How To Build your Own PC

By Alan Hamill
B.Sc. Ph.D., C.Phys.

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Introduction

You're probably wondering why a guy with a PhD in physics is writing a book on "How to build PC's".

It started during my university years. I had a serious interest in computers and how they work. During my first degree in Applied Physics, I learned about digital electronics and computer architecture.

During my Ph.D., I learned many skills and entered into the world of programming, mostly in C++. I was always taking PC's apart and putting them back together. It grew to be my main hobby.

When I finished my PhD, I worked as a staff scientist in the European Molecular Biology Laboratory (EMBL) in Heidelberg Germany. As a biophysicist, I built optical systems such as the Photonic Force Microscope and the Atomic Force Microscope that allowed Biologists to probe single cells and even single molecules.

A lot of that work comprised of building customized PC's for controlling the optical system, capturing data in both video and numerical formats, analyzing the data with custom-written programs and producing results based on specific experiments. Once again, I found myself building highly technical custom PC's. I thoroughly enjoyed doing that.

I was even building PC's at home for the children, my wife and myself. Our house sometimes looked more like the inside of a lab than it did a family home.

My contract with EMBL ended in December of 2001 and we moved back to the UK. I was a bit dismayed with the "science as a job" scene by this time as it's mostly contract work. I decided to set up shop and do what I enjoy – build PC's.

I started selling PC's that I had built on Ebay and was surprised with the overwhelming response. It became a real good business and I still make a decent living from it.

Going back to the main issue of "Why write a book?" In my chosen field, which is science, we share our knowledge. That is how our world grows (technologically speaking). However, when it comes to building PC's I noticed a distinct lack of material on the subject.

I am sick and tired of so-called EXPERTS that warn, "Oh, don't do this yourself! Get a pro to do it for you." That pro is probably him and he's got dollar signs whizzing around in his head; "Oh good, another gullible customer to rip off with jargon!"

Well folks, I am here to tell you, "YOU DON'T NEED THEM!!"

ANYONE can build a PC - you will save plenty of $$$'s and have a sense of achievement. Unfortunately, there will be some unavoidable technical content, but I will do my best to explain it all in jargon-free terms.

I can explain terms such as "CMOS" and "BIOS" and I included a jargon-buster and glossary of technical terms at the end of the book for you to refer to if you get stuck.

The main aim of this book is to guide someone with NO technical knowledge through the process of building a PC. My promise to you is that I will make myself available to answer any questions you have. My personal email and website address are both at the end of this book. So, go on! Get to work! Maybe you will enjoy it as much as I do and start a small business. Good luck!

Dr. Alan Hamill

Foreword

In my years of scientific study, I met people from all over the world who are experts in their fields.

I am an expert in my field of physics because I have knowledge on certain aspects of the work that no-one else in the world has. That is my definition of an expert. I'm not blowing my own trumpet, just putting things in perspective for you because what I tell you will probably rock the world of the so-called "expert PC builder".

In my opinion, there is no such thing as an expert when it comes to building a PC. The expertise is with the people who develop the electronic components and software that make the PC work. These things are ready-made and all YOU have to do is to learn what goes where.

You don't have to know HOW it works to build a PC.

I could tell you how a CPU works, give long explanations on how digital signals are translated into video imagery or the workings of the analog to digital converter. But you don't need to know this stuff to build your own PC.

The sad thing is that the so-called experts baffle you with techno-babble that they probably don't understand themselves and then con you into buying more expensive components than you actually need. That's how they make their money!

I'll tell you again that there is no such thing as a computer expert with respect to building a PC.

In this book I will show you, step-by-step, how easy it is to build your own PC and pick the components that you NEED. This will save you a lot of money and give you a great sense of achievement.

The words "Expert PC Builder" will fade into oblivion when you see how simple it is to do.

This book shows you with simple, easy-to-understand illustrations how to build your own PC and gives you the necessary technical terms to fend off "experts". You get the knowledge necessary to buy the right parts, build your own PC and to be your own expert!

Before You Begin

The first thing to do is to buy a rechargeable electric screwdriver with interchangeable heads (Philips head (star) and plain heads in various sizes). You'll thank me for this advice as you start your computer-building project.

Most people don't know that all components in computers can be fried by static electricity. Our bodies, clothes and shoes generate enough to completely destroy the works of a PC.

Have you ever pulled a sweater off and heard a crackling sound? That's static - the PC builder's biggest enemy.

THIS IS AN ESSENTIAL PURCHASE: Get an antistatic wrist strap or, even better, an antistatic board from your electrical store or PC supplies store. They both plug into a mains socket but don't worry - you won't get electrocuted! It simply drains static from your body and the surrounding area to ground. Eliminating static gives you the freedom to carry out your project in confidence!

Let's Get Started

You need to decide what you want your computer to do:

- Is it for the family to access to the Internet?

  A base model is all you need.

- Are you a video enthusiast who wants to compile, edit and publish your own videos?

  You need to do more planning but remember, I will always be at hand for advice.

This is a blueprint for a basic PC that YOU will quickly learn to build and upgrade!

2.1 The Motherboard (MB)

"Motherboard" is a frightening word to some, but it is just the control panel for the rest of the PC.

Motherboards come in all shapes, sizes and configurations. Some, particularly from the major companies, have quite astounding features. The "best" motherboard for your project depends on what you want to do with the computer and which CPU you want to use.

Today's standards are either AMD or PENTIUM but I'll come back to CPU's later.

Let’s concentrate on the motherboard for now. I am going to use a Pentium 4 motherboard as our example. Everything in this book applies to AMD MB’s fitting of CPU’s and every other component.

