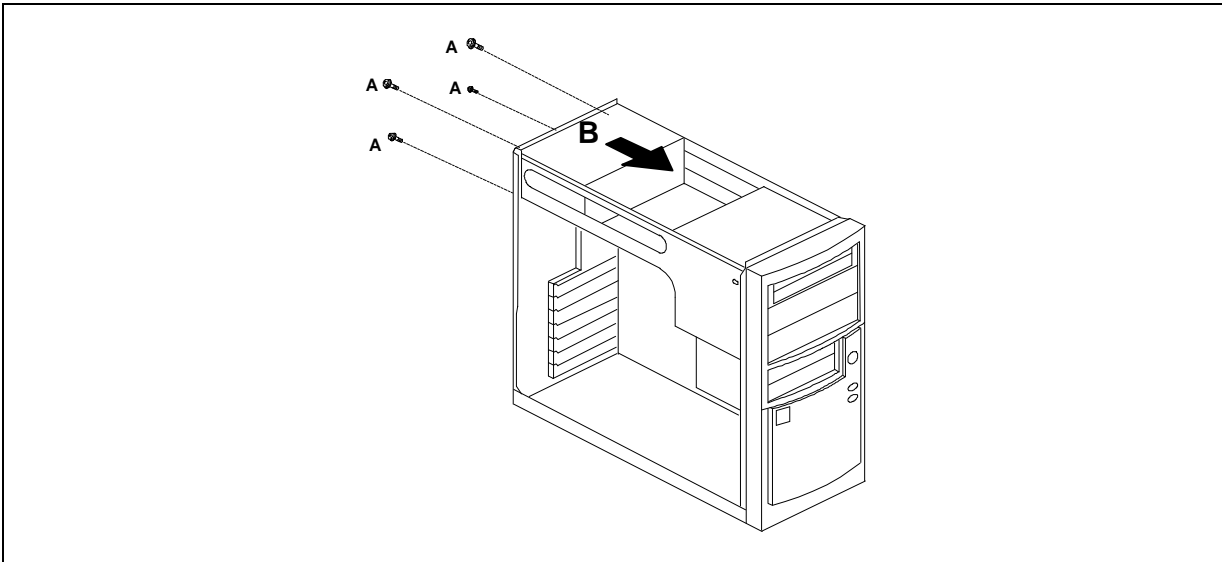


Picture 8 : Removing the System board

## Removing the Power Supply Unit

To remove the Power Supply Unit, do as follows:

1. Remove the system unit cover (see page 1-6)
2. Disconnect power cables from the System board and other devices.
3. Remove 4 screws that holds the Power Supply Unit from behind of the System unit (A).
4. Slide about 30mm the Power Supply Unit towards to the front panel of the System unit (B).
5. Lift the Power Supply Unit and take it off.



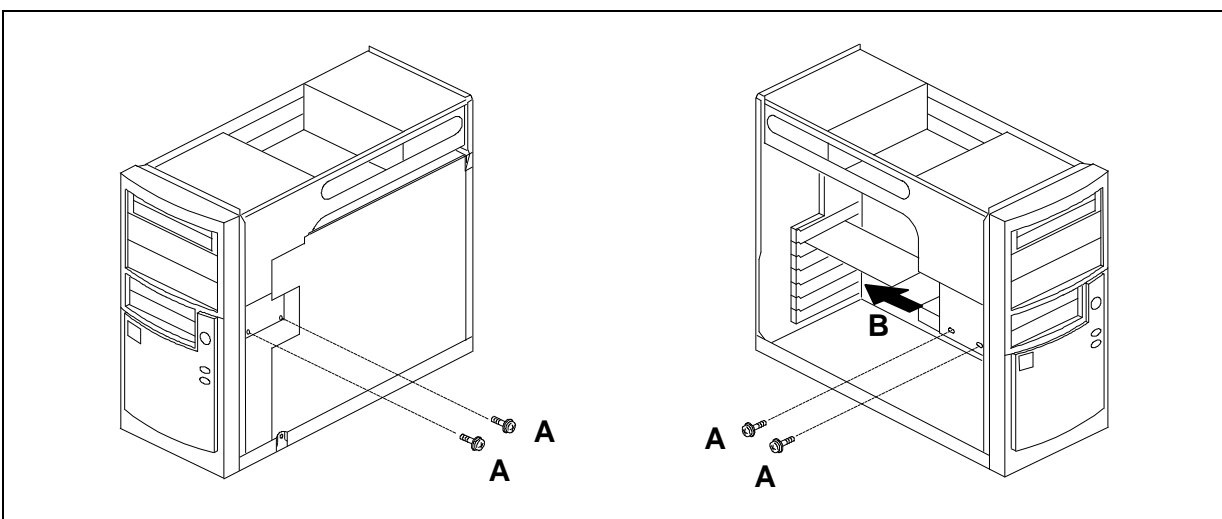
Picture 9 : Removing the Power Supply unit

## Removing and installing the Hard Disk drive

If you have installed a CD-ROM, a Hard Disk or replaced an existing floppy drive, check the parameters in the SETUP.

To remove the Hard Disk drive, do as follows:

1. Open the system unit cover (see page 1-6).
2. Disconnect the power and data cables from the devices attached to the mass memory carriage. Disconnect data cables also from the System Board.
3. Open screws (A) that hold Hard Disk both side of the mass memory carriage.
4. Pull Hard Disk towards to rear of the system unit (B) and take it off.



Picture 10 : Removing the Hard Disk drive

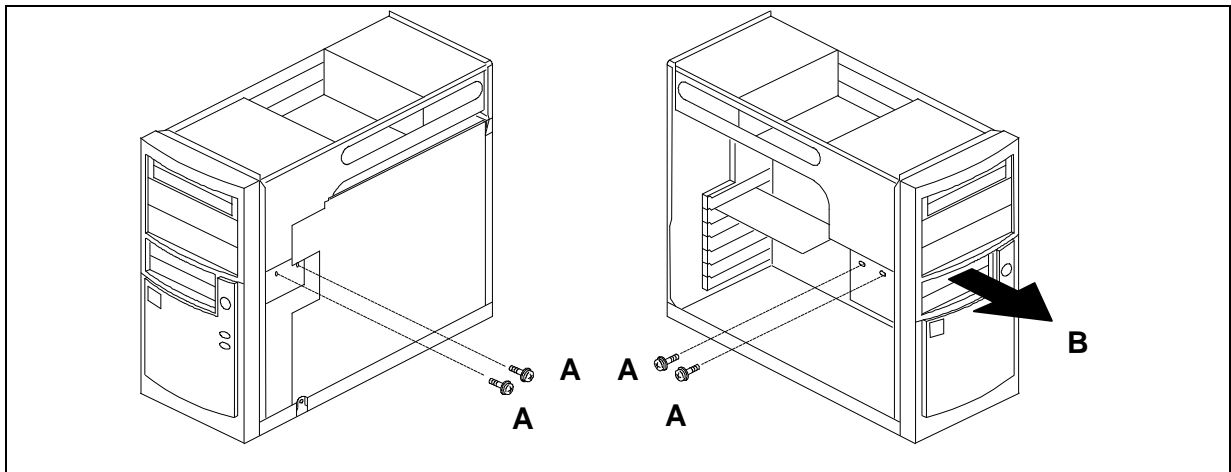


## Removing and installing the Floppy Disk drive

If you have installed a CD-ROM, or replaced an existing floppy drive, check the parameters in the SETUP.

To remove the Floppy Disk drive, do as follows:

1. Remove the system cover (see page 1-6)
2. Disconnect the power and data cables from the devices attached to the mass memory carriage. Disconnect data cables also from the System Board.
3. Open screws (A) that hold Floppy Disk drive both side of the mass memory carriage.
4. Push Floppy drive towards to the Front Panel of the system unit (B) and pull it off.



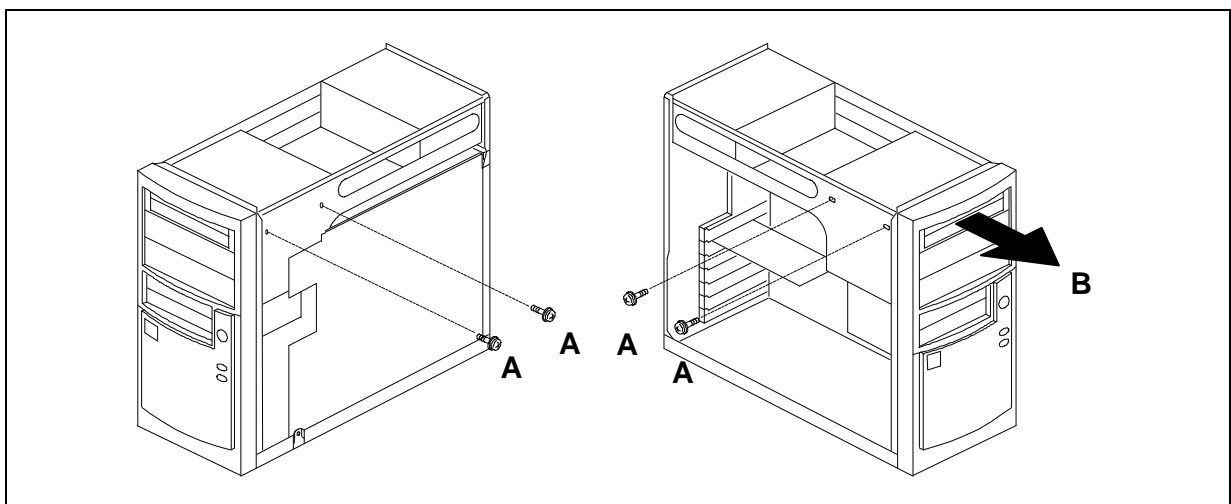
Picture 11: Removing the Floppy Disk drive

## Removing and installing the CD-ROM drive

If you have installed a CD-ROM, a Hard Disk or replaced an existing floppy drive, check the parameters in the SETUP.

To remove the CD-ROM drive, do as follows:

1. Remove the system cover (see page 1-6)
2. Disconnect the power and data cables from the devices attached to the CD-ROM drive. Disconnect data cables also from the System Board.
3. Open screws (A) that hold CD-ROM drive both side of the 5,25" device slot.
4. Push CD-ROM drive towards to the Front Panel of the system unit (B) and pull it off.

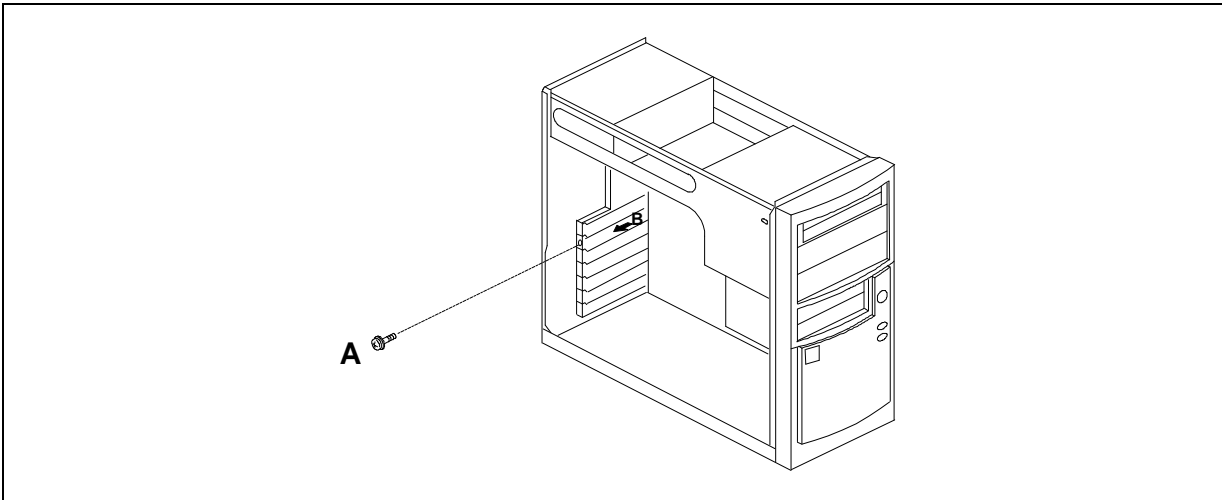


Picture 12: Removing the CD-ROM drive

## Removing/Adding an Expansion Slot Cover

To remove/add the Expansion Slot Cover, do as follows:

1. Remove the System unit cover (see page 1-6)
2. Remove screw that holds the Expansion Slot Cover (A)
3. Pull the Expansion Slot Cover out of the chassis(B).

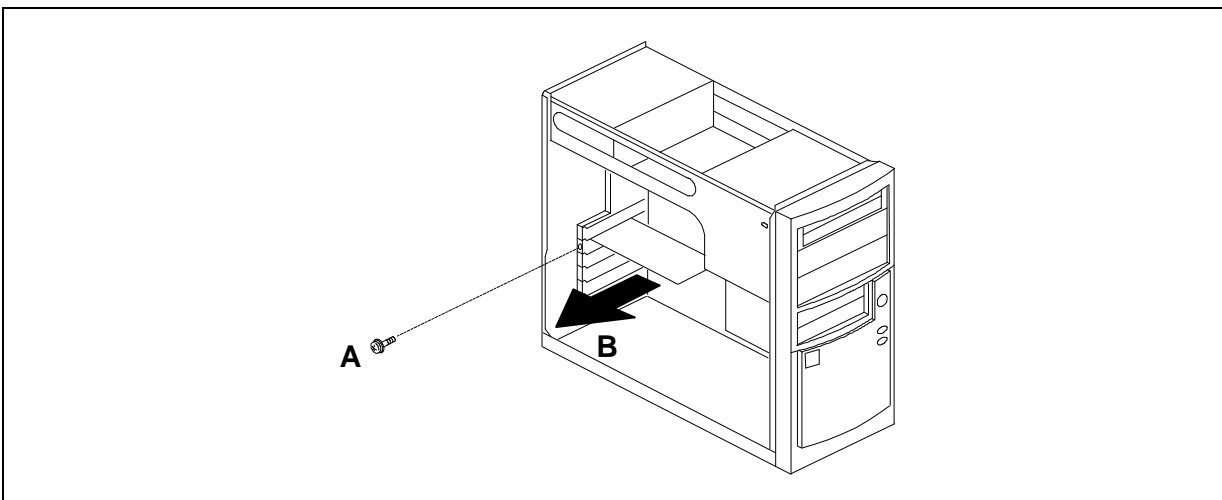


Picture 13 : Removing an Expansion Slot Cover.

## Removing and installing the additional adapter card

To remove the additional adapter card, do as follows:

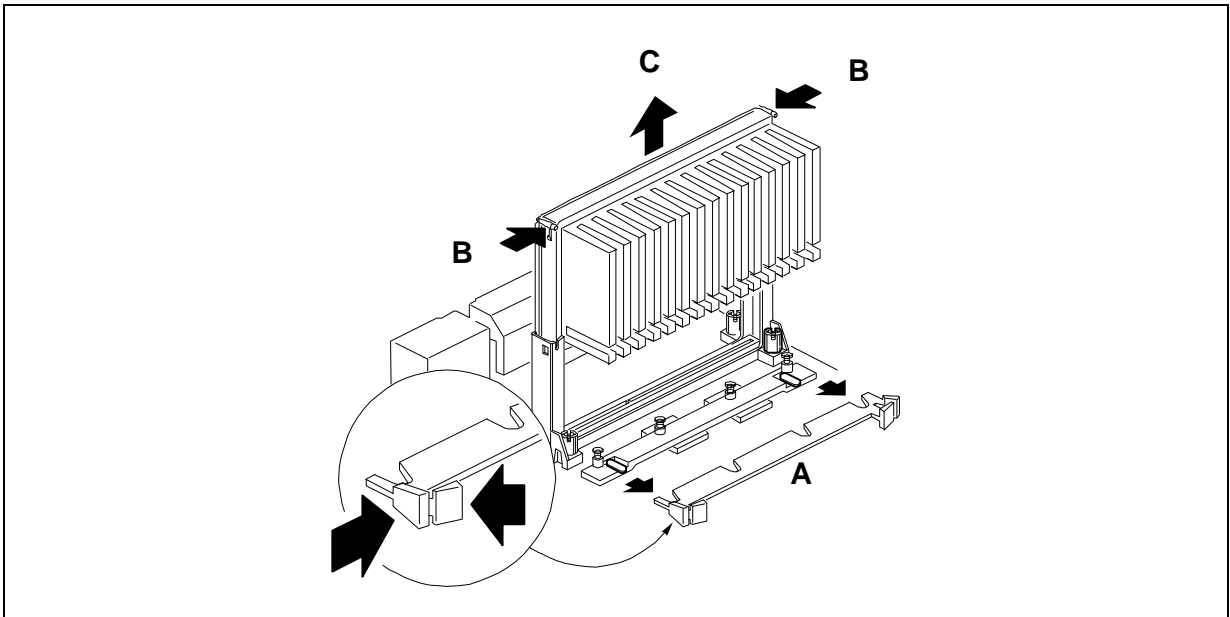
1. Remove the system unit cover (see page 1-6)
2. Disconnect possible cables from the adapter.
3. Remove screw (A) that holds the adapter card in expansion slot.
4. Pull adapter card from expansion slot with care (B).



Picture 14 : Removing additional adapter card.

## Removing a Pentium II processor

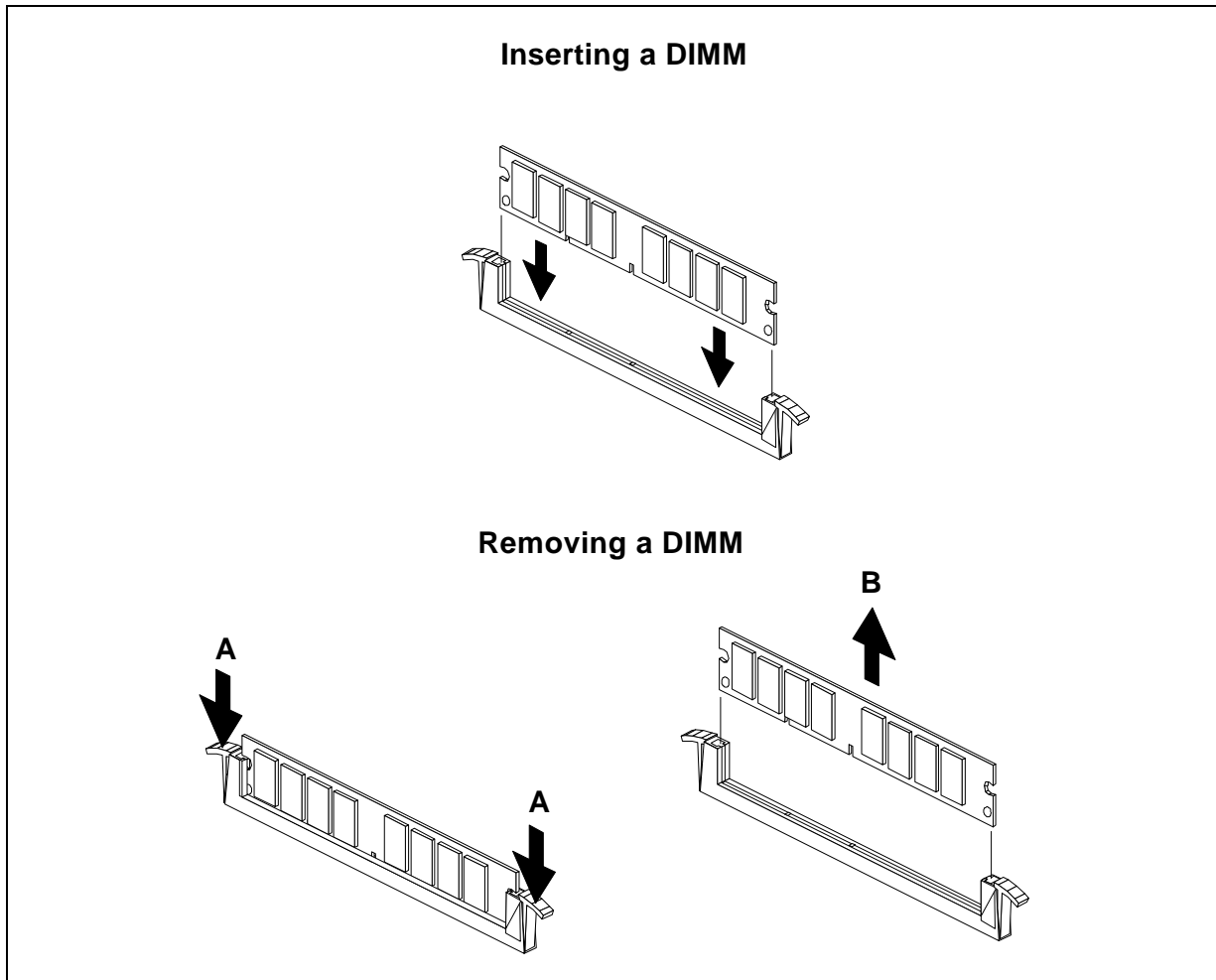
1. Open the system unit cover (see pages 1-6).
2. Touch the metal chassis before touching the processor or system board. Keep part of your body in contact with the metal chassis to dissipate the static charge while handling the processor and avoid moving around needlessly.
3. Carefully remove the lock (A) that secures the processor to the socket.
4. Locate the plastic securing clips (B) at each end of the processor cartridge. Press the clips inward until they snap in place.
5. Disconnect the power cable of the CPU fan.
6. Remove the processor from its slot (C).



Picture 15 : Removing a Pentium II processor

## Adding or Removing a DIMM module

1. Open the system unit cover (see pages 1-6).
2. Touch the metal chassis before touching the DIMM module or system board. Keep part of your body in contact with the metal chassis to dissipate the static charge.
3. Holding the DIMM only by the edges, remove it from its antistatic package.
4. Place the DIMM into the socket and secure it in place with the two plastic clips (A) as shown below.



Picture 16 : Inserting and removing a DIMM module

### To remove a DIMM module :

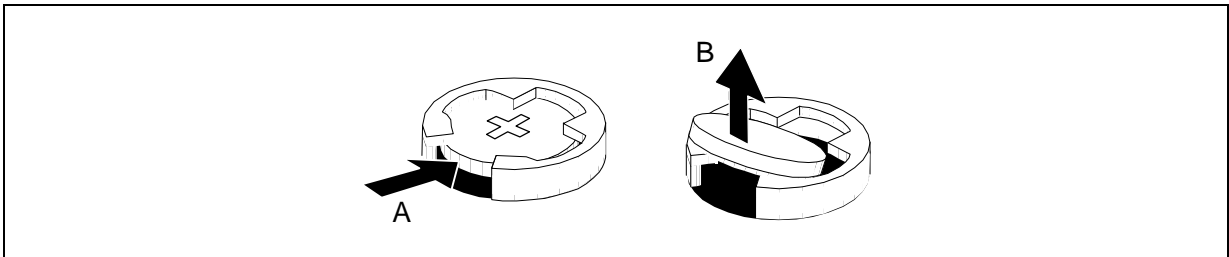
6. Gently spread the retaining clip (A) at each end of the DIMM, as shown above.
7. Holding the DIMM only by the edges, lift it away from the socket (B), as shown above.

## Replacing the battery

A lithium battery, installed in a socket on the system board, provides power for the real-time clock and CMOS RAM. If the battery fails, replace it with an equivalent battery (3 V Lithium Cell battery, Sony CR2032).

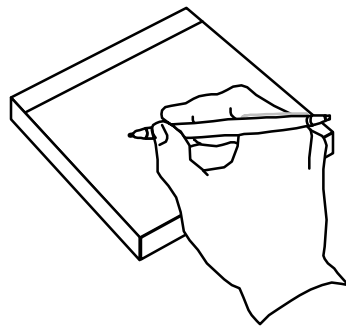
To replace the battery, do the following:

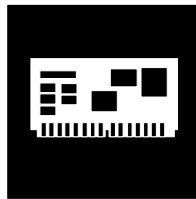
1. Open the system unit cover (see pages 1-6).
2. Touch the metal chassis before touching the DIMM module or system board. Keep part of your body in contact with the metal chassis to dissipate the static charge.
3. Slide (A) the battery in the socket towards the cardedge as far as it easily slides, and then lift the battery out (B).



Picture 17 : Replacing the Battery

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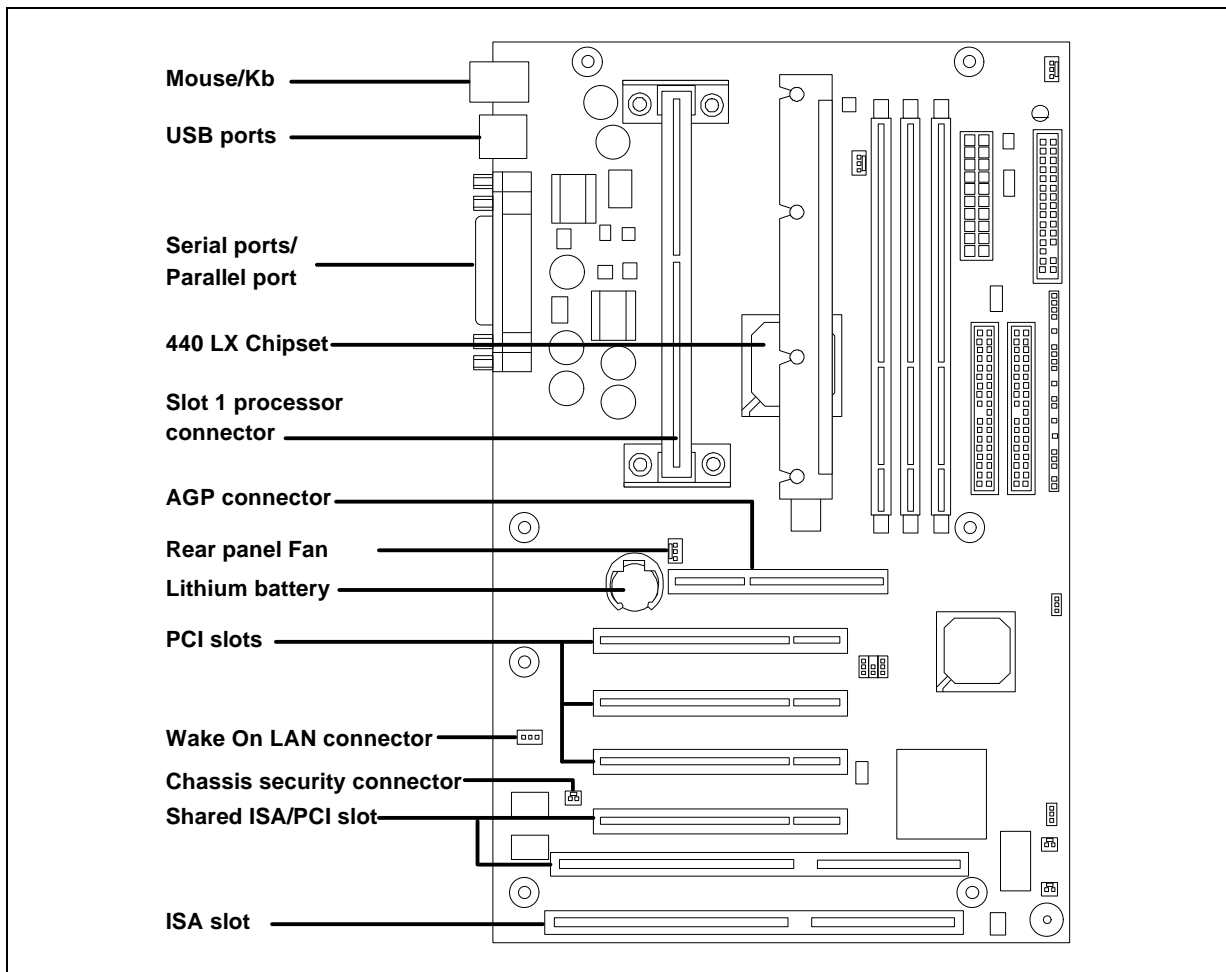




# Section 2 :

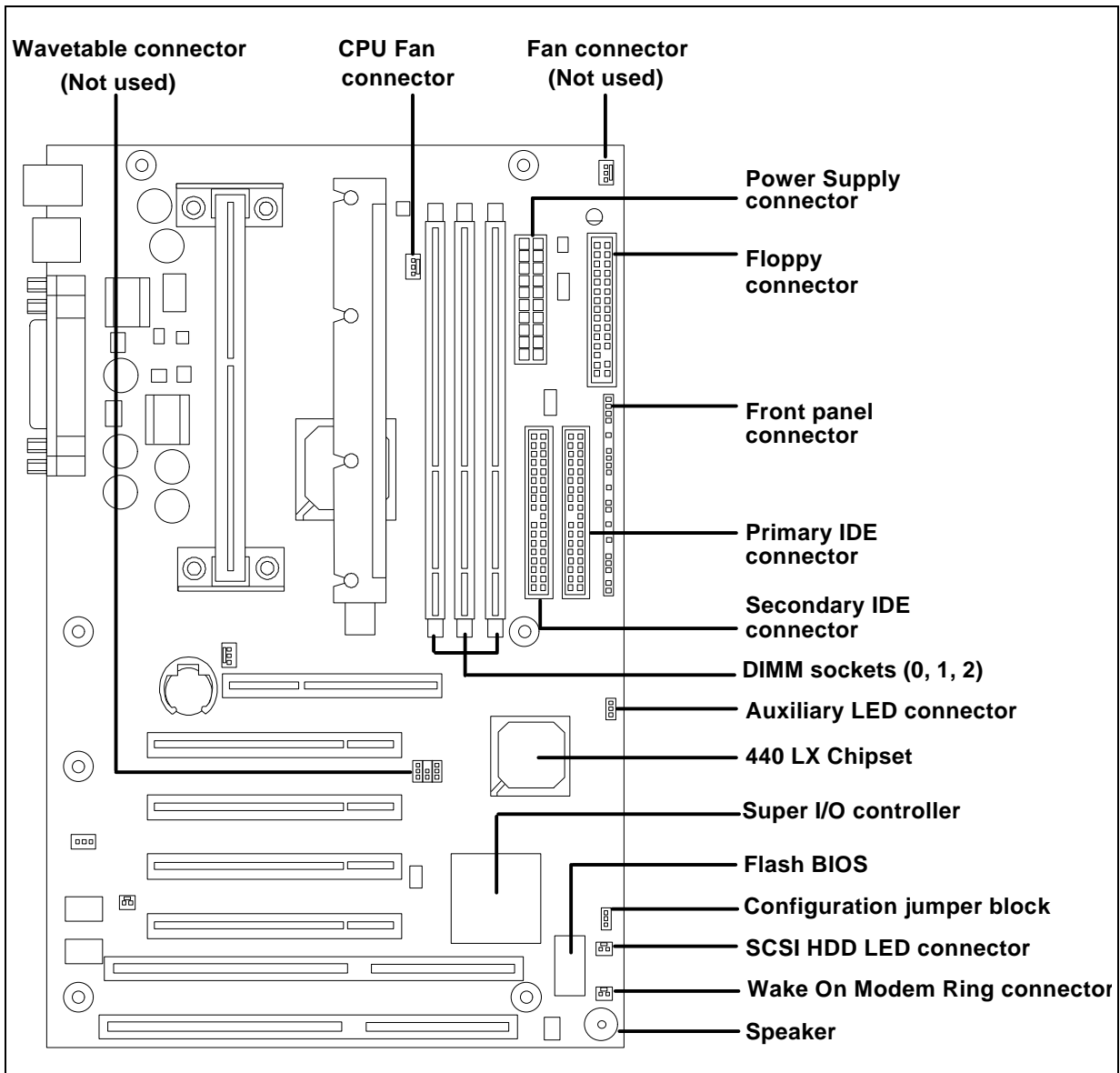
## Board & Jumper settings

## System Board layout

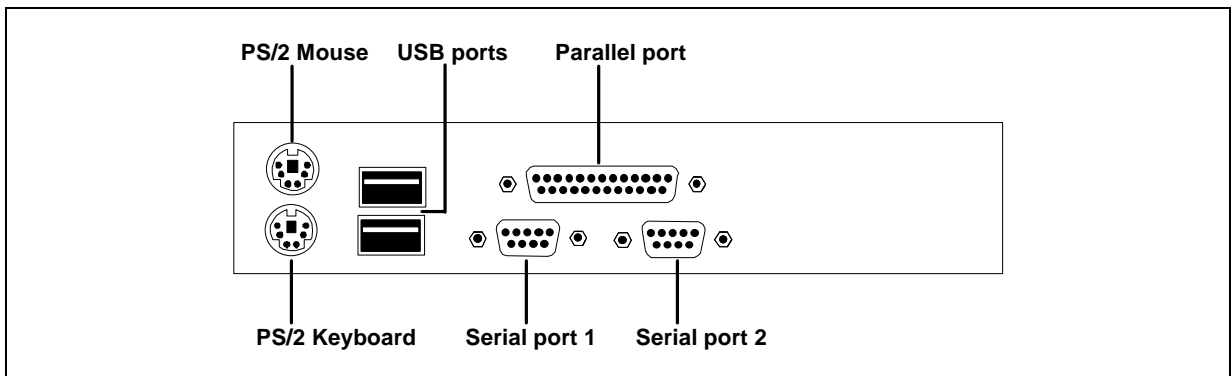


Picture 18 : System Board layout (1)





Picture 19: System Board layout (2)

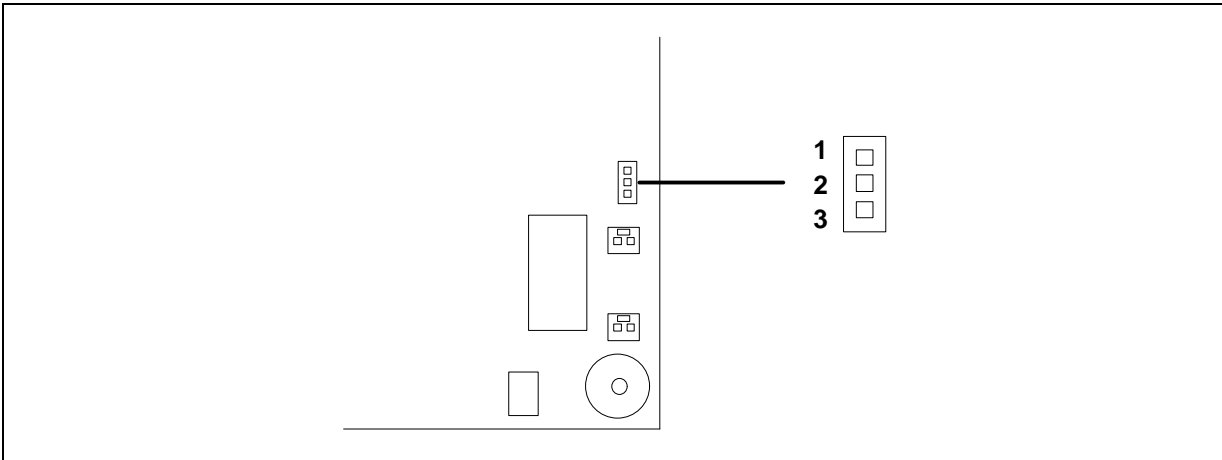


Picture 20 : System Board rear connectors

## Jumper settings

Configuration jumper (J8B2)

Jumper in configuration header (J8B2) is to set one of the three modes: Normal, Configure and Recovery mode. The Setup program allows to make all system board configurations.