Every MB comes with its own set-up manual and software, but it can be a daunting experience holding one in your hands if you have never seen or held a MB, never mind fitted one to a machine. When you get used to the idea and you have installed your first MB, you just carefully keep plugging things into it to make your own PC!

Use the MB's manual just for reference if you have little or no technical knowledge. Even the introduction to most of these manuals is highly technical. Don’t be put off. Here is an example of what you might see at the beginning of a MB manual.

> This mainboard features an integration of the powerful processor Intel Pentium 4 and the single-chip North Bridge of ProSavage P4M266 plus South Bridge VT8233A, by which the whole system performance is upgraded to 400 MHz system bus.
>
> The Intel P4 processor is a rapid execution engine providing 400MHz quadpumped system bus to make 3.2GB data transfer rates possible while, in addition to the built-in S3 Savage4 Graphics Accelerator, ProSavage P4M266 North Bridge plus VT8233A South Bridge supports Intel P4 processor to implement the AGP 4X external bus, the LPC Super I/O, the DDR SDRAM and UATA 133/100/66 data transfer rate. This chapter is to introduce to users every advanced function of this high performance integration."

1-1.1 CPU Socket CPU Socket 478B on board, supporting Intel' Pentium 4 and Northwood processors in the 478-pin package form a 400 MHz System Bus;

® *Hyper-pipelined technology; Advanced dynamic execution; Advanced transfer cache;*

….. and so on.

Pure techno-talk. You don't have to understand this to build a PC.

If you decide later on to turn it into a small business as I did, then the technical information becomes important. All the information you need for you to build a PC is in this ebook.

Getting started

The first things you need to start building your own PC are:

Bare bones shopping list

1. Tools
2. Anti-static wristband or anti-static board
3. Motherboard – ATX standard
4. Case –ATX standard
5. CPU – Pentium OR AMD.

The Motherboard (MB)

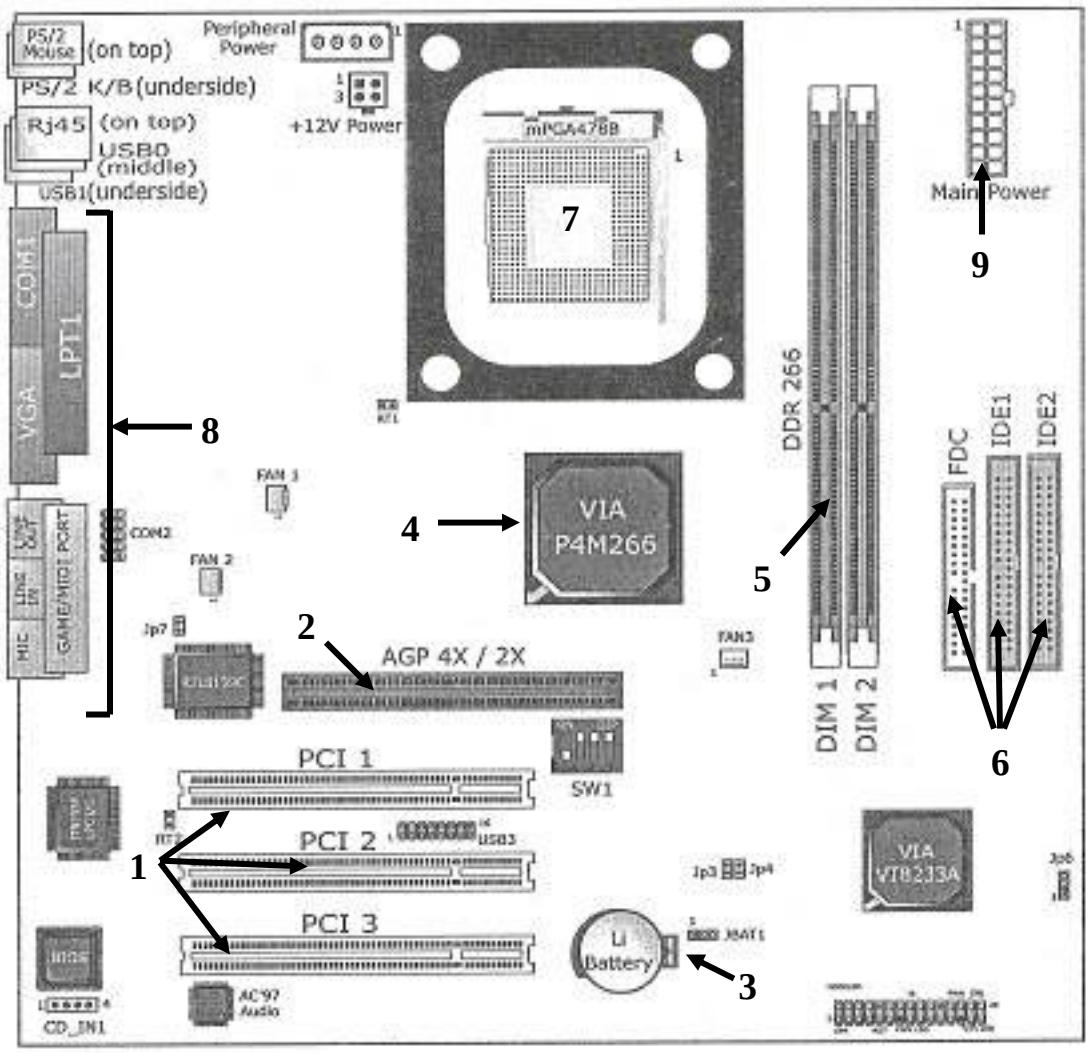


Figure 1.1.An Illustration of the Soltek 85MIV-L motherboard for Pentium

This Pentium board looks fairly simple without all the circuitry, and it is. There's almost nothing to it!