Picture 21 :Configuration jumper block

### Configuration Jumper Settings :

Mode	Jumper position	Configuration
Normal	1 - 2	The Bios uses current configuration information and passwords for booting.
Configure	2 - 3	For configure processor speed and cleaning passwords.
Recovery	none	Upgrading the BIOS or recovering BIOS data. A recovery Disk is required.

## Configuration modes

Before changing jumper settings remember always unplug all power attached cables from system unit.

### Normal Mode (default setting)

Normal mode is for normal computer booting and operations. To enable this normal mode connect pins 1 and 2 with single jumper. The BIOS uses current setup configuration information which includes bus and processor speed, configuration information and passwords. Use of the Setup program can be protect by using administrative or user password.

In this mode the BIOS attempts an automatic recovery if the configuration information in flash memory corrupted.

### Configure mode

Configure mode is to change setup configuration information. To enable configure mode connect pins 2 and 3 with single jumper. When this mode is enable, Setup executes automatically after POST. In Setup the Maintenance menu is displayed. In this mode BIOS default settings is used for booting.

To make changes become valid:

- Exit setup program
- Shut down computer and disconnect unplug power attached cables from system unit.
- Change configuration jumper in normal mode
- Boot up the computer

Note: After rebooting computer Setup uses administrative and user settings with latest changes.

In this mode the BIOS attempts an automatic recovery if the configuration information in flash memory corrupted.

### Recovery Mode (Force Flash Load procedure)

Recovery mode is for upgrading the BIOS or recovering BIOS data. To enable recovery mode remove single jumper from configuration header. When this mode is enabled BIOS tries to recover or upgrade BIOS from BIOS diskette in floppy drive.

BEEP codes indicates recovery/upgrade status:

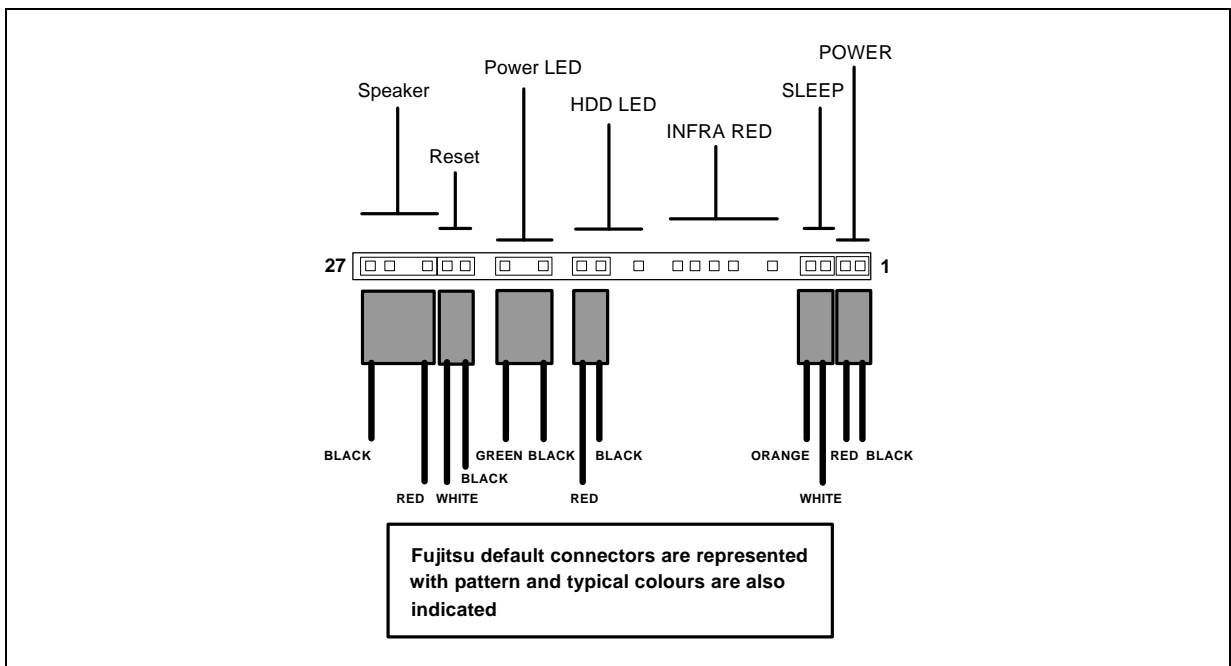
- one beep: start of recovery/upgrade.
- two beeps: succesful recevery/upgrade.
- multiple beeps: failed recovery/upgrade.

Note: If recovery/upgrade BIOS diskette not in floppy drive BIOS runs POST test and displays message: jumper is not properly installed.

To make changes become valid:

- Exit setup program
- Shut down computer and disconnect Main power from system unit.
- Change configuration jumper in normal mode
- Boot up the computer

### System board front panel connectors



Picture 22 :Typical front panel connectors

## Front panel I/O connectors

The front panel connector includes headers for the following I/O connections:

### Speaker

The speaker is enabled by a jumper on pins 26-27 of the front panel connector. The onboard speaker can be disabled by removing the jumper, and an offboard speaker can be connected in its place. The speaker (onboard or offboard) provides error beep code information during the POST in the event that the computer cannot use the video interface. The speaker is not connected to the audio subsystem and does not receive output from the audio subsystem.

### Reset

This header can be connected to a momentary SPST type switch that is normally open. When the switch is closed, the system board resets and runs the POST.

### Power LED (/Sleep/MessageWaiting)

This header can be connected to an LED that will light when the computer is powered on.

### HDD LED

This header can be connected to an LED to provide a visual indicator that data is being read from or written to an IDE hard drive. For the LED to function properly, the IDE drive must be connected to the onboard IDE controller. This LED will also show activity for devices connected to the SCSI hard drive LED header.

### Infrared

Serial Port 2 can be configured to support an IrDA module connected to this 6-pin header. After the IrDA interface is configured, files can be transferred to or from portable devices such as laptops, PDAs and printers using application software.

### Sleep/Resume switch

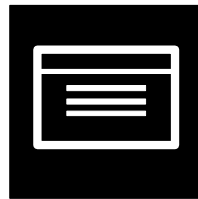
When APM is enabled in the system BIOS, and the operating system's APM driver is loaded, the system can enter sleep (standby) mode in one of the following ways:

- Optional front panel sleep/resume button
- Prolonged system inactivity using the BIOS inactivity timer feature

The 2-pin header located on the front panel I/O connector supports a front panel sleep/resume switch, which must be a momentary SPST type that is normally open. Closing the sleep/resume switch sends a System Management Interrupt (SMI) to the processor, which immediately goes into System Management Mode (SMM). While the system is in sleep mode it is fully capable of responding to and servicing external interrupts (such as an incoming fax) even though the monitor turns on only if a keyboard or mouse interrupt occurs. To reactivate or resume the system, the sleep/resume switch must be pressed again, or the keyboard or mouse must be used.

### Power On

This header can be connected to a front panel power switch. The switch must pull the SW\_ON# pin to ground for at least 50 ms to signal the power supply to switch on or off. (The time requirement is due to internal debounce circuitry on the motherboard.) At least two seconds must pass before the power supply will recognize another on/off signal.



# **Section 3 :**

## **System Setup**

## Entering Resident Setup Utility (RSU)



Close all open files and leave your application program before entering Setup. You cannot exit back into an application. The system automatically reboots when you leave Setup.

To enter SETUP (i.e. RSU), do as follows:

1. Turn on the power to the system, or if the system is already on, shutdown properly the Operating System and restart the system (f. eg. press CTRL+ALT+DEL).
2. 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

## Moving around in RSU

### Setup Key

<F1> or <Alt-H>

<Esc>

<←> or <→>

<↑> or <↓>

<Home> or <End>

<PgUp> or <PgDn>

<F5> or <->

<F6> or <+> or <Space>

<F9>

<F10>

<Enter>

### Description

Brings up a help screen for the current item.

Exits the menu.

Selects a different menu screen.

Moves the cursor up or down.

Moves the cursor to the top or bottom of the window.

Moves the cursor to the top or bottom of the window.

Selects the previous value for a field.

Selects the next value for a field.

Loads the default configuration values for the current menu.

Saves the current values and exit Setup.

Executes command or selects the submenu..

## Setup Menu Screens

### Setup Menu Screen

Maintenance

Specifies the processor speed and clears the Setup passwords. This is only available in configure mode. See section 2 for information about configure mode

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

## Maintenance menu

### Processor Speed

Specifies the processor speed in Megahertz :

200  
233  
266  
300  
333

### Clear All Passwords

Clears the User and Supervisor (i.e. Admin) passwords.

## Main menu

### Processor Type

Displays processor type.

### Processor Speed

Displays processor speed.

### Cache RAM

Displays size of second-level cache.

### Total Memory

Displays the total amount of RAM on the motherboard.

### BIOS Version

Displays the version of the BIOS.

### Language

Selects the default language used by the BIOS.

English (US) (default)

### System Time

Specifies the current time.

### System Date

Specifies the current date.

### Floppy Options

When selected, displays the following Floppy Options submenu:

#### Diskette A:

Specifies the capacity and physical size of diskette drive A :

Disabled  
360 KB, 5¼"  
1.2 MB, 5¼"  
720 KB, 3½"  
**1.44 MB, 3½" (default)**  
2.88 MB, 3½"

#### Diskette B:

Specifies the capacity and physical size of diskette drive B.

**Disabled (default)**  
360 KB, 5¼"  
1.2 MB, 5¼"  
720 KB, 3½"  
1.44 MB, 3½"  
2.88 MB, 3½"

**Floppy Write Protect**

Disables or enables write protect for the diskette drive(s).

**Disabled (default)**

Enabled

**Hard Disk Pre-Delay**

Selects the hard disk drive pre-delay. Causes the BIOS to insert a delay before attempting to detect IDE drives in the system. Some drives require a longer spin-up time before responding to commands. This allows more time for the drive to be ready before attempting to detect drives.

**Disabled (default)**

3 seconds  
6 seconds  
9 seconds  
12 seconds  
15 seconds  
21 seconds  
30 seconds

**Primary IDE Master**

Reports type of connected IDE device. When selected, displays the following Primary IDE Master submenu:

**Type**

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 sector fields.

None  
ATAPI Removable  
CD-ROM  
User

**Auto (default)**

IDE Removable

---

**CHS Format**

---

**Cylinders**

Specifies number of disk cylinders.

**Heads**

Specifies number of disk heads (1 to 16).

**Sectors**

Specifies number of disk sectors (1 to 64).

**Maximum Capacity**

Reports the maximum capacity for the hard disk. Value calculated from number of cylinders, heads and sectors.

---

**LBA Format**

---

**Total Sectors**

Specifies number of total sector in LBA mode.

**Maximum Capacity**

Reports the maximum capacity for the hard disk. Value calculated from number of cylinders, heads and sectors.

**Multi-Sector Transfers**

Specifies number of sectors per block for transfers from the hard disk to memory.

Disabled  
2 Sectors  
4 Sectors  
8 Sectors  
**16 Sectors (default)**



**LBA Mode Control**

Enables or disables logical block addressing (LBA) in place of the cylinders, heads and sector fields.

Note: Changing the LBA Mode Control after a hard drive has been formatted can corrupt data on the drive.

Disabled

**Enabled (default)**

**Transfer Mode**

Specifies method for transferring data between the hard disk and system memory.

Standard

Fast PIO 1

Fast PIO 2

Fast PIO 3

Fast PIO 4

FPIO 3 & Bus Mastering

**FPIO 4 & Bus Mastering (default with Ultra DMA/33 IDE HDD)**

**Ultra DMA**

Specifies the Ultra DMA mode for the hard disk.

**Disabled (default if not Ultra DMA/33 IDE HDD)**

Mode 0

Mode 1

**Mode 2 (default with Ultra DMA/33 IDE HDD)**

**Primary IDE Slave**

Reports type of connected IDE device. When selected, displays the following Primary IDE Slave submenu. Settings of this submenu, see Primary IDE Master submenu settings in this section.

**Secondary IDE Master**

Reports type of connected IDE device. When selected, displays the following Secondary IDE Master submenu. Settings of this submenu, see Primary IDE Master submenu settings in this section.

**Secondary IDE Slave**

Reports type of connected IDE device. When selected, displays the following Secondary IDE Slave submenu. Settings of this submenu, see Primary IDE Master submenu settings in this section.

## Advanced menu

### Plug & Play O/S

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. It is recommend to set this settings as *No* (i.e. not a default setting).

No  
**Yes (default)**

### Reset Configuration

Clears the BIOS configuration data on the next boot.

**No (default)**  
 Yes

### Memory Cache

Enables or disables the memory cache.

**Enabled (default)**  
 Disabled

### ECC Configuration

Specifies ECC memory operation.

**Non-ECC (default)**  
 ECC

### Resource Configuration

Configures memory blocks and IRQs for legacy ISA devices. When selected, displays the following Resource Configuration submenu:

#### Memory Reservation

Reserves specific upper memory blocks for use by legacy ISA devices. Memory hole frees address space in RAM for legacy ISA boards.

**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

#### IRQ Reservation

Reserves specific IRQs for use by legacy ISA devices. An \* (asterisk) displayed next to an IRQ indicates an IRQ conflict.

**IRQ 3 Available (default)**  
 Reserved  
**IRQ 4 Available (default)**  
 Reserved  
**IRQ 5 Available (default)**  
 Reserved  
**IRQ 7 Available (default)**  
 Reserved

<b>IRQ 10</b>	<b>Available (default)</b> Reserved
<b>IRQ 11</b>	<b>Available (default)</b> Reserved

**Peripheral Configuration**

Configures peripheral ports and devices. When selected, the following Peripheral Configuration submenu is displayed:

**Serial port A**

Configures serial port A. *Auto* assigns the first free COM port, normally COM1, the address 3F8h and the interrupt IRQ 4. An \* (asterisk) displayed next to an address indicates a conflict with another device.

- Disabled
- Enabled
- Auto (default)**

**Base I/O address**

Specifies the I/O port address of the COM-port.

- 3F8 (default)**
- 2F8
- 3E8
- 2E8

**Interrupt**

Specifies the interrupt of the COM-port.

- IRQ 3
- IRQ 4 (default)**

**Serial port B**

Configures serial port B. *Auto* assigns the first free COM port, normally COM2, the address 2F8h and the interrupt IRQ 3. An \* (asterisk) displayed next to an address indicates a conflict with another device.

- Disabled
- Enabled
- Auto (default)**

**Mode**

Specifies the mode of the COM-port for normal and infrared applications.

- Normal (default)**
- IrDA
- ASK-IR

**Base I/O address**

Specifies the I/O port address of the COM-port.

- 3F8
- 2F8 (default)**
- 3E8
- 2E8

**Interrupt**

Specifies the h/w interrupt of the COM-port.

- IRQ 3 (default)**
- IRQ 4

**Parallel port**

Configures parallel port. *Auto* assigns LPT1 the address 378h and the interrupt IRQ 7. An \* (asterisk) displayed next to an address indicates a conflict with another device.

- Disabled
- Enabled
- Auto (default)**

**Mode**

Selects the mode for the parallel port. *Output Only* operates in AT† -compatible mode. *Bi-directional* operates in bidirectional PS/2-compatible mode. *EPP* is Extended Parallel Port mode, a high-speed bidirectional mode. *ECP* is Enhanced Capabilities Port mode, a high-speed bidirectional mode.

Output only  
**Bi-directional (default)**  
EPP  
ECP

**Base I/O address**

Specifies the I/O port address of the LPT-port.

**378 (default)**  
278  
228

**Interrupt**

Specifies the h/w interrupt of the LPT-port.