Components on the MB and their functions in simple terms.

1. PCI, 1 2 & 3: where you plug-in the sound card, modem and such devices.

2. AGP 4X/2X: for plugging in the newest line of graphics cards.

You can also get PCI graphics cards. The 4x and 2x AGP are just acceleration (industry standard) protocols for graphics cards - don't worry about them for now.

3. Battery for the CMOS and Bios: I'll explain this later in proper sequence.

4. VIA P4M266: The chipset used by the MB. It is the "engine", embedded into the board and you can basically ignore it.

5. DIMM 1 & 2: this is where the system's RAM goes.

Today's standards are DDR or SDRAM. Make sure to get the type that your MB supports.

6. FDC - your floppy drive plugs-in here.

IDE1: your Hard Disk Drive (HDD) plugs in here and

IDE2: your CD or DVD or CDRW plugs-in here.

7. This is where the CPU will reside.

8. All the blocks on the left represent the sockets you see on the outside of the case, including those for the mouse, keyboard, printer, speakers etc …..

9. Main board power plug; the power unit is usually included with the case.

The Case

Now you need a case to put the MB in.

It is up to you to decide what case has the look that you prefer, but there are some things to consider before you buy;

- Does it have a 300W ATX power supply?

- Does it meet Pentium and AMD standards!?

Two examples for you to consider are the Nokia and ATX FOX cases. There are many more on the market. Ignore any that don't meet the standards.

These cases both come with ATX-standard 300W power supplies fitted to them. This is something to look for with the case you prefer because most MB's are ATX standard. They need a supply of that standard to power them. Don't just take a power unit out of any old PC and expect it to power an ATX standard board – it may even damage your MB!

You also get, as standard, the connectors for the external power-on LED, reset hard disk drive LED and system speaker with ATX cases. These components all plug into a small set of pins on the MB. I will give the details on that later.

Figure 1.2 Cases NOKIA FOX

The Nokia case (left) and the FOX case (right) meet the P4 and AMD standards with ATX 300W power units installed. These are MIDI tower cases.

The CPU

Your choice of CPU is both application-dependent and a personal choice - some prefer AMD over Pentium and vice-versa.

I've used a Pentium board as an illustration. The needs of a family or small business can be met with a P4 1.6Ghz. I started my business with a much slower Pentium and a dial-up modem, so the 1.6Ghz will serve you well.

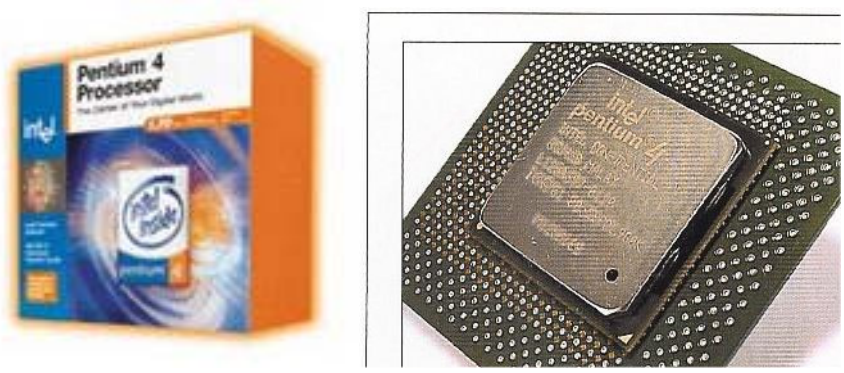


Figure 1.3 The Pentium 4 Processor

If you've big plans such as a video studio, sound mastering or even some of the top-end gaming systems, your CPU requirements will differ, ranging from 1.6Ghz up to 2.8Ghz depending on your needs. But remember that I am always ready to help!

The Bare Bones

Before Installation of the Motherboard:

I recommend that you install the CPU and Heatsink/Fan before installation of the MB. It's easier to do outside of the case.

Your new case should come with brass mounting screws that screw directly into the case and the spacers that keep the MB at a distance from the body of the case. Use the spacers! If you just screw the board straight on to the case, you will blow the whole project.

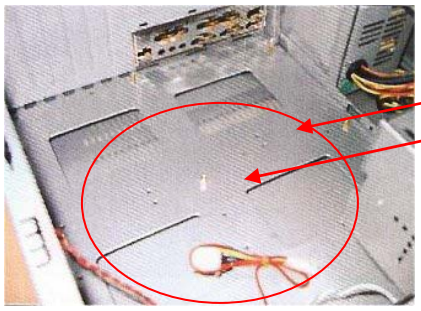


Figure 2.1 The inside of empty case

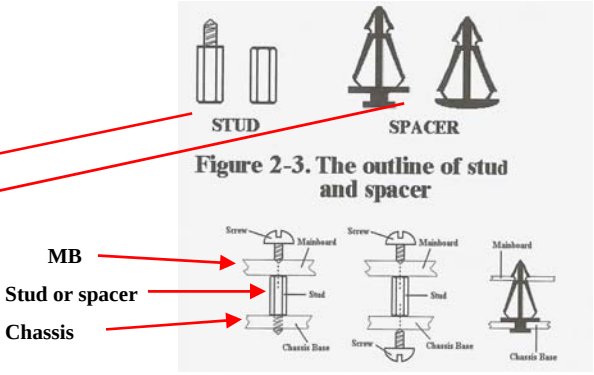


Figure2.2 The studs & spacers

The studs are screwed into the chassis of the case.

Make sure you have your anti-static protection in place, then carefully place the board into the case to determine where the studs should be put.