IRQ 5  
**IRQ 7 (default)**

**DMA channel**

Specifies the DMA channel of the LPT-port that is used in ECP mode.

DMA 1  
**DMA 3 (default)**

**Floppy disk controller**

Configures the floppy disk controller.

Disabled  
**Enabled (default)**

**IDE controller**

Configures the IDE controller.

Disabled  
Primary  
Secondary  
**Both (default)**

**Audio**

Enables or disables the onboard audio subsystem.

**Note:** ErgoPro m664-series system board is not equipped with on-board audio

Disabled  
**Enabled (default)**

**Legacy USB Support**

Enables support for legacy universal serial bus devices.

Disabled  
Enabled

### Keyboard Configuration

Configures keyboard features. When selected, the following the Keyboard Features submenu is displayed:

#### Numlock

Specifies the power on state of the Numlock feature on the numeric keypad of the keyboard.

##### Auto (default)

On  
Off

#### Key Click

Enables the key click option.

##### Disabled (default)

Enabled

#### Keyboard auto-repeat rate

Selects the key repeat rate.

##### 30/sec (default)

26.7/sec  
21.8/sec  
18.5/sec  
13.3/sec  
10/sec  
6/sec  
2/sec

#### Keyboard auto-repeat delay

Selects the delay before key repeat.

¼ sec

##### ½ sec (default)

¾ sec  
1 sec

### Video Configuration

Configures video features. When selected, the following Video Configuration submenu is displayed:

#### Palette Snooping

Controls the ability of a primary PCI graphics controller to share a common palette with an ISA add-in video card.

Historically, the VGA colour palette -or RAMDAC- could be multiplied on a number of display boards on the ISA bus, all using the same port-addresses. This way, all palettes contained the same colours. The PCI bus would effectively isolate any VGA on the PCI bus from a similar RAMDAC on the ISA bus. The colours loaded into the PCI VGA would not be copied to the ISA device. The devices using this technique are mainly video input and output overlay boards, using a single monitor and connecting the VGA and overlay through the feature connector.

To enable the possibility of having multiple RAMDACs on both the PCI and ISA bus, the PCI VGA palette snooping can be enabled. In this mode, all output to the VGA RAMDAC will be visible to all devices on both the ISA and the PCI bus. The speed of the slowest bus (ISA) will determine how fast the RAMDAC can be written. If there is a single RAMDAC in use, the function is not needed and can be disabled. There will be no great impact on overall performance.

Some graphics controllers set up the VGA snooping in their own power-up initialisation. In such a case, any manual selection -either 'Enabled' or 'Disabled'- will be overridden at the next power-on.

When entering SETUP, the current state of the graphics hardware will always be displayed, regardless of whether it is a fixed setting from the graphics sub-system or a previous manual selection. Enabling the VGA snooping might cause colour corruption on some graphics boards. Keep the default state unless change is absolutely necessary.

##### Disabled (default)

Enabled

**AGP Aperture Size**

Sets the aperture size for the AGP Video Controller.

**64 MB (default)**

256 MB

**DMI Event Logging**

Configures DMI Event Logging. When selected, the following DMI Event Logging submenu is displayed:

**Event log capacity**

Indicates if there is space available in the event log.

**Space available (default)**

**Event log validity**

Indicates if the contents of the event log are valid.

**Valid (default)**

**View DMI event log**

Enables viewing of DMI event log.

**Clear all DMI event logs**

Clears the DMI Event Log after rebooting.

**No (default)**

Yes

**Event Logging**

Enables logging of DMI events.

**Enabled (default)**

Disabled

**ECC Event Logging**

Enables logging of ECC events.

**Disabled (default)**

Enabled

**Mark DMI events as read**

Marks all DMI events as read.

## Security menu

### User Password is

Reports if there is a user password set.

Clear  
Set

### Supervisor Password is

Reports if there is a supervisor (i.e. admin) password set.

Clear  
Set

### Set User Password

Specifies the user password. The user password can be up to seven (7) alphanumeric characters long (recommended values for password are the letters A to Z, and/or numbers 0 to 9, and password should not contain these characters: ESC, F11, F12, PRINT SCREEN, SCROLL LOCK, PAUSE, CAPSLOCK, SHIFT, CTRL, ALT, ALT GR, BACKSPACE, NUM LOCK).

### Set Supervisor Password

Specifies the supervisor (i.e. admin) password. The supervisor password can be up to seven (7) alphanumeric characters long (recommended values for password are the letters A to Z, and/or numbers 0 to 9, and password should not contain these characters: ESC, F11, F12, PRINT SCREEN, SCROLL LOCK, PAUSE, CAPSLOCK, SHIFT, CTRL, ALT, ALT GR, BACKSPACE, NUM LOCK).

### Unattended Start

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.

**Disabled (default)**  
Enabled

## Power menu

### Power Management

Enables or disables the BIOS power management feature.

Disabled  
Set

### Fan Always On

Forces fan(s) connected to the onboard fan header(s) to remain on when the computer is in a power management state.

No  
**Yes (default)**

### Inactivity Timer

Specifies the amount of time before the computer enters standby mode.

**Off (default)**  
1 Minute  
2 Minutes  
4 Minutes  
6 Minutes  
8 Minutes  
12 Minutes  
16 Minutes

### Hard Drive

Enables power management for hard disks during standby and suspend modes.

Disabled  
**Enabled (default)**

### VESA Video Power Down

Enables power management for video during standby and suspend modes.

Disabled  
**Enabled (default)**



## Boot menu

### Restore On AC/Power Loss

Specifies how the computer responds following a power failure. *Stay Off* keeps power off until power button pressed. *Last State* restores previous power state before a power failure. *Power On* restores power without restoring previous power state.

Stay Off  
**Last State (default)**  
Power On

### On Modem Ring

Specifies how the computer responds to an incoming call on an installed modem when the power is off.

**Stay Off (default)**  
Power On

### On LAN

Specifies how the computer responds to a LAN wakeup event when the power is off.

Stay Off  
**Power On (default)**

### On PME

Specifies how the computer responds to a PCI power management enable event when the power is off.

**Stay Off (default)**  
Power On

### QuickBoot Mode

Enables the computer to boot without running certain POST tests.

**Enabled (default)**  
Disabled

### Scan User Flash Area

Enables the BIOS to scan the flash memory for user binary files that are executed at boot time.

**Disabled (default)**  
Enabled

### First Boot Device

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.

**Removable Devices (default)**  
Hard Drive  
ATAPI CD-ROM Drive  
Network Boot

### Second Boot Device

Removable Devices  
**Hard Drive (default)**  
ATAPI CD-ROM Drive  
Network Boot

### Third Boot Device

Removable Devices  
Hard Drive

**ATAPI CD-ROM Drive (default)**  
Network Boot

#### **Fourth Boot Device**

Removable Devices  
Hard Drive  
ATAPI CD-ROM Drive  
**Network Boot (default)**

#### **Hard Drive**

Lists available hard drives. The system will attempt to boot to the Operating System from the first hard drive in the list. If no Operating System is found, the system will try the next drive listed until an Operating System is found. When selected, the following Hard Drive submenu is displayed:

1. **<installed IDE HDD is shown here>**
2. **Bootable ISA Cards**

#### **Removable Devices**

Lists available removable devices. The Operating System assigns drive letters to these devices in the order displayed. Change the sequence and drive lettering of a device by selecting it with <↑> or <↓> and moving it the <+> or <-> key. When selected, the following Removable Devices submenu is displayed:

1. **Legacy Floppy Drives**

## Exit menu

**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 default values for all the Setup options.

**Load Custom Defaults**

Loads the custom defaults for Setup options.

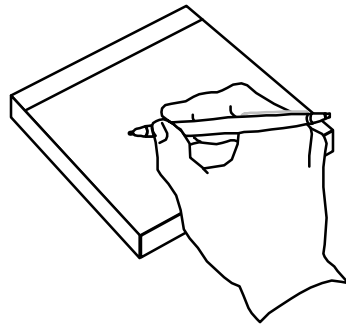
**Save Custom Defaults**

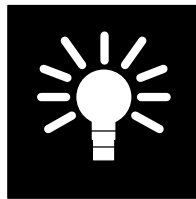
Saves the current values as custom defaults. Normally, the BIOS reads the Setup values from flash memory. If this memory is corrupted, the BIOS reads the custom defaults. If no custom defaults are set, the BIOS reads the factory defaults.

**Discard Changes**

Discards changes without exiting Setup. The option values present when the computer was turned on are used.

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# **Section 4 :**

## **Miscellaneous and Hints**

## BIOS

The system BIOS is always shadowed. The system is stored in a Flash RAM, thus the BIOS is field upgradable with a floppy.

At boot-up the BIOS version is shown on the screen. The BIOS information message is displayed indicating the System BIOS version and unit ID (machine identifier) :

**PhoenixBIOS 4.0 Release 6.0**  
**Copyright 1985 - 1997 Phoenix technologies Ltd.**  
**All Rights Reserved**  
**4A4LL0X0.86A.0015.P05.9712111454**

The BIOS Identification :

PC-type	Unit ID	BIOS Version
m664-series	<b>4A4LL0X0.86A.0015.P05</b>	<b>4A4LL0X0.86A.0015.P05</b>

## Larger than 8.4 GB HDD BIOS support

The system BIOS supports, and recognises larger than 8.4 GB Hard Disks.

## Shadow option proms

The video BIOS and ROMs on add-on boards can be shadowed, if shadowing is supported by the add-on board.

## Drivers

Pre-installed Windows NT 4.0 Workstation in m664-series include all required drivers, f.eg. graphics (AGP, PCI), add-on board audio, LAN, and preparation for the SCSI.

Original Operating System CD-media of Windows NT 4.0 does not include all required drivers for devices used in ErgoPro m664-series. Latest drivers can be obtained from

- Fujitsu ICL Computers web-site (i.e. <http://www.fujitsu-computers.com>, or it's mirror sites <http://www.fujitsu.se> or <http://www.fujitsu.fi>)
- GENESIS
- Indigo CD, volume 2 release 5 (1997) or newer
- Drivers and Utilities CD for ErgoPro m664-series

## Utilities

Pre-installed Windows NT 4.0 Workstation in m664-series does not include ErgoPro specific utilities, but it includes F-Prot AntiVirus Toolkit and Intel's LANDesk Client Manager (i.e. the DMI 2.0 client s/w).

Original Operating System CD-media of Windows NT 4.0 does not include ErgoPro specific utilities that are used in ErgoPro m664-series. ErgoPro specific utilities can be obtained from

- Drivers and Utilities CD for ErgoPro m664-series

## rFlash.exe

This tool is not available for the ErgoPro m664-series.

## rSetup.exe

This tool is not available for the ErgoPro m664-series.

## **BIOS Upgrade**

### **ErgoPro BIOS Upgrade Diskette**

There is an automatic way of upgrading the ErgoPro m664-series system BIOS, i.e. using the "ErgoPro BIOS Upgrade diskette for m664-series (BIOS ID 4A4LL0X0.86A)". The bootable DOS diskette uses the iFLASH.EXE BIOS Upgrade utility. The contents of the diskette can be obtained from

- Fujitsu ICL Computers web-site (i.e. <http://www.fujitsu-computers.com>, or it's mirror sites <http://www.fujitsu.se> or <http://www.fujitsu.fi>), partner side (password required)
- GENESIS
- Indigo CD, volume 2 release 7 (1998) or newer

### **DOSFLASH.EXE**

This tool is not available for the ErgoPro m664-series.

## Tips & Hints

### Using ISA Configuration Utility (ICU)

The driver DWCFGMG.SYS must be loaded before HIMEM.SYS. Can be used in DOS, Windows 3.x and Windows for Workgroups 3.11 environments. If there are problems of configuring devices, f.e. audio, in Windows NT 4.0, DOS version of ICU can be used to ensure the resources of the devices, then DOS ICU must be used before starting Windows NT 4.0, booting DOS ICU from the floppy drive.

### Hard disk partitioning

#### DOS 6.XX and Windows NT 4.0, FAT

Partition size	Cluster size (allocation unit)	File system
0 MB - 15 MB	4 096 Bytes (4 kB)	FAT12
16 MB - 127 MB	2 048 Bytes (2 kB)	FAT16
128 MB - 255 MB	4 096 Bytes (4 kB)	FAT16
256 MB - 511 MB	8 192 Bytes (8 kB)	FAT16
512 MB - 1023 MB	16 384 Bytes (16 kB)	FAT16
1024 MB - 2048 MB	32 768 Bytes (32 kB)	FAT16
2048 MB - 4096 MB	65 536 Bytes (64 kB)	FAT16
4096 MB - 8192 MB	131 072 Bytes (128 kB), <b>Windows NT 4.0 only</b>	FAT16
8192 MB - 16384 MB	262 144 Bytes (256 kB), <b>Windows NT 4.0 only</b>	FAT16

The maximum partition size of the FAT file system in DOS is 2 GB (including Windows 95 FAT).  
The maximum partition size of the FAT file system in Windows NT is 4 GB.

The FAT file system only supports 512 byte sectors, so both sectors per cluster and the cluster size is fixed. The FAT file system supports cluster sizes up to 256 kB. Therefore, the physical size of a 1 byte file will be 1 cluster which may be (depending on the disk used) as little as 2048 Bytes or as great as 32 768 Bytes of disk space used.

#### Windows 95 (OSR 2.xx), FAT32

Partition size	Cluster size (allocation unit)	File system
	4 096 Bytes (4 kB)	FAT32
< 8 GB	4 096 Bytes (4 kB)	FAT32

The maximum size of the partition, using FAT32, is 8 GB (Gigabytes).  
The maximum size of the hard disk, using FAT32, is 2 TB (Terabytes).

#### Windows NT, NTFS

Partition size	Cluster size (allocation unit)	File system
0 MB - 512 MB	512 Bytes	NTFS
513 MB - 1024 MB	1024 Bytes	NTFS
1025 MB - 2048 MB	2048 Bytes	NTFS
> 2048 MB	4096 Bytes	NTFS



The NTFS file system supports cluster sizes up to 64 kB.  
 The file record size is always 1 kB regardless of the cluster size.

**USB Legacy Support**

USB legacy support enables USB keyboards and mice to be used even when no operating system USB drivers are in place. By default, USB legacy support is disabled. USB legacy support is only intended to be used in accessing BIOS Setup and installing an operating system that supports USB. This sequence describes how USB legacy support operates in the default (disabled) mode.

1. When you power up the computer, USB legacy support is disabled.
2. POST begins.
3. USB legacy support is temporarily enabled by the BIOS. This allows you to use a USB keyboard to enter the Setup program or the maintenance mode.
4. POST completes and disables USB legacy support (unless it was set to Enabled while in Setup).
5. The operating system loads. While the operating system is loading, USB keyboards and mice are not recognized. After the operating system loads the USB drivers, the USB devices are recognized.

To install an operating system that supports USB, enable USB Legacy support in BIOS Setup and follow the operating system's installation instructions. Once the operating system is installed and the USB drivers configured, USB legacy support is no longer used. USB Legacy Support can be left enabled in BIOS Setup if needed.

Notes on using USB legacy support:

- If USB legacy support is enabled, don't mix USB and PS/2 keyboards and mice. For example, do not use a PS/2 keyboard with a USB mouse, or a USB keyboard and a PS/2 mouse.
- Do not use USB devices with an operating system that does not support USB. USB legacy is not intended to support the use of USB devices in a non USB operating system.
- USB legacy support is for keyboards and mice only. Hubs and other USB devices are not supported.

**ATA/ATAPI device support**

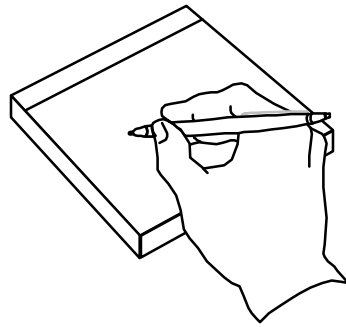
If Auto is selected as a primary or secondary IDE device in Setup (i.e. RSU), the BIOS automatically sets up the two local-bus IDE connectors with independent I/O channel support. The IDE interface supports hard drives up to PIO Mode 4 and recognises ATAPI devices, including CD-ROM drives, tape drives and Ultra DMA drives.

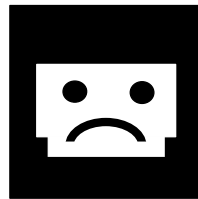
Add-in ISA IDE controllers are not supported.

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 below:

Configuration	Primary IDE interface		Secondary IDE interface	
	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

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# Section 5 :

## Power-on self test and error indications

## BIOS Power On Self Test (POST)

After the power has been turned on, the system performs a power on self-test, i.e. POST, to check that all parts are working properly.

If the test does not find any faults you will hear one long beep. During the POST BIOS information is shown on the screen:

```
PhoenixBIOS 4.0 Release 6.0  
Copyright 1985 - 1997 Phoenix Technologies Ltd.  
All Rights Reserved  
4A4LL0X0.86A.0015.P05.9712111454
```

The message indicates the BIOS version (0015.P05).

The following pages describe the steps that you should take if either fault situation should occur.

## Beep codes

Whenever a recoverable error occurs during Power-On Self Test (POST), the BIOS displays an error message describing the problem. The BIOS also issues a beep code (one long tone followed by two short tones) during POST if the video configuration fails (no card installed or faulty) or if an external ROM module does not properly checksum to zero.

An external ROM module (e.g video BIOS) can also issue audible errors, usually consisting of one long tone followed by a series of short tones. For more information on the beep codes issued, check the documentation for that external device.

There are several POST routines that issue a POST Terminal Error and shut down the system if they fail. Before shutting down the system, the terminal-error handler issues a beep code signifying the test point error, writes the error to I/O port 80h, attempts to initialize the video and writes the error in the upper left corner of the screen (using both mono and color adapters).

If POST completes normally, the BIOS issues one short beep before passing control to the operating system.

### List of 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 keyboard controller
1-3-3-1	28h	Autosize DRAM
1-3-3-2	29h	Initialise 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 initialisation
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

## BIOS Error Messages

### List of 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.
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.
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.

## BIOS check points (POST codes)

At the beginning of each POST task, the BIOS outputs the check point (error code) to I/ O port 80h. If the BIOS detects a terminal error condition, it issues a terminal-error beep code (See BEEP CODES earlier in this section), attempts to display the check point on upper left corner of the screen and on the port 80h LED display, and halts POST. It attempts repeatedly to write the check point to the screen. This attempt may "hash" some CGA displays. If the system hangs before the BIOS can process the error, the value displayed at the port 80h is the last test performed. In this case, the screen does not display the check point.

This list shows the check point number (hex) and what BIOS is doing in POST while this checkpoint is displayed.

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
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

Code	Description of POST Operation
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
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



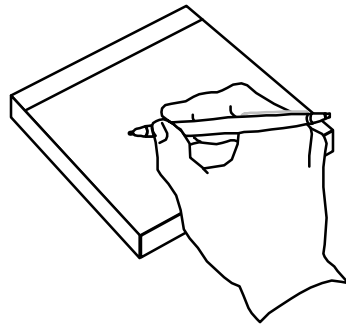
<b>Code</b>	<b>Description of POST Operation</b>
66h	Configure advanced cache registers
67h	Initialize multiprocessor APIC
68h	Enable external and processor caches
69h	Setup System Management Mode (SMM) area
6Ah	Display external L2 cache size
6Ch	Display shadow-area message
6Eh	Display possible high 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
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

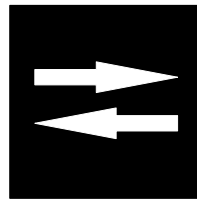
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<b>Code</b>	<b>Description of POST Operation</b>
99h	Check for SMART Drive
9Ah	Shadow option ROMs
9Ch	Set up power management
9Eh	Enable hardware interrupts
9Fh	Determine number of ATA and SCSI drives
A0h	Set time of day
A2h	Check key lock
A4h	Initialize 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
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

<b>Code</b>	<b>Description of POST Operation (Boot Block Flash Ram)</b>
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

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# Section 6 :

## Input, Output and Special functions

## System board

### Form factor

The system board is based on the ATX form factor, following the ATX specification. Outer dimensions are 12" x 7.75".

### Processor

The system board provides the Slot 1 connector for one Pentium II processor. The Pentium II processor is provided in the SEC cartridge together with the 512kB L2 cache. The active heatsink is attached to the SECC with two clips (i.e. heatsink with fan).

### Voltage Regulator

The system board has an on-board switched-mode voltage converter for the CPU core voltage, which is automatically set to the required value by the CPU itself. Fixed voltages are provided for the GTL bus and clock synthesizer.

### Core logic

The system board is based on the Intel's 440LX AGPset (chip set), which consists the following two chips:

- 82443LX, north bridge with AGP interface
- 82371AB (PIIX4), south bridge with ACPI, USB, IDE and SMBus controllers

The 440LX has the following main features:

- Optimized for the Pentium® II processor
- Quad Port Acceleration
- SDRAM support
- Advanced Configuration and Power Interface support (ACPI)
- Ultra DMA/33 support

### Super I/O

The system board has NS's PC97307 Super I/O controller (PnP ISA compatible). The Super I/O has the following main features:

- Floppy controller
- Keyboard controller
- One Parallel port
- Two Serial ports

### Floppy disk controller

The floppy disk controller is integrated into the NS's PC97307 Super I/O controller and is DP8473 and N82077 software compatible. It can handle the following floppy drive types: 360 kB, 1.2 MB (both 3.5" and 5.25", 3.5" requires driver), 720 kB, 1.44 MB and 2.88 MB.

### Keyboard (Mouse) controller

The PS/2-type keyboard (and PS/2-type mouse) controller is integrated into the NS's PC97307 Super I/O controller and is 8042A software compatible.

### Parallel port communication

There is one multi-mode parallel port using a standard 25-pin female D-type connector. The parallel port mode can be set through the Resident Set-up Utility. The following modes are supported:

Compatible	Standard mode
Bidirectional	PS/2 compatible bi-directional parallel port
Enhanced mode (EPP):	Enhanced Parallel Port (EPP 1.9), and is IEEE1284 compliant.
High speed mode (ECP):	Microsoft and Hewlett Packard Extended Capabilities Port, and is IEEE1284 compliant.

The multi mode port interface logic and buffers are placed in the NS PC97307 Super I/O controller.

In addition to selecting mode of the parallel port in the RSU (Advanced/Peripheral Configuration menu), I/O, IRQ and DMA settings can manually be set in the RSU, too. More information about available settings of the parallel port, see Advance/Peripheral menu settings in section 3 in this handbook.

## Serial port communication

It comprises 2 high speed NS16550A compatible UARTs with send/receive 16 Byte FIFOs. The 2 connectors are 9-pin standard RS-232C D-type connectors. The UARTs are placed in the NS's PC97307 Super I/O controller.

System can be waked up from a sleep mode when the modem generates the Ring Indicator signal, this function is available on both serial port ports. This Wake On modem ring function can be enabled/disabled through the Resident Set-up Utility (Boot menu). More information about available settings of the serial ports, see Boot menu settings in section 3 in this handbook.

## System BIOS

The PhoenixBIOS system BIOS is stored in the 2Mbit Flash EEPROM. The system BIOS has a boot block which is not write protected by the jumper setting. The system BIOS is software upgradeable. The system BIOS does not include video BIOS.

## Video BIOS

The Video BIOS is located on the graphics adapter and is made by the manufacturer of the graphics adapter (f.eg. in ATI Xpert@Work AGP and ATI 3D Charger graphics adapters the video BIOS is located in both of these adapter and both have an original ATI video BIOS).

## System memory

The system board has three 168-pin, 3.3 V, DIMM sockets for 64-bit wide, 4-clock, non-buffered, 100 MHz SDRAM modules.

## Video memory

The Video memory is located on the graphics adapter.

## PCI bus

The PCI bus is PCI 2.1 specification compliant, running on 33 Mhz (i.e. synchronous to the system bus and runs at half of the system bus frequency). PCI-to-PCI Bridge and altogether five (5) PCI bus master devices are supported.

## AGP interface

The graphics system is based on the Accelerated Graphics Port (AGP) specification. The system board has one 124-pin 'AGP expansion slot' connector for one, AGP ATX form factor, graphics adapter.

## PCI bus enhanced IDE interface

There are two enhanced PCI bus IDE controllers/interfaces (PCI master devices) on the system board, integrated into the Intel 82371AB, i.e. PIIX4 controller, with Bus Master capability and synchronous DMA Mode (i.e. Ultra DMA/33), and can handle up to four IDE devices. The 82371AB supports PIO modes 0 to 4 and DMA multiword mode 2 timing up to 16 MB/s and Bus Master synchronous DMA mode up to 33 MB/s. Each IDE device can have independent timings. It does not consume any ISA DMA channels. The IDE controller has 16 \* 32-bit buffers for IDE PCI burst transfers integrated.

Both the primary and the secondary IDE bus can handle up to 2 hard drives or other IDE devices. The BIOS has support for ATAPI devices and it also supports booting from the CD-ROM.

The primary IDE interface, when enabled, reserves IRQ 14, and IRQ 15 is used if the secondary IDE controller is enabled.

BIOS auto-detects attached IDE devices automatically. The on-board PCI bus IDE interfaces, i.e. Primary and Secondary IDE interfaces can be disabled from the Resident SETUP Utility (Advanced/Peripheral Configuration menu). More information about available settings of the IDE devices and IDE interfaces, see Main and Advanced/Peripheral Configuration menu settings in section 3 in this handbook.

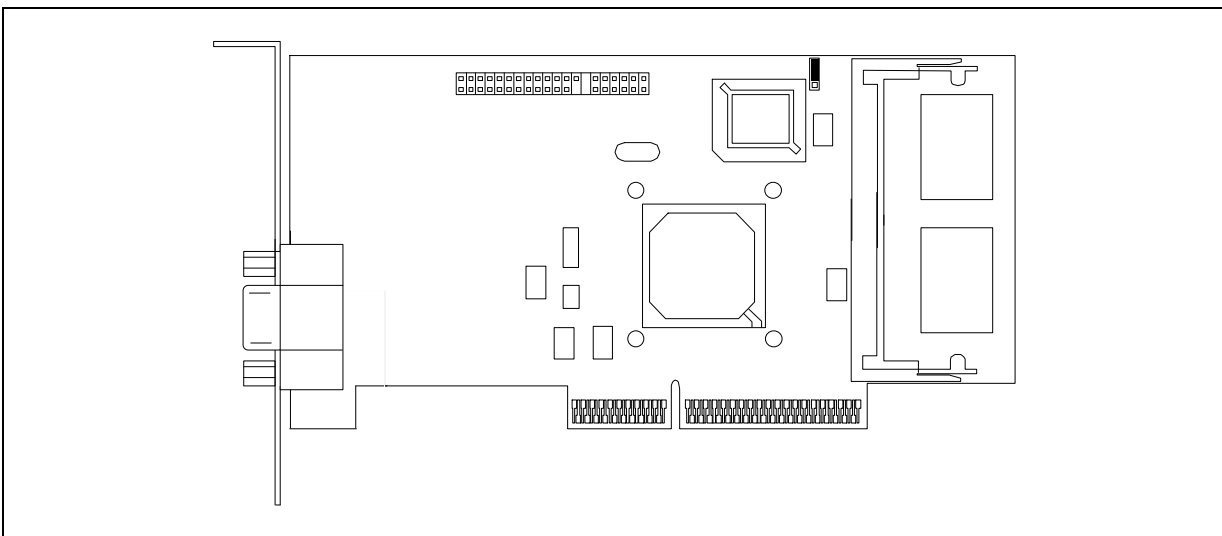
## USB controller

The Universal Serial Bus (USB) master controller with dual-port hub is integrated in PIIX4. Two USB port connectors are provided on the rear panel.

## Video

The system board has no on-board graphics controller. There are two options of having graphics controller in the system, AGP add-on board plugged in the dedicated AGP slot on the system board, or PCI add-on board plugged in the PCI slot on the system board.

### ATI Xpert@Work AGP add-on board (AF31554)



ATI Xpert@Work AGP, based on ATI '3D RAGE PRO', 64-bit 3D graphics engine with 4 kB on-chip texture cache and 4 MB Synchronous Graphics RAM (100 MHz SGRAM), is an **ATX form factor**, AGP bus based graphics accelerator adapter (3.3 V, Bus Master device) supporting 133 MHz, sidebands and pipelining.

The amount of the SGRAM can be upgraded to 8 MB with an optional 4 MB SO-DIMM memory expansion module (100 MHz). The RAMDAC, which has 64-bit data path to the SGRAM, can handle pixel frequencies up to 230 MHz. The video interface is DDC1, DDC2B+ and VESA DPMS compatible. The adapter has an AMC connector (v. 2.0). The adapter has the INTERRUPT ENABLED/DISABLED jumper. As a default the jumper is in the DISABLED position, i.e. the adapter does not reserve an interrupt. Main features:

#### H/W Video Acceleration

- Full screen/Full speed Video Playback
- YUV to RGB color space conversion
- DVD / MPEG-2 decode assist
- Front and back end scalers support multi-stream video for video conferencing and other applications
- Hardware mirroring

#### H/W 2D Acceleration of

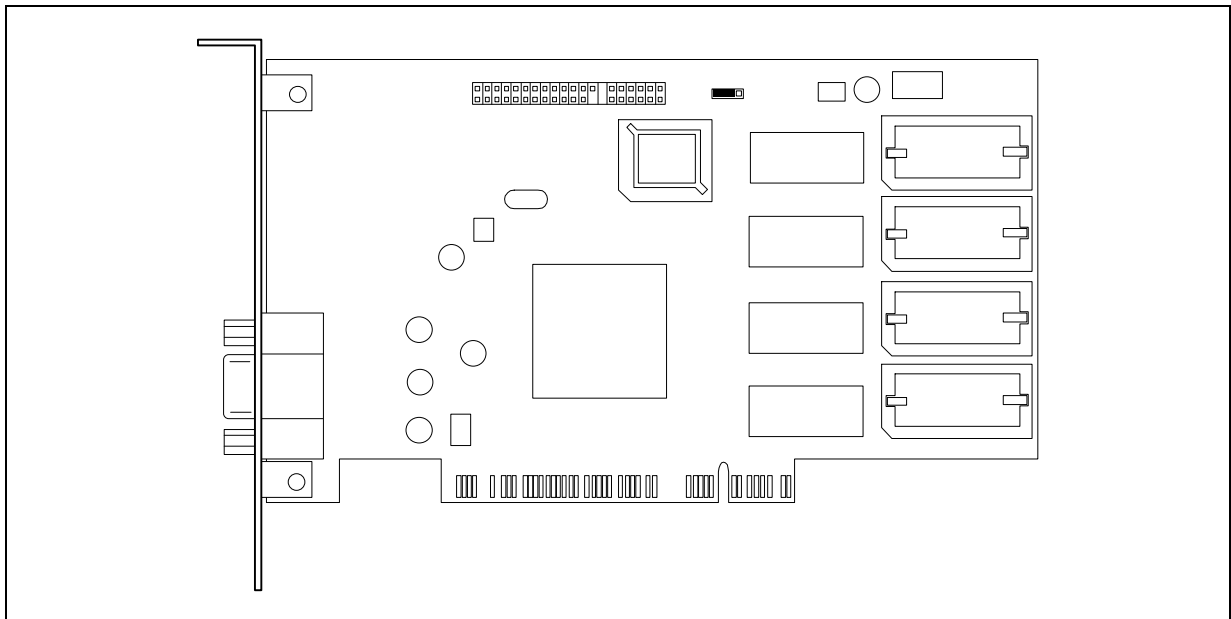
- BitBlocktransfer
- Line Draw
- Polygon/Rectangle Fill
- Bit Masking
- Monochrome Expansion
- Panning/Scrolling
- Scissoring
- Full ROP support and 64 x 64 x 2 h/w cursor
- Acceleration in 8-32 Bpp modes



**3D**

- 1M Triangle/s Setup-Engine
- 4 kB on-chip texture (cache)
- 16-bit Z-buffering
- Single-pass trilinear filtering
- Perspective correct mip-mapping
- Video texturing
- Goraud and Specular Shading
- Alpha blending
- Fog
- Edge anti-aliasing
- Texture lighting
- Sub-pixel and sub-texel accuracy

**ATI 3D Charger PCI add-on board (AF31552)**



ATI 3D Charger, based on ATI '3D RAGE II +DVD', 64-bit 3D graphics engine with 2 MB EDO RAM (40 ns), is an PCI based graphics accelerator adapter (5 V, Bus Master device).

The amount of the EDO RAM can be upgraded up to 4 MB with an optional 2 MB EDO RAM memory expansion modules (40 ns). The RAMDAC, which has 64-bit data path to the EDO RAM, can handle pixel frequencies up to 170 MHz. The video interface is DDC1, DDC2B+ and VESA DPMS compatible. The adapter has an AMC connector (v. 2.0). The adapter has the INTERRUPT ENABLED/DISABLED jumper. As a default the jumper is in the DISABLED position, i.e. the adapter does not reserve an interrupt. Main features:

**H/W Video Acceleration**

- Video scaling
- YUV to RGB color space conversion
- Colour and Chroma keying
- Motion compensation
- Multistream video

**H/W 2D Acceleration of**

- BitBlocktransfer
- Line Draw
- Polygon/Rectangle Fill
- Bit Masking
- Monochrome Expansion
- Panning/Scrolling
- Scissoring
- Full ROP support and 64 x 64 x 2 h/w cursor
- Acceleration in 8-32 Bpp modes

**3D**

- 16-bit Z-buffering
- Bi and Trilinear filtering
- Perspective correct mip-mapping
- Video texturing
- Goraud Shading
- Alpha blending
- Fog

**AMC (ATI Multimedia Channel)**

The ATI Multimedia Channel connector (i.e. a 16-bit bi-directional video port) consist of two parts, the conventional VGA feature connector and the "AMC extension". The connector has been designed so that the standard VGA feature connector cables can be still used with non-AMC devices. When using AMC cards, both parts of the AMC connector are in use (single cable). Several AMC devices (for example video capture/conferencing, hardware MPEG-2/DVD and TV tuner) can be connected to the channel at the same time (daisy chain cabling) but only one device can be used at a time.