Put a fine tip felt pen through the holes in the board and mark the chassis where the studs should go. This prevents you putting in a stud that doesn't match up with a hole on the board. Check the positioning and screw the studs into the chassis. You can also use the plastic spacers but I generally

keep them for the edges of the board if there are any spare holes on the board.

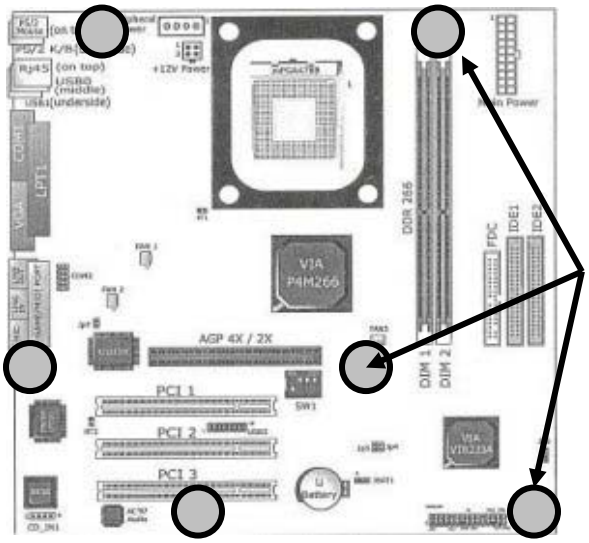


Figure 2.3 showing holes in MB

When the studs are firmly in the chassis, you can screw the motherboard in to the case via the studs.

But it is easier to install the CPU and Heatsink/Fan on the MB before you screw it into the case, because you have more room outside of the case.

Installing The CPU

Install the CPU before any other component. Every MB has a surface mount Zero Force Insertion (ZIF) socket. With the Pentium, this is a 478 – pin socket, shown at 7 in the MB diagram in figure 1.1

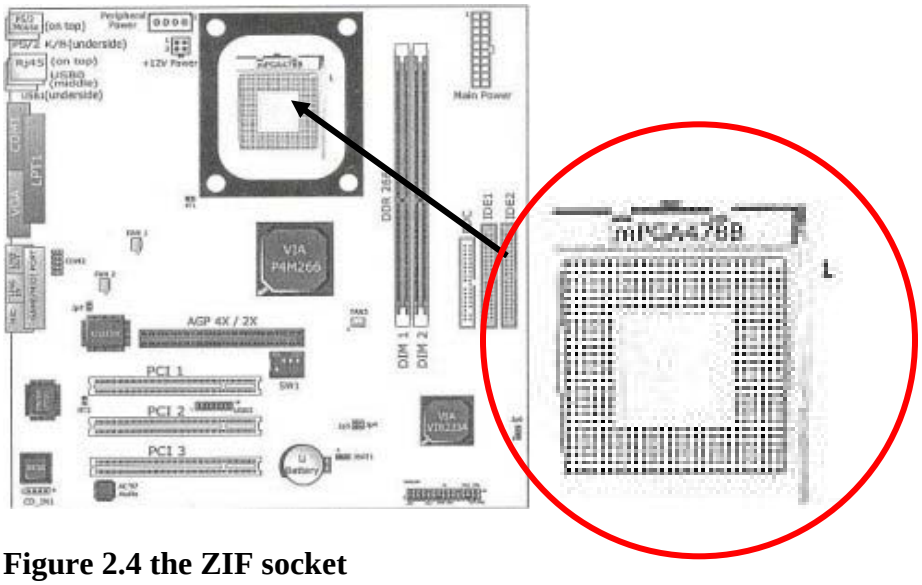


Figure 2.4 the ZIF socket

The actual processor itself has a gold mark indicating the orientation of the CPU in the socket.

Figure 2.5 The CPU

Follow the next steps in this section carefully to install the CPU in the onboard socket.

You must also install the specific CPU fan designed in tandem for that CPU after you install the CPU. The next section describes the fan installation.

1.Pull the socket lever sideways, then turn the lever up 90 degrees to raise the upper part of the socket from the lower platform.

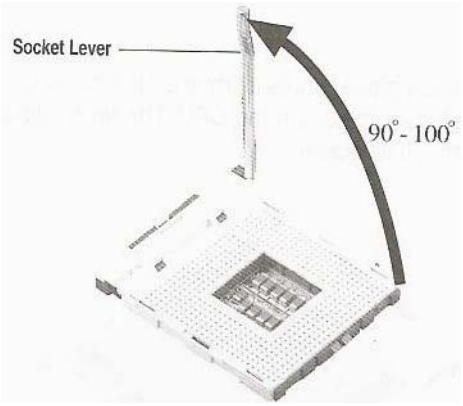


Figure 2.6 open the ZIF socket

2. Configure pin 1 of the CPU to Pin 1 of the socket, as shown in the diagram below.

The CPU should simply fall into the socket

DO NOT FORCE IT INTO THE SOCKET.

Figure 2.7 inserting the CPU

3. Make sure that all the CPU pins entered the socket completely and it is flat to the surface. Then you can lower the lever to lock the CPU in the socket.

Figure 2.8 The CPU locked in the ZIF

4. With the CPU now locked in its socket, you can mount the heatsink and fan.

Mounting the Heatsink and Fan

The CPU needs a cooling system, the heatsink/fan.