**Refresh rates, ATI Xpert@Work AGP**

Maximum refresh rates defined for the ATI Xpert@Work AGP graphics adapter (depends on the monitor in use).

Resolution	8 bpp (256 colours)		16 bpp (65 k colours)		24 bpp (16.7 M colours)	
	4 MB <sup>(1)</sup>	8 MB <sup>(2)</sup>	4 MB	8 MB	4 MB	8 MB
640 x 480	200 Hz	200 Hz	200 Hz	200 Hz	200 Hz	200 Hz
800 x 600	200 Hz	200 Hz	200 Hz	200 Hz	200 Hz	200 Hz
1024 x 768	150 Hz	150 Hz	150 Hz	150 Hz	150 Hz	150 Hz
1152 x 864	120 Hz	120 Hz	120 Hz	120 Hz	120 Hz	120 Hz
1280 x 1024	100 Hz	100 Hz	100 Hz	100 Hz	100 Hz	100 Hz
1600 x 1200	85 Hz	85 Hz	85 Hz	85 Hz	N/A <sup>(3)</sup>	75 Hz

<sup>(1)</sup> As a default, ATI Xpert@Work AGP has 4 MB of SGRAM soldered on the adapter itself

<sup>(2)</sup> ATI Xpert@Work AGP with 4 MB SGRAM SO-DIMM module added to the adapter (total video mem = 8 MB)

<sup>(3)</sup> N/A = mode Not Available

**Refresh rates, ATI 3D Charger PCI**

Maximum refresh rates defined for the ATI 3D Charger PCI graphics adapter (depends on the monitor in use).

Resolution	8 bpp (256 colours)		16 bpp (65 k colours)		24 bpp (16.7 M colours)	
	2 MB <sup>(1)</sup>	4 MB <sup>(2)</sup>	2 MB	4 MB	2 MB	4 MB
640 x 480	200 Hz	200 Hz	200 Hz	200 Hz	200 Hz	200 Hz
800 x 600	200 Hz	200 Hz	200 Hz	200 Hz	160 Hz	160 Hz
1024 x 768	150 Hz	150 Hz	150 Hz	150 Hz	N/A <sup>(3)</sup>	120 Hz
1152 x 864	100 Hz	100 Hz	100 Hz	100 Hz	N/A	85 Hz
1280 x 1024	85 Hz	85 Hz	N/A	85 Hz	N/A	75 Hz

<sup>(1)</sup> As a default, ATI 3D Charger PCI has 2 MB of EDO RAM soldered on the adapter itself

<sup>(2)</sup> ATI 3D Charger PCI with 2 MB EDO RAM modules added to the adapter (total video mem = 4 MB)

<sup>(3)</sup> N/A = mode Not Available

### Video memory upgrades

Video controller	Memory on the graphics board	Memory upgrade module	Kit code for the upgrade module	Total video memory
ATI Xpert@Work	4 MB (SGRAM)	4 MB (SGRAM)	PL060611 <sup>(1)</sup>	8MB (SGRAM)
ATI 3D Charger	2 MB (EDO)	2 MB (EDO)	PL060612 <sup>(2)</sup>	4 MB (EDO)

<sup>(1)</sup> Video memory upgrade kit for ATI Xpert@Work consists one 4 MB, 100 MHz SGRAM SO-DIMM module

<sup>(2)</sup> Video memory upgrade kit for ATI 3D Charger consists two 2 MB,40 ns EDO RAM modules

### Ethernet subsystem

The system board has no on-board LAN. For the add-on board LAN with WOL features, there is a three pin Wake On LAN header on the system board.

### Audio

The system board has no on-board audio.

There is one option available, i.e Creative Vibra 16XV, PnP ISA add-on board. It is based on the CT2511 single chip 16-bit stereo codec controller (Sound Blaster). It fulfills requirements of PnP, Microsoft's PC97, Sound Blaster and APM compatibility. . In addition to SB Audio, the CT2511 contains a CQM Music Synthesizer and an MPU-401 MIDI functions. The maximum audio sample frequency is 48 kHz, 8/16-bits per channel.

Main functions:

- Sound Blaster 2.0 and Sound Blaster 16 compatible
- ISA 16-bit I/O addressing
- Full Duplex operations (16-bit data for recording and playback)
- Type F DMA
- MPC 2 and 3 compliant
- Microsoft PC97 compliant
- PnP support
- APM 1.2 support

Audio connectors on the system units (optional, only with integrated on-board audio):

- On the adapter: Microphone Input (mono), Input (stereo), Output (stereo), MIDI/Joystick
- On the system board: CD audio, Telephony

#### Creative ViBRA 16XV PnP Resources:

Device 0 (PnP ID = CTL0043)	IRQ	DMA	I/O (hex)
SB			<b>220-22F</b> , 240-24F, 260-26F, 280-28F
CQM (Adlib)			<b>388-38B</b> , 38C-38F, 390-393, 394-397
MPU-401 UART			<b>300-301</b> , 310-311, 320-321, 330-331
SB	<b>5, 7, 9, 10</b>		
SB		<b>0, 1, 3</b>	

Device 1 (PnP ID = CTL7005)	IRQ	DMA	I/O (hex)
Gameport			200 - 20F ( <b>201</b> )

Default values are shown as ***Bold Italic***

## Add-on board slots on system board

The system board in ErgoPro m664-series has the following slots:

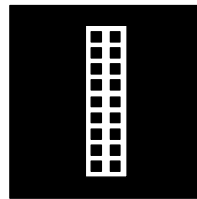
- 1 AGP slot (32-bit)
- 3 PCI slots (32-bit)
- 1 shared PCI/ISA slot (32-bit/16-bit)
- 1 ISA slot (16-bit)

All PCI slots are master slots.

## Front panel indicators

The front panel has two indicators (LEDs), from top to bottom:

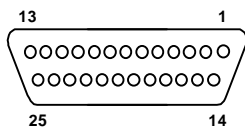
<b>Power</b> (Green/Orange)	Illuminated (green) when the system is ON, orange in Power Save mode.
<b>HDD</b> (Orange)	Illuminated during HDD activity.



# Section 7 :

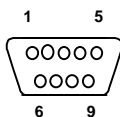
## Pin assignments

### Parallel port (Standard mode)



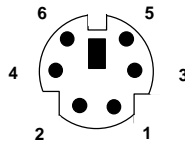
PIN	In/Out	Signal
1	Out	Strobe
2	In/Out	Data bit 0
3	In/Out	Data bit 1
4	In/Out	Data bit 2
5	In/Out	Data bit 3
6	In/Out	Data bit 4
7	In/Out	Data bit 5
8	In/Out	Data bit 6
9	In/Out	Data bit 7
10	In	Acknowledge
11	In	Busy
12	In	Paper End
13	In	Select
14	Out	Auto Line Feed
15	In	Error
16	Out	Initialise Printer
17	Out	Select In
18- 25	-	Ground

### Serial ports



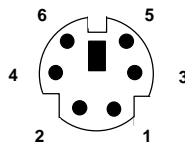
PIN	In/Out	Signal
1	In	Carrier Detect
2	In	Receive Data
3	Out	Transmit Data
4	Out	Data Terminal Ready
5	-	Signal Ground
6	In	Data Set Ready
7	Out	Request to Send
8	In	Clear to Send
9	In	Ring Indicator

## Mouse port



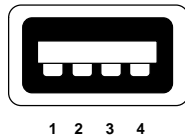
PIN	Signal
1	Data
2	No connect
3	Ground
4	+ 5 V DC
5	Clock
6	No connect
Shield	Frame Ground

## Keyboard connector



PIN	Signal
1	Data
2	No connect
3	Ground
4	+ 5 V DC
5	Keyboard Clock
6	No connect
Shield	Frame Ground

## Universal Serial Bus (USB) connector

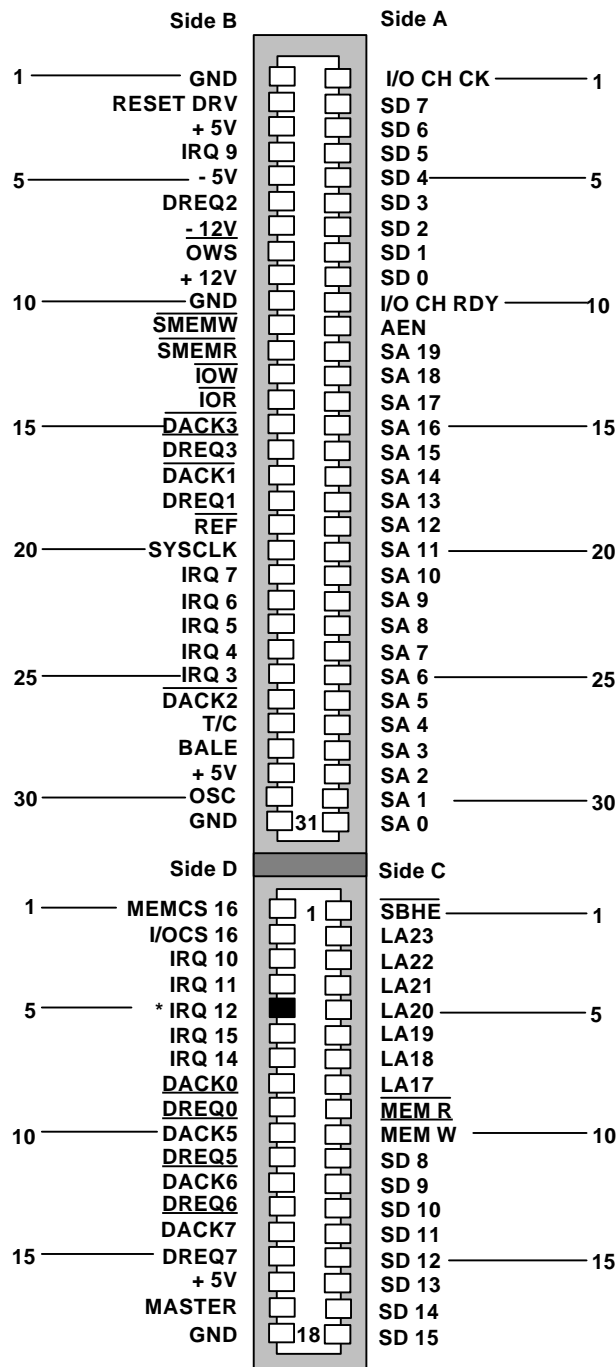


PIN	Signal
1	VCC (Cable power)
2	- Data
3	+ Data
4	Ground(Cable ground)



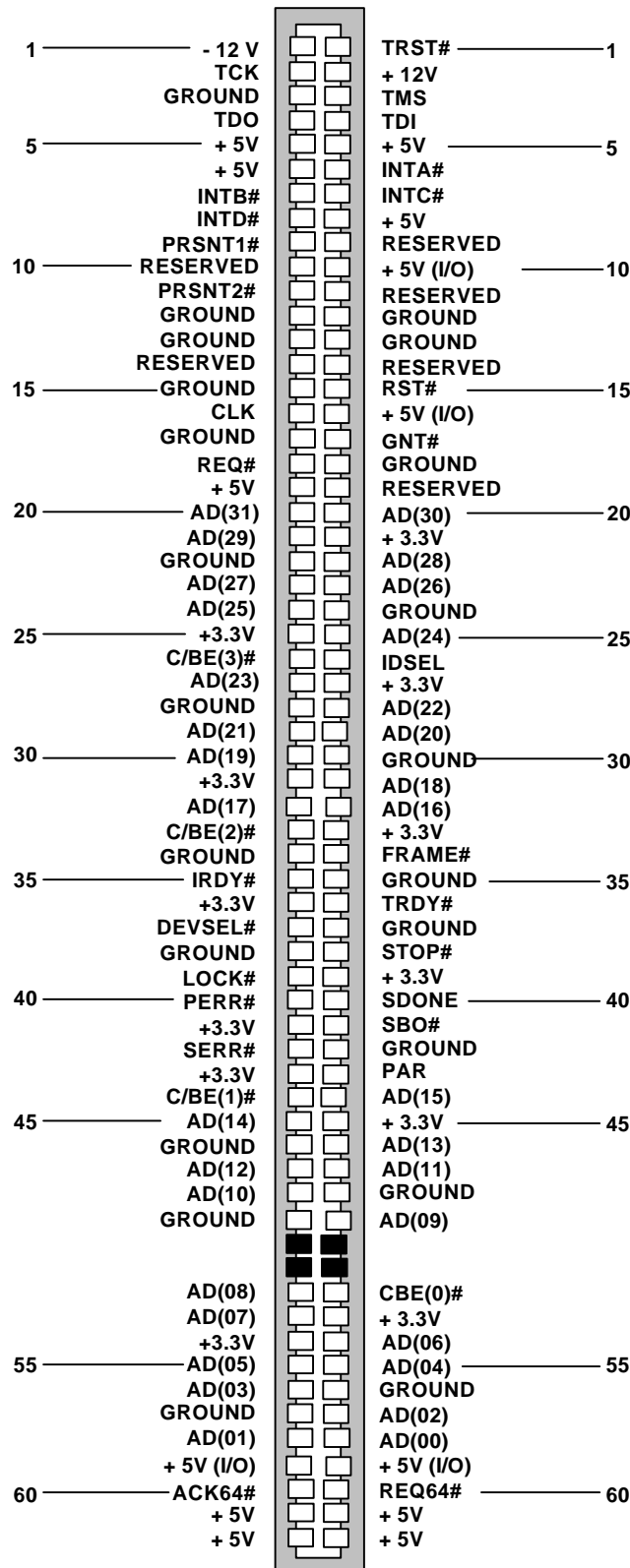


### ISA bus connector

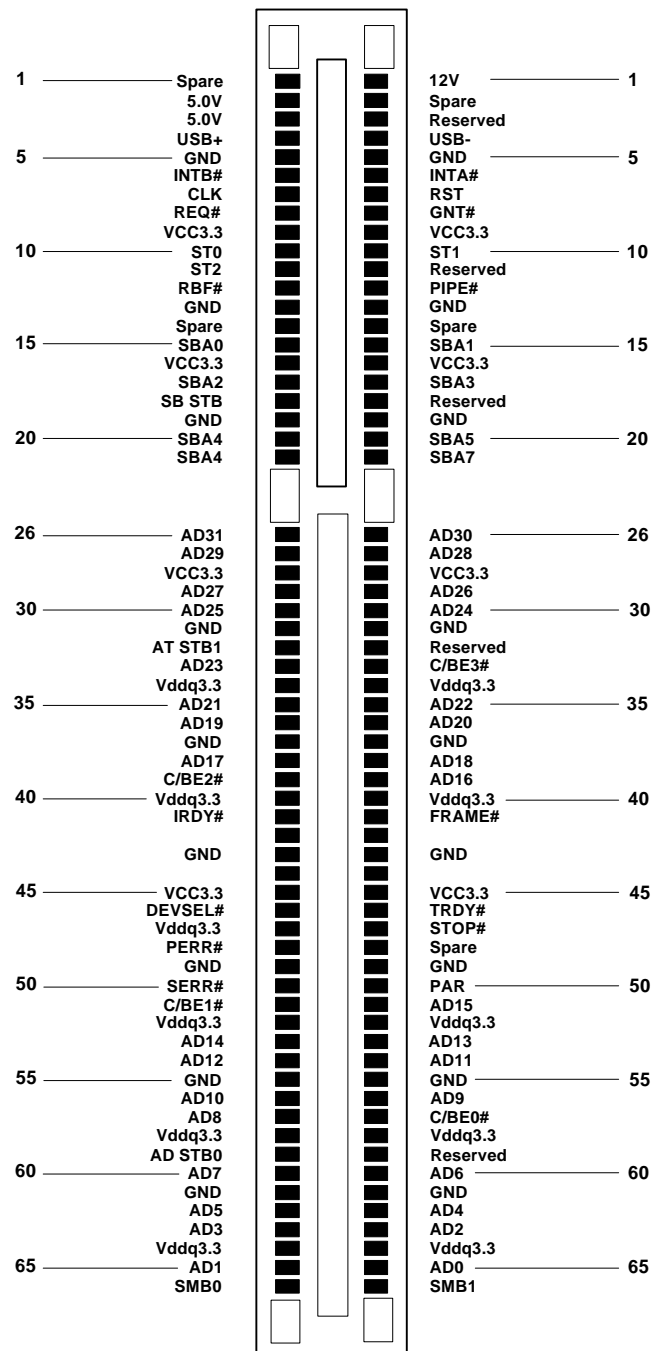


\* : Reserved for PS/2 type mouse, but the mouse interface can be disabled from the RSU (setup)

### PCI bus connector

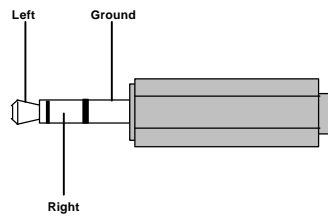


### AGP connector

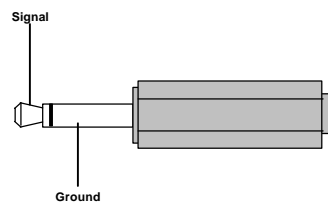


## Audio connectors

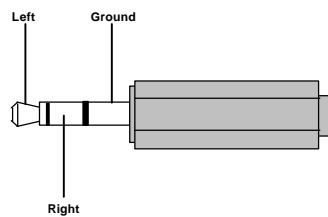
### Speaker type connector



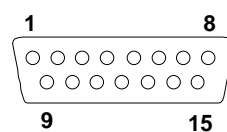
### Microphone type connector (if not as speaker type connector)



### Line-In type connector



### MIDI/Joystick connector in Creative Vibra 16XV adapter

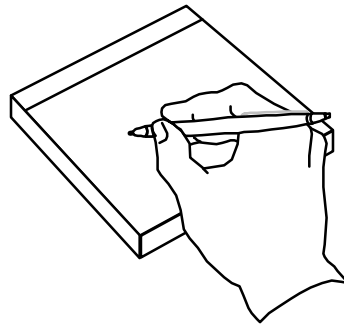


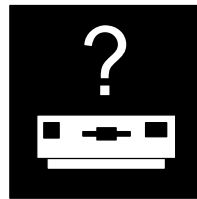
PIN	Signal	PIN	Signal
1	Vcc	9	Vcc
2	JBUT0	10	JBUT2
3	JSX1	11	JSX2
4	Ground	12	MIDI OUT
5	Ground	13	JSY2
6	JSY1	14	JBUT3
7	JBUT1	15	MIDI IN
8	Vcc		

## Front panel I/O connectors

PIN	Signal
<b>Power On</b>	
1	SW_ON#
2	Ground
<b>Sleep/Resume</b>	
3	Sleep request
4	+ 5 V
<b>Infrared</b>	
6	+ 5 V
7	Key
8	+IrRX /receive)
9	Ground
10	IrTX (transmit)
11	CONIR (consumer IR)
<b>HDD LED</b>	
13	+ 5 V
14	Key
15	HD Active#
16	+ 5 V
<b>Power LED</b>	
18	Ground
19	Key
20	+ 5 V
<b>Reset</b>	
22	Ground
23	SW_RST
<b>Speaker</b>	
24	Ground
25	Key
26	PIEZO_IN
27	SPKR_HDR

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# Section 8 :

## Machines identification

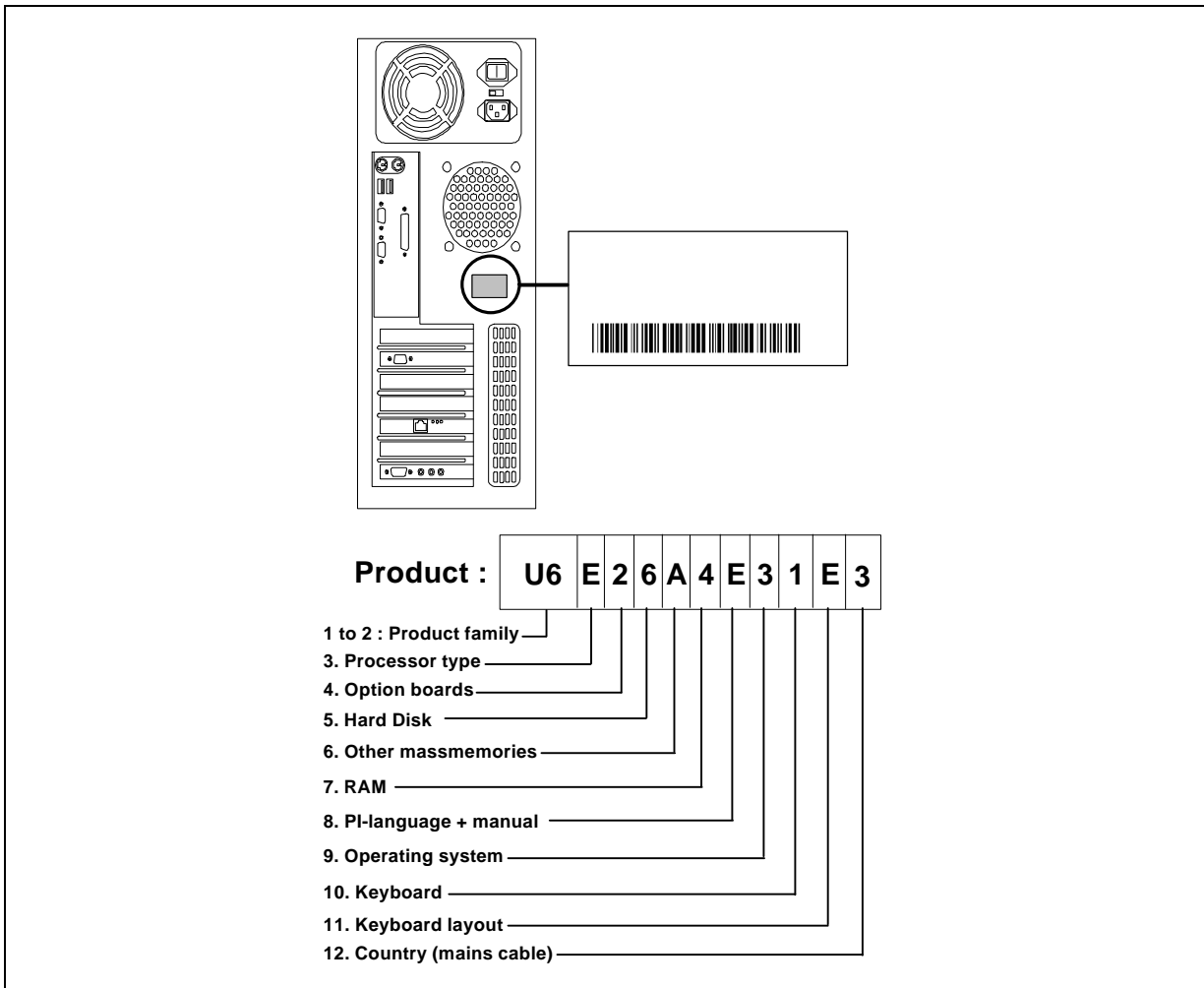
## m664-series : structure code

Every ErgoPro has a configuration label located in the system unit. The configuration label consists of information of identifying the ErgoPro model, it's configuration and it's serial number, example:

- the exact name of the ErgoPro model: **m664/266-64-3.2GB**
- the amount of RAM installed: **m664/266-64-3.2GB**
- the size of the Hard Disk installed: **m664-64-3.2GB**
- the structure (product) code: **U6E26A4E31E3**
- the serial number of the PC: **78083V8** (where **78**083V8 defines the manufacturing year of this PC as 1997, and **7808**3V8 defines the manufacturing week of this PC as week 8 of the year 1998).

In ErgoPro m664-series, the configuration label is located in the rear panel. The picture below shows the location of the configuration label in the rear panel on m664-series.

The twelve (12) digit code (i.e. a structure code, sometimes referred as a product code) can be divided into eleven parts, indicating that way the exact configuration of the machine. The following pages explain those codes.





## Identification codes

The following code information should be used for product identification **only**. The information should **not** be used to build up an ordering code (Customer specific structure codes are not listed below).

### 1-2. PRODUCT FAMILY

U6 m664/\*\* without on-board audio and LAN AF31131

### 3. PROCESSOR TYPE and HEATSINK

D	Pentium II 233 MHz with MMX	AF33903 + PL070144
E	Pentium II 266 MHz with MMX	AF33904 + PL070144
F	Pentium II 300 MHz with MMX	AF33905 + PL070144
G	Pentium II 333 MHz with MMX	AF33909 + PL070144

### 4. OPTION BOARDS

1	ATI 3D Charger PCI + Creative Vibra 16XV + headset	AF31552 + AF30083 + PL090202
2	ATI Xpert@Work AGP + Creative Vibra 16XV + headset	AF31554 + AF30083 + PL090202
6	ATI Xpert@Work AGP + Creative Vibra 16XV + 2940U + headset	AF31554 + AF30083 + AF31083 + PL090202

### 5. HARD DISK

6	3.2 GB IDE	AF21232
7	4.3 GB IDE	AF21233
8	6.4 GB IDE	AF21234
D	4.3 GB SCSI	AF21246
E	6.4 GB SCSI	AF21242

### 6. OTHER MASSMEMORIES

A	CD-ROM 20x IDE	AF23331 + PL040507
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### 7. RAM

2	32 MB SDRAM (DIMM)	AF33852D
4	64 MB SDRAM (DIMM)	AF33853D or 2 x AF33852D
5	128 MB SDRAM (DIMM)	AF33854D

### 8. PI-LANGUAGE + MANUAL

A	Hungarian
C	PAN-European
E	English
F	Danish
G	German
H	Spanish
J	French
K	Dutch
L	Norway
M	Finnish
N	Swedish
P	Portuguese
U	None
V	Czech
Y	Polish

### 9. OPERATING SYSTEM

2	Windows 95
3	Windows NT 4.0 Workstation

### 10. KEYBOARD

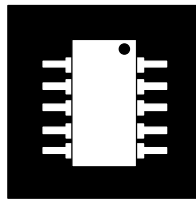
0	None
1	e105

**11. KEYBOARD LAYOUT**

0	None
2	Belgium
3	US
C	Eastern Europe
E	English
F	Danish
G	German
H	Spanish
J	French
K	Dutch
L	Norwegian
M	Finnish
N	Swedish
P	Portuguese
S	Italian

**12 COUNTRY (MAINS CABLE + BADGE + MOUSE)**

0	None
1	EU cable, Fujitsu
2	EU cable, MikroMikko
3	UK cable, Fujitsu
5	DK cable, Fujitsu
6	CH cable, Fujitsu
7	US cable, Fujitsu
8	IT cable, Fujitsu
A	AUS cable, Fujitsu
B	South Africa, Fujitsu



# Section 9 :

**Specification tables**  
**Memory tables**

## Machine specifications

### Processor related information of m664-series

Used on	m664/233 (U6D)	m664/266 (U6E)	m664/300 (U6F)	m664/333 (U6G)
<b>Processor &amp; speed</b>	iNTEL Pentium II 233 MHz SECC package	iNTEL Pentium II 266 MHz SECC package	iNTEL Pentium II 300 MHz SECC package	iNTEL Pentium II 333 MHz SECC package
<b>MMX support</b>	Yes			
<b>Fujitsu ICL code</b>	PL060620 (includes active heatsink with fan)	PL060621 (includes active heatsink with fan)	PL060622 (includes active heatsink with fan)	PL060623 (includes active heatsink with fan)
<b>Heatsink</b>	Yes, an active heatsink (i.e. with fan) is attached to the processor's SECC package with two clips. The fan is attached to the heatsink with two screws			
<b>External clock</b>	66 MHz			
<b>Clock multiplier</b>	3.5	4	4.5	5
<b>System clock</b>	33 MHz (PCI), 8 MHz (ISA)			
<b>Operating voltage</b>	2.8 V (2.1 V to 3.5 V) PSU/regulator is automatically adjusted to the right voltage level by the VID pins of the CPU			
<b>Power consumption of the processor chip (total)</b>	34.8 W	38.2 W	43.0 W	23.7 W
<b>Internal, 1<sup>st</sup> level cache (L1)</b>	Built-in to the Pentium II processor: 16 kB, 4-way set associative, write back for code 16 kB, 4-way set associative, write back for data			
<b>2<sup>nd</sup> level cache (L2)</b>	Built-in to the SECC package 512 kB, ECC (117 MHz)	Built-in to the SECC package 512 kB, ECC (133 MHz)	Built-in to the SECC package 512 kB, ECC (150 MHz)	Built-in to the SECC package 512 kB, ECC (166 MHz)
<b>Co-processor</b>	Floating Point Unit built-in to the Pentium II processor			
<b>Overdrive</b>	Not available			

**General information of m664-series**

General	m664/233	m664/266	m664/300	m664/333
“Socket” type	242 pin Single Edge Contact Cartridge (SECC), slot 1			
System board	AF33131			
Used on (structure)	U6D	U6E	U6F	U6G
BIOS ID	4A4LL0X0.86A			
Audio	No on-board audio, optional Creative VIBRA 16XV PnP ISA add-on board (CT4170)			
Floppy drive interface	On-board, PC82077AA compatible			
Graphics	No on-board graphics, two options available: ATI Xpert@Work AGP graphics adapter with 4 MB of SGRAM, connected in ‘AGP slot’ (controller: ‘3D RAGE PRO’), <b>ATX style</b> ATI 3D Charger PCI graphics adapter with 2 MB of EDO RAM, connected in PCI slot (controller: ‘3D RAGE II + DVD’)			
ATI AMC 2.0	Yes, located in the ATI Xpert@Work AGP and ATI 3D Charger PCI graphics adapters			
IDE interface	On-board, PCI bus enhanced IDE interface with two connectors, supporting Ultra DMA/33, PIO 4 and DMA 2 mode IDE hard disks and ATAPI devices			
IDE hard disks	3.2 GB, 4.3 GB and 6.4 GB (Ultra DMA/33). All disks support SMART			
SCSI interface	No on-board SCSI interface, optional Adaptec AHA2940U rev B (narrow), Ultra SCSI host controller, occupies one PCI slot			
SCSI hard disks	4.3 GB, 6.4 GB UltraSCSI HDDs			
LAN	No on-board LAN, optional Intel EtherExpress PRO 100B WOL, PCI controller			
Parallel port	On-board, one bi-directional parallel port with 25-pin female connector (supported modes SPP, ECP and EPP)			
Serial ports	On-board, two 16C550 compatible serial ports with two 9-pin male connectors (16-bytes FIFO)			
USB	On-board, two USB connectors on the rear panel			
Serial Infrared support	Additional IrDA adapter, connected to the serial port			

## Architecture & Configuration of m664-series

	m664/233, m664/266, m664/300, m664/333
<b>Chip set</b>	Intel 440LX AGPset (i.e. 82443LX and 82371AB)
<b>Memory banks</b>	3, with SDRAM support
<b>SIMM modules per bank</b>	Not available
<b>DIMM modules per bank</b>	1
<b>BIOS</b>	256 kB (i.e. 2 Mb) Boot Block Flash RAM, Intel/Phoenix platform with PnP (1.0A), ACPI (1.0) and PCI (2.1) support
<b>Keyboard controller</b>	Industry standard (AMI), built-in PC97307
<b>Theft prevention</b>	No
<b>Power Management</b>	Yes, APM rev. 1.2 compliant (Windows 95), ACPI 1.0 compliant (future Windows 9x)
<b>Desktop Management</b>	Yes, DMI 2.0
<b>Floppy drive</b>	Yes, a place for one 3.5" floppy drive, BIOS support: 720kB, 1.44MB and 2.88MB (3.5"), 360kB and 1.2MB (5.25")
<b>Architecture / Expansion slots</b>	Slots on the system board: one AGP (32-bit), three PCI (32 bit), one shared PCI/ISA (32 bit / 16 bit), two ISA (16-bit)
<b>Mass memory bays</b>	A 3.5" device bay for three 3.5" devices (one of them occupied by Floppy drive), two devices attached to the 3.5" bay are front accessible.  A 5.25" device bay for three 5.25" or 3.5" devices. Attaching the 3.5" device to the 5.25" bay requires rails (not supplied by Fujitsu). All devices attached to the 5.25" bay are front accessible.
<b>HD silencer</b>	No
<b>Power supply</b>	235 W ATX-style, 110/240 V, 48 Hz to 63 Hz, Power Supply Unit has a monitor outlet connector
<b>Fans</b>	Two temperature controlled fans, one in front panel (air in to the housing), another one in the PSU (air out from the PSU/housing).
<b>Dimensions</b>	
<b>Width</b>	190 mm
<b>Height</b>	440 mm
<b>Depth</b>	480 mm
<b>Weight</b>	13 kg (approx.)