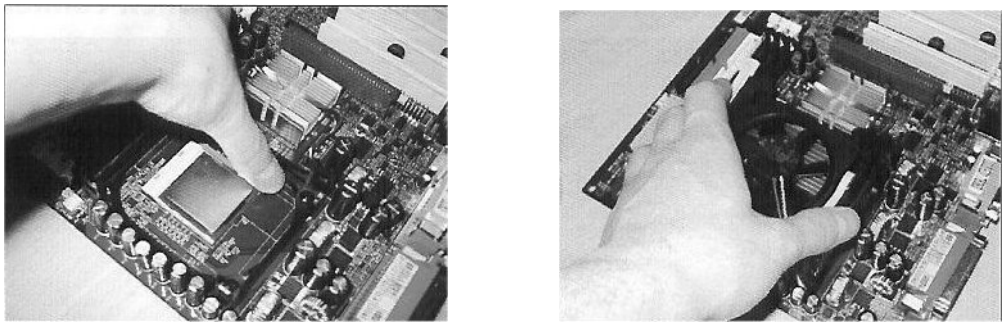


Figure 2.9 lock down the CPU & put the Heatsink/Fan in the retention bracket

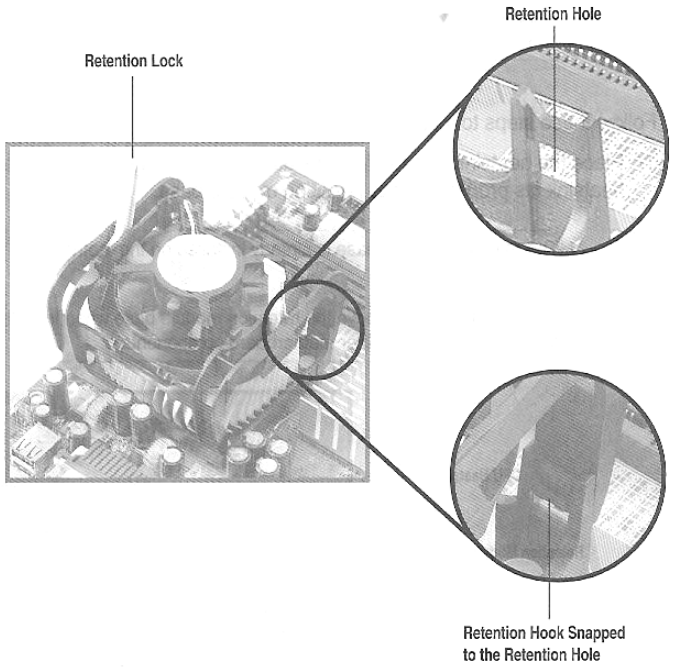


Figure 2.10 The retention hooks snap into place on the MB Bracket

In the P4, the heatsink and fan are an all-in-one unit that has 4 retention clamps and 2 retention locks. The mounting for the heatsink/fan unit is already on the MB in the Pentium boards. You just have to push the unit down on top of the CPU. Figure 2.11 shows the fully-fitted unit.

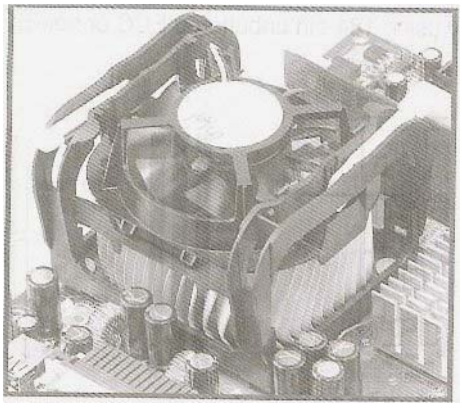


Figure 2.11 the fitted heatsink/fan

Connect the fan to the MB. The manual that came with your MB will show the location. It's a three-pin connector. Just plug it in.

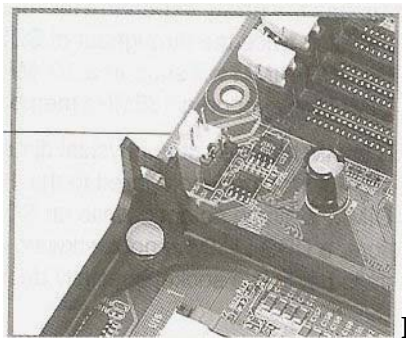
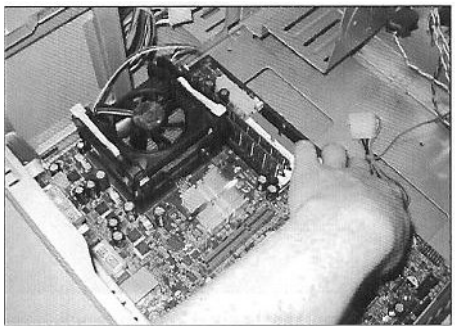
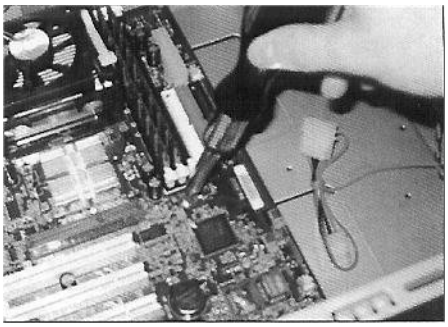


Figure 2.12. 3-pin fan connector

Installing the Motherboard

Now the MB and CPU Heatsink/Fan are in place, we can install the MB.





Figures 2.13 placement of the MB over studs and screw into place

Align the holes in the MB with the studs you put in the case and then screw the MB into the case!

Now we can start to add components to turn the board into your PC!

Overview of AMD

Fitting the motherboard and CPU are almost the same with AMD as described for the Pentium. Possible differences are discussed below.

One important difference when purchasing AMD merchandise is that the CPU can be purchased as a separate item, but then you must buy a separate heatsink/fan that is rated for the speed of your processor. If you use the wrong fan, the processor will soon die from overheating!

An AMD CPU **A Coolmaster Heatsink/Fan**

Figure 3.1 AMD CPU and Heatsink/Fan

If you purchase an AMD ATHLON 1700+ you MUST buy a Heatsink/Fan that has the ability to cool the processor, such as the appropriate Coolmaster. Their range of Heatsink/Fans for AMD CPU's go up to 2700+.

The easiest way to ensure you get it right is to buy a retail package that comes with CPU and matching heatsink/fan.

Figure 3.2. The AMD retail package – best buy!

You get a 4-year warranty & even your own AMD badge for the PC case.

The installation of an AMD CPU is the same as a Pentium CPU.

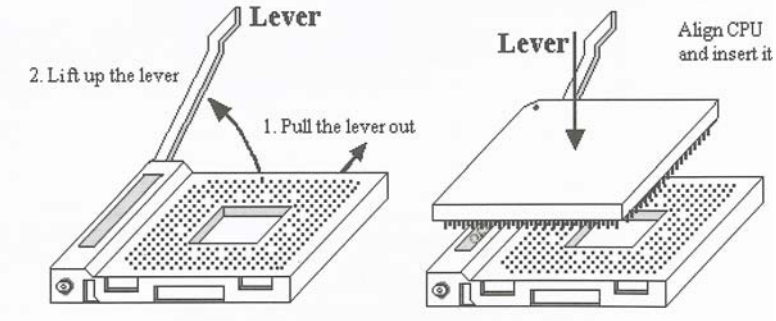
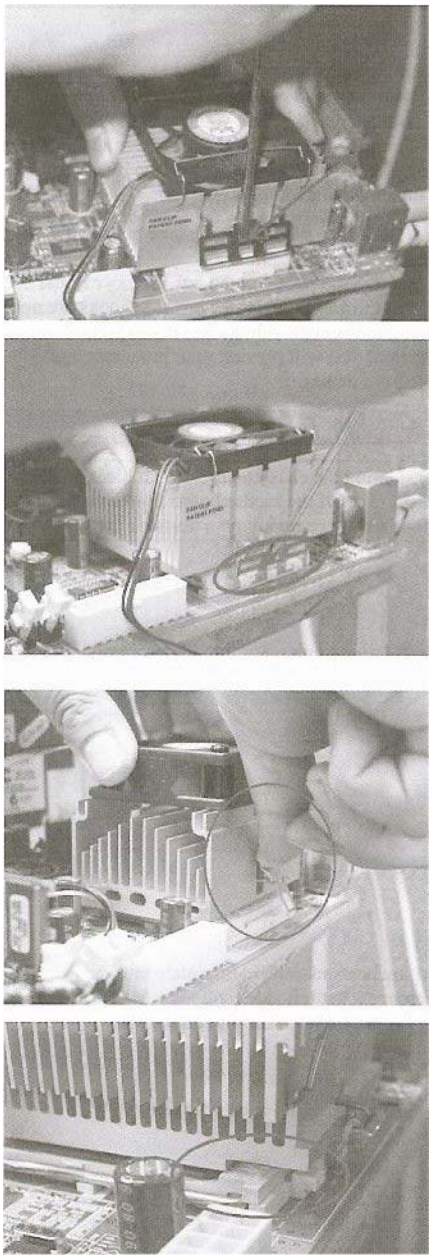


Figure 3.3. Installing the AMD CPU

Just follow the same procedure as the Pentium CPU installation but there may be these differences;

- Its ZIF socket may be a little larger.
- Installing the Heatsink/Fan is slightly different. AMD motherboards do not have the same easy mounting lock-in board mount illustrated in the Pentium section. The Heatsink/Fan is mounted slightly differently.



On the ZIF socket for the AMD board, there are catches at either side. On one side, the silver-mounting latch is pushed under the catch on the ZIF socket.

The heatsink/fan is then pushed flat and that lets the latch firmly hold one side of the heatsink/fan in place.

Figure 3.4 Fitting of AMD Heatsink/Fan

Push down gently on the Heatsink/Fan to push the other side into place, ensuring that the Heatsink/Fan is flat on the surface of the CPU. The last picture shows the orientation of the Heatsink/Fan on the CPU ZIF socket. Examine the ZIF socket and the bottom of the Heatsink/Fan. You will see a ridge that must be aligned for the Heatsink/Fan to properly cool the CPU.

It’s not as difficult as it may look. I always recommend installing the CPU and Heatsink/Fan FIRST, because trying to fit when the motherboard is already installed is much more difficult as there is very little room to work. Believe me - I learned the hard way and the inside will soon look like spaghetti junction when more components and connections are in place.

Adding the Main Components.

This section shows the connection of the power unit, installation of the Hard Disk Drive (HDD), the floppy drive (FDD), Memory, Graphics cards (Both AGP and PCI) and modems etc.

First, we connect the case power switch, reset and HDD LED to the MB

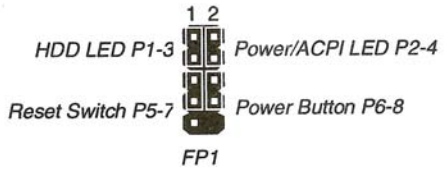


Fig 4.1 small jumper connectors for power etc.

You have a bundle of wires leading from the front end inside the case. Figure 4.1 shows the general configuration of connectors but check your MB manual to find out exactly where it is and the configuration you must use. It varies between MB's. There is also a speaker connector that also simply plugs in.

It is important that it is done properly or nothing will happen when you switch your new PC on. Get the power-on switch right at least!

Here is how a particular board is set up; the row of pins are circled.