## System memory map

Address range	Size (kB)	Use	Cached
000000 - 09FBFF	639	Base memory	Yes
09FC00 - 09FFFF	1	Extended BIOS data area	Yes
0A0000 - 0AFFFF	64	VGA graphics	No
0B0000 - 0B7FFF	32	VGA text (colour mode)	No
0B8000 - 0BFFFF	32	VGA text (mono mode)	No
0C0000 - 0C7FFF	32	VGA BIOS	Yes
0C8000 - 0DFFFF	96	Free	Yes
0E0000 - 0EFFFF <sup>(1)</sup>	64	System BIOS	Yes
0EF000 - 0EF7FF	2	Reserved for the CPU memory management	Yes
0EF800 - 0EFFFF	2	PnP BIOS Data Area	Yes
0F0000 - 0FFFFFF <sup>(2)</sup>	64	System BIOS	Yes
100000 - 18000000 <sup>(3)</sup>	3830	Extended memory	Yes

<sup>(1)</sup> E0000 - E7FFF 32 KB POST BIOS (available as UMB)

<sup>(2)</sup> F8000 - F8FFF 4 KB OEM Logo or Scan User Flash

FA000 - FBFFF 8 KB ESCD (Plug and Play configuration and DMI)

FC000 - FFFFF 16 KB Boot block

<sup>(3)</sup> - 18000000 383 MB TOM (Top Of Memory)

## Memory configurations m664-series

Bank 0	Bank 1	Bank 2	Total Memory
32 MB	-	-	32 MB
-	32 MB	-	32 MB
-	-	32 MB	32 MB
32 MB	32 MB	-	64 MB
-	32 MB	32 MB	64 MB
32 MB	-	32 MB	64 MB
64 MB	-	-	64 MB
-	64 MB	-	64 MB
-	-	64 MB	64 MB
32 MB	32 MB	32 MB	96 MB
64 MB	64 MB	-	128 MB
-	64 MB	64 MB	128 MB
64 MB	-	64 MB	128 MB
128 MB	-	-	128 MB
-	128 MB	-	128 MB
-	-	128 MB	128 MB
64 MB	64 MB	64 MB	192 MB
128 MB	128 MB	-	256 MB
-	128 MB	128 MB	256 MB
128 MB	-	128 MB	256 MB
128 MB	128 MB	128 MB	384 MB

The system board provides three 168-pin, gold plated, 3.3 V (5 V tolerance) DIMM sockets. The three (3) DIMM sockets are arranged in one bank per one socket. The sockets are designated from Bank 0 to Bank 2. Each bank provides a 64/72-bit wide data path. There are no jumper settings required for the memory size or type, which is automatically detected by the system BIOS.

The sockets support 2M x 64 (16 MB), 4M x 64 (32 MB), 8M x 64 (64 MB) and 16M x 64 (128 MB) single- or double-sided modules. Minimum supported memory size is 16 MB and maximum memory size is 384 MB, using three 128 16M x 64 DIMM modules. DIMMs must be gold plated, 4-clock, 100 MHz or faster, unbuffered, SDRAM modules. Each DIMM module must have an nvram. The contents of the nvram is programmed according to Intel's specification "4-CLOCK, 66 MHz, 64-Bit UNBUFFERED SDRAM DIMM, REVISION 1.0

In addition to memory combinations mentioned in the table above, all memory combinations of mixing 16 MB, 32, MB, 64 MB and 128 MB DIMMs randomly in three sockets are allowed.

Example: 128 MB in socket 0, 32 MB in socket 1 and 64 MB in socket 2

**Note:** All configurations use non-parity SDRAM DIMMs (i.e. ECC is not supported).



## DIMM recommendations

DIMM size (MB)	Description	Speed	Voltage	Type	Clock lines	Pins	Module	Kit code
16	2M*64	100 MHz	3.3V	SDRAM	4	168	N/A	N/A
32	4M*64	100 MHz	3.3V	SDRAM	4	168	AF33852D	PL060167
64	8M*64	100 MHz	3.3V	SDRAM	4	168	AF33853D	PL060168
128	16M*64	100 MHz	3.3V	SDRAM	4	168	AF33854D	PL060169

### Explanations of the terms :

- Speed:** For SDRAM DIMMs this is the slowest clock speed that can be used (in MHz).
- Module:** Product code which is used to identify spare numbers and correct DIMM brands used with these machines.
- Kit code:** This is the code that can be used when ordering memory upgrades. The kit includes one (1) DIMM.

## DMA channels

The system board supports seven ISA-compatible DMA channels by utilising two DMA controller chips which operate in cascade mode as a master-slave pair. The slave uses channels 0 to 3, supporting 8-bit data transfers while the master controller uses channels 4 to 7, supporting 16-bit data transfers. Controllers are 8237A compatible.

The following table lists each DMA channel and its use.

16-bit channels	8-bit channels	Use(s)
Master (CTRL1)	Slave (CTRL2)	
	CH 0	
	CH 1	Optional Creative Audio (PnP ISA)
	CH 2	Floppy drive controller
	CH 3	Optional Creative Audio (PnP ISA) Parallel Port (for ECP)
CH 4		Cascading slave to master
CH 5		
CH 6		
CH 7		

## Interrupt levels

Two programmable interrupt controllers supply interrupt control. The controllers are cascaded together as a master-slave pair and provide 15 ISA-compatible interrupt levels. Excluding NMI, all interrupts can be masked. Controllers are 8259A compatible.

The table below shows the interrupt level assignments.

Interrupt	Function
<b>NMI</b>	Parity error (System memory does not have parity checking)
<b>Master (Controller 1)</b>	
<b>IRQ0</b>	Timer output 0 (internal)
<b>IRQ1</b>	Keyboard controller
<b>IRQ2</b>	Interrupt from slave
<b>IRQ3</b>	COM2
<b>IRQ4</b>	COM1
<b>IRQ5</b>	Optional Creative Vibra 16XV audio (PnP ISA) by default
<b>IRQ6</b>	Diskette drive controller
<b>IRQ7</b>	LPT1
<b>Slave (Controller 2)</b>	
<b>IRQ8</b>	Real-time Clock
<b>IRQ9</b>	
<b>IRQ10</b>	
<b>IRQ11</b>	
<b>IRQ12</b>	PS/2-type mouse device
<b>IRQ13</b>	Math co-processor error
<b>IRQ14</b>	Primary IDE interface
<b>IRQ15</b>	Secondary IDE interface

## I/O addresses

The I/O address map is shown below. The hexadecimal addresses 0000 to 00FF are reserved for the system board I/O. The addresses hex 0100 through 03FF are available for the I/O channel. Additional addresses are allocated for the TokenRing adapter boards, and serial ports COM3 and COM4.

### System board addresses 0000 to 00FF

Hex range	Device
0000 - 000F	PIIX4 - DMA controller 1, slave
0020 - 0021	PIIX4 - Interrupt controller 1, master
002E - 002F	Super I/O controller - configuration registers
0040 - 0043	PIIX4 - Timer/Counter 1
0048 - 004B	PIIX4 - Timer/Counter 2
0060	Keyboard controller - Reset IRQ
0061	PIIX4 - NMI, Speaker control
0064	Keyboard controller - CMD/STAT byte
0070, bits 6:0	PIIX4 - Real-time clock, address
0070, bit 7	PIIX4 - enable NMI
0071	PIIX4 - Real-time clock, data
0078 - 0079	Reserved - system board configuration
0080 - 008F	PIIX4 - DMA page registers
00A0 - 00A1	PIIX4 - Interrupt controller 2, slave
00B2 - 00B3	APM control
00C0- 00DE	PIIX4 - DMA controller 2, master
00F0	Reset numeric error

### I/O channel addresses 0100 to 03FF

Hex range	Device
0120 - 0127	Creative audio (PnP ISA) by default
0170 - 0177	Secondary IDE interface
01F0 - 01F7	Primary IDE interface
0200 - 0207	Joystick in Creative Vibra 16XV audio PnP ISA add-on board
0220 - 022F	Creative Vibra 16XV audio (PnP ISA) by default
0228 - 022F	Parallel port 3 (LPT 3)
0240 - 024F	Creative Vibra 16XV audio (PnP ISA), alternative
0260 - 026F	Creative Vibra 16XV audio (PnP ISA), alternative
0278 - 027B	Parallel port 2 (LPT 2)
0278 - 027F	Parallel port 2 (LPT 2), EPP mode
0280 - 028F	Creative Vibra 16XV audio (PnP ISA), alternative
0290 - 0297	Management extension hardware
02E8 - 02EB	Serial port 4 (COM4)
02F8 - 02FF	Serial port 2 (COM2)

Hex range	Device
0300 - 0301	MPU-401 in Creative Vibra 16XV audio (PnP ISA), alternative
0310 - 0311	MPU-401 in Creative Vibra 16XV audio (PnP ISA), alternative
0320 - 0321	MPU-401 in Creative Vibra 16XV audio (PnP ISA), alternative
0330 - 0331	MPU-401 in Creative Vibra 16XV audio (PnP ISA) by default
0376	Secondary IDE interface, command port
0377	Floppy interface 2 command
0377, bits 6:0	Secondary IDE interface, status port
0377, bit 7	Floppy disk change, interface 2
0378 - 037B	Parallel port 1 (LPT1)
0378 - 037F	Parallel port 1 (LPT1), EPP mode
0388 - 038B	CQM (Adlib), Creative Vibra 16XV audio (PnP ISA) by default
038C - 038F	CQM (Adlib), Creative Vibra 16XV audio (PnP ISA), alternative
0390 - 0393	CQM (Adlib), Creative Vibra 16XV audio (PnP ISA), alternative
0394 - 0397	CQM (Adlib), Creative Vibra 16XV audio (PnP ISA), alternative
03B0 - 03DF	ATI Xpert@Work AGP graphics adapter
03E8 - 03EF	Serial port 3 (COM3)
03F0 - 03F5	Floppy interface 1
03F6	Primary IDE interface, command port
03F7	Floppy interface 1, command (write)
03F7, bits 6:0	Primary IDE interface, status port
03F7, bit 7	Floppy disk change, interface 1
03F8 - 03FF	Serial port 1 (COM1)

**I/O channel addresses 0400 to FFFF**

Hex range	Device
04D0 - 04D1	Edge/Level triggered PIC
0678 - 067B	Parallel port 2 (LPT 2), ECP mode
0778 - 077B	Parallel port 1 (LPT 1), ECP mode
0CF8- 0CFB	PCI configuration address registers
0CF9	Turbo and Reset control register
0CFC- 0CFF	PCI configuration data registers
8000 - 80FF	ATI Xpert@Work AGP graphics adapter
9020 - 903F	USB controller
9040 - 905F	Optional LAN (Intel EtherExpress PRO 100b)
FF00 - FF07	IDE Bus Master register
FFA0 - FFA7	Primary IDE Bus Master registers
FFA8 - FFAF	Secondary IDE Bus Master registers

## PCI Configuration Space Map

Bus number (hex)	Device number (hex)	Function number (hex)	Description
00	00	00	Intel 82440LX (PAC)
00	01	00	Intel 82440LX AGP bus (PAC)
00	07	00	Intel 82371AB PCI/ISA Bridge (PIIX4)
00	07	01	Intel 82371AB IDE Bus Master (PIIX4)
00	07	02	Intel 82371AB USB (PIIX4)
00	07	03	Intel 82371AB Power Management (PIIX4)
00	0D	00	PCI expansion slot 1
00	0E	00	PCI expansion slot 2
00	0F	00	PCI expansion slot 3
00	10	00	PCI expansion slot 4

## Timer

The system board has three programmable timers, defined as follows :

Channel	Use
CH 0	System timer
CH 1	DRAM refresh timer
CH 2	Tone generator (Speaker)

## Real-time clock (RTC) and CMOS RAM

A real-time clock component provides Real-Time Clock and Calendar functions. The circuit contains 114 bytes of battery-backed-up CMOS-static RAM memory used for clock functions, and for storing the configuration information (e.g., the number of diskette drives, the amount of system board memory, etc.).

The CMOS RAM memory is backed up with a non-rechargeable battery that has a considerable lifetime. However, should the battery begin to fail, the following message (and possibly others) appears on the screen during the power-on test:

**System battery is dead - Replace and run SETUP**

A used battery is an external coin-cell style , 3 V Lithium Cell battery (f.eg.**Sony CR2032**), which provides power to the RTC and CMOS memory.

## Power supply

### Characteristics

Power supply	<b>235 W T350000074</b>
Input voltage	100-120 V / 200-240 V ± 10%
Input frequency	50-60 Hz ± 5%
Max power input (w/o monitor)	N/A
Max power output	235 W
Max output current :	
+3.3 V	<b>TBA A ± TBA %</b>
+5V	<b>TBA A ± TBA %</b>
-5V	<b>TBA A ± TBA %</b>
+12V	<b>TBA A ± TBA %</b>
-12V	<b>TBA A ± TBA %</b>
+5VSB	<b>TBA A ± TBA %</b>
Max ground leakage current	
115V/60Hz	N/A
230V/50Hz	N/A

### Power consumption (without monitor)

System unit	Memory (RAM-Cache-Video)	Mass memories	Typical power consumption	Power Save Mode <sup>(1, 5)</sup>
m664/233 <sup>(2)</sup>	64 MB - 512 kB - 4 MB	20x CD - 6.4 GB IDE HDD	69.3 W <sup>(3)</sup> 75.3 W <sup>(4)</sup>	31.2 W <sup>(3)</sup> 36.0 W <sup>(4)</sup>
m664/266 <sup>(2)</sup>	64 MB - 512 kB - 4 MB	20x CD - 6.4 GB IDE HDD	74.2 W <sup>(3)</sup> 82.0 W <sup>(4)</sup>	32.0 W <sup>(3)</sup> 35.4 W <sup>(4)</sup>
m664/300 <sup>(2)</sup>	64 MB - 512 kB - 4 MB	20x CD - 6.4 GB IDE HDD	80.0 W <sup>(3)</sup> 88.8 W <sup>(4)</sup>	33.4 W <sup>(3)</sup> 38.0 W <sup>(4)</sup>
m664/333 <sup>(2)</sup>	64 MB - 512 kB - 4 MB	20x CD - 6.4 GB IDE HDD	55.0 W <sup>(3)</sup> 60.1 W <sup>(4)</sup>	30.8 W <sup>(3)</sup> 34.8 W <sup>(4)</sup>

<sup>(1)</sup> (Windows 95) Suspend mode when APM enabled (i.e. when all the power safe features are enabled)

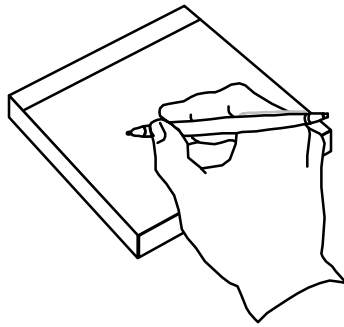
<sup>(2)</sup> m664/xxx with add-on board LAN and ATI Xpert@Work AGP add-on graphics board

<sup>(3)</sup> (Max) figures in Windows 95

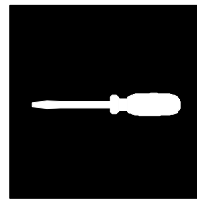
<sup>(4)</sup> (Max) figures in Windows NT 4.0 Workstation

<sup>(5)</sup> Power consumption in (Remote/Power) OFF mode: 2.5 W

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# Section 10 :

## Spare parts table

## Spare parts for m664-series

Part No	Description	MTBF
AF33131	System board (AL440LX), without on-board audio & LAN	176 000
T350000074	PSU, 235 W, ATX	100 000
PL060620 <sup>(1)</sup>	iNTEL PENTIUM II 233 MHz (with active heatsink)	
PL060621 <sup>(1)</sup>	iNTEL PENTIUM II 266 MHz (with active heatsink)	
PL060622 <sup>(1)</sup>	iNTEL PENTIUM II 300 MHz (with active heatsink)	
PL060623 <sup>(1)</sup>	iNTEL PENTIUM II 333 MHz (with active heatsink)	
AF33852D	32 MB SDRAM DIMM module	250 000
AF33853D	64 MB SDRAM DIMM module	250 000
AF33854D	128 MB SDRAM DIMM module	250 000
AF31554	ATI Xpert@Work AGP graphics adapter with 4 MB SGRAM (ATX style)	230 000
AF31552	ATI 3D Charger PCI graphics adapter with 2 MB EDO RAM	120 000
AF30083	Creative ViBRA 16XV, PnP ISA audio adapter	
AF31083	Adaptec AHA-2940U rev B, PC97 compliant U-SCSI, PCI, host adapter	450 000
PL060611	4 MB SGRAM upgrade memory module for ATI Xpert@Work AGP graphics adapter (SO-DIMM)	
PL060612	2 MB EDO upgrade memory module for ATI 3D Charger PCI graphics adapter (EDO DRAM)	
AF22123	Floppy drive, 1.44 MB, 3.5"	30 000
AF23331	ATAPI CD-ROM, 20x	70 000
AF21232	IDE HDD, 3.2 GB	300 000
AF21233	IDE HDD, 4.3 GB	300 000
AF21234	IDE HDD, 6.4 GB, Ultra DMA/33	300 000
AF21246	SCSI HDD, 4.3 GB, Ultra SCSI	500 000
AF21242	SCSI HDD, 6.4 GB, Ultra SCSI	500 000
A8900053	Cable, FDD	
A8900080	Cable, IDE, Cable Select (for two IDE HDD/ATAPI devices)	
A8900102	Cable, SCSI, internal, for 5 SCSI devices, incl. active term.	
A8900103	Cable, HDD LED (for SCSI HDD)	
A7108104	Cable, CD audio (for Creative Vibra 16XV add-on board)	
SE90211E	Drivers and Utilities CD for ErgoPro m664-series	

<sup>(1)</sup> PL-code includes

- the Pentium II processor with L2 cache (i.e. SECC)
- Active heatsink (i.e. heatsink with fan) ready attached to the SECC

<sup>(2)</sup> ATI Xpert@Work AGP is based on '3D RAGE PRO' graphics controller

<sup>(3)</sup> ATI 3D Charger PCI is based on '3D RAGE II + DVD' graphics controller

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