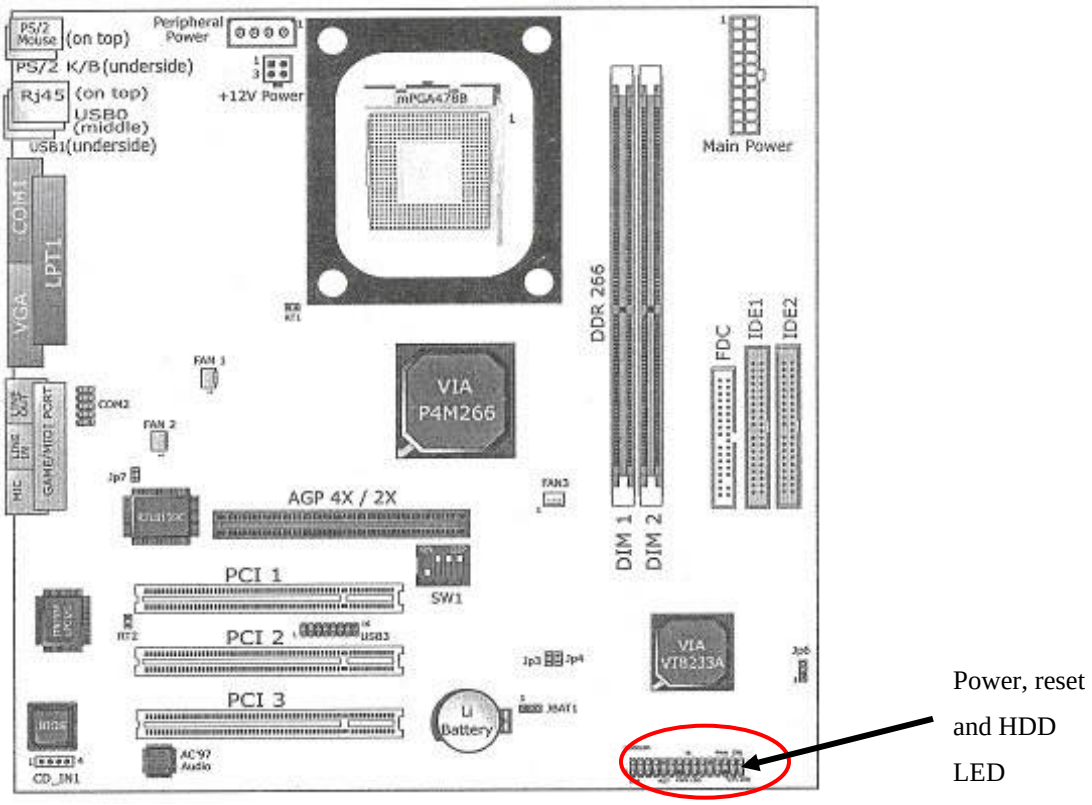


Figure 4.2. the position on this particular MB for power..etc connectors.

I ALWAYS install the HDD, floppy drive and CD ROM/DVD/CDRW after the MB.

If you start by installing PCI and AGP or memory modules, you will have to remove them in order to put the HDD etc in the case. I know from experience!

You will notice the cages at the front on the inside of the case. The CD units go in the large ones at the top, then the HDD and the FDD go in the smaller ones that are lower down.

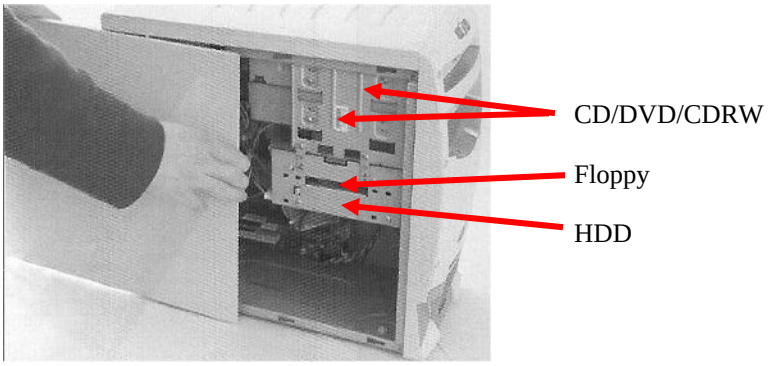


Figure 4.3 The open case side showing the cage where the drives are put.

It's easy to see where to put the floppy drive; it must line up with the external access point so you can put your disks in. Anywhere on the same part of the cage that you can get the mounting screws to line up will do for the HDD.

Small brackets on the inside of the cage let you simply slide both units in to the case.

Important: Make sure the power connector on the HDD is facing outward, towards you. The orientation for the FDD is simple; the button that ejects the disk must line up with the external button of the case. There's no guesswork there.

There are many makes and models of both HDD and FDD, with varying prices, but they all serve the same function. For your FDD, it's an easy choice about which model to buy, get one that suits your budget and save money, if you can, for the items to come.

Installing the HDD

The HDD is where your programs, including the vital operating system, will reside.

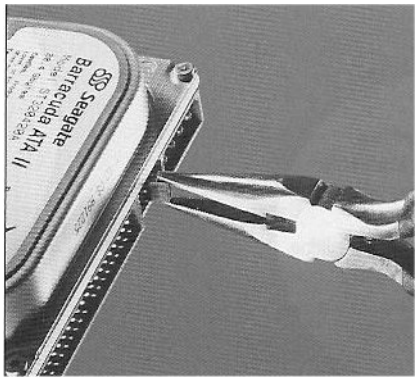


Figure 4.4 The HDD **Fig 4.5 Use long nose pliers to change jumper settings**

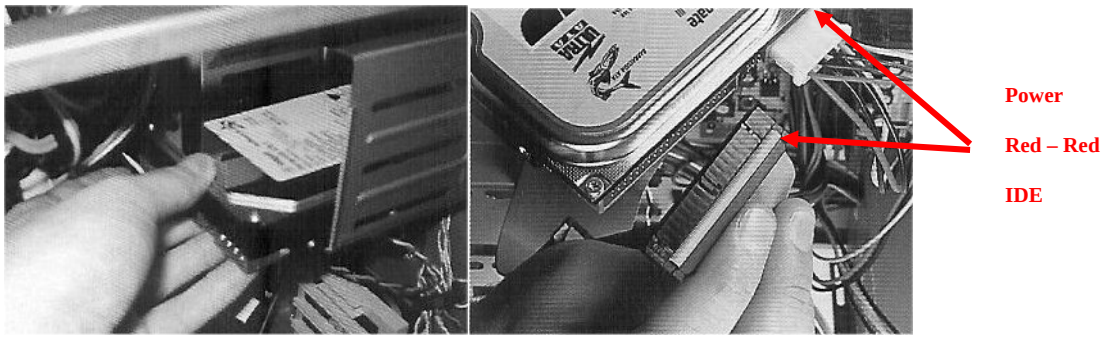


Figure 4.6 Slot the HDD into the cage and connect IDE and power (red – red)

You can buy HDD's with a capacity from 20GB up to a massive 200GB. Your choice depends on what you use your PC for. A 60 - 80GB HDD would serve most needs but you need to consider a larger HDD if you will be, for example, editing videos.

The IDE cable has a notch in the middle so you can't really go wrong connecting it. The power cable can only go in one way as one side is beveled.

If you have any doubt, just remember **red to red** for IDE and power cables. The IDE cable has a red line that runs the full length of the cable and should face the red wire on the power cable.

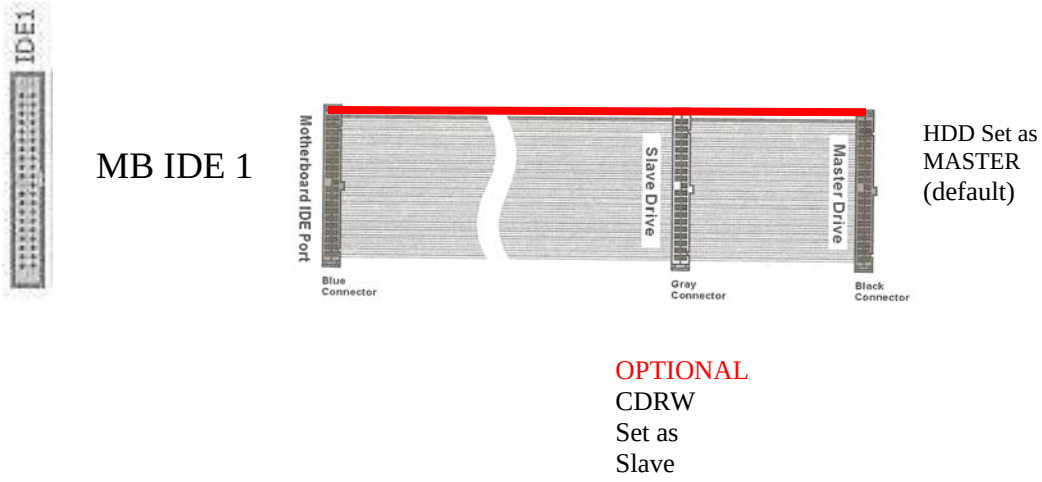


Figure 4.7 The IDE Ribbon cable showing master, slave and MB connectors

Installing the floppy

The floppy drive has to be inserted from the inside. See HDD installation above.

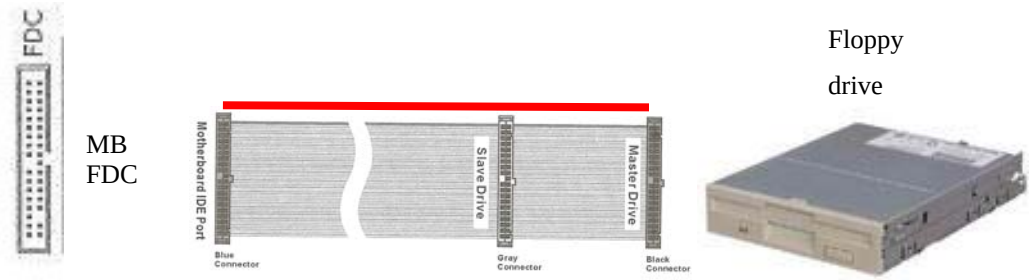


Figure 4.8 The MB socket (top) the IDE cable is slimmer that HDD IDE cables and the floppy drive

Installing a CD/DVD/CDRW

Remove one of the front panels from your case - they simply push OUT from the inside.

A new unit will have mounting screws for the inside cage and an audio wire to connect your CD to the onboard sound connector or to your sound card.

Look at the back of the unit to see where this wire connector goes: R marks where the red wire should be.

There is another row of pins with a little jumper. You will see (M) Master and (S) slave - this is important if you are putting more than one unit in the system i.e. a DVD and a CDRW.

I always mount the DVD on top and the CDRW below, then set the DVD to master and the CDRW to slave. This lets the Bios recognize that you have 2 units (more on that later).

You will see a long double-row of pins next to that. This is your IDE connection and next to that is the power connector.

Let's assume that you are just installing 1 unit for now.

The unit itself, whether it is a DVD, CDROM or DVD writer, is a standard size. Fit them as shown below.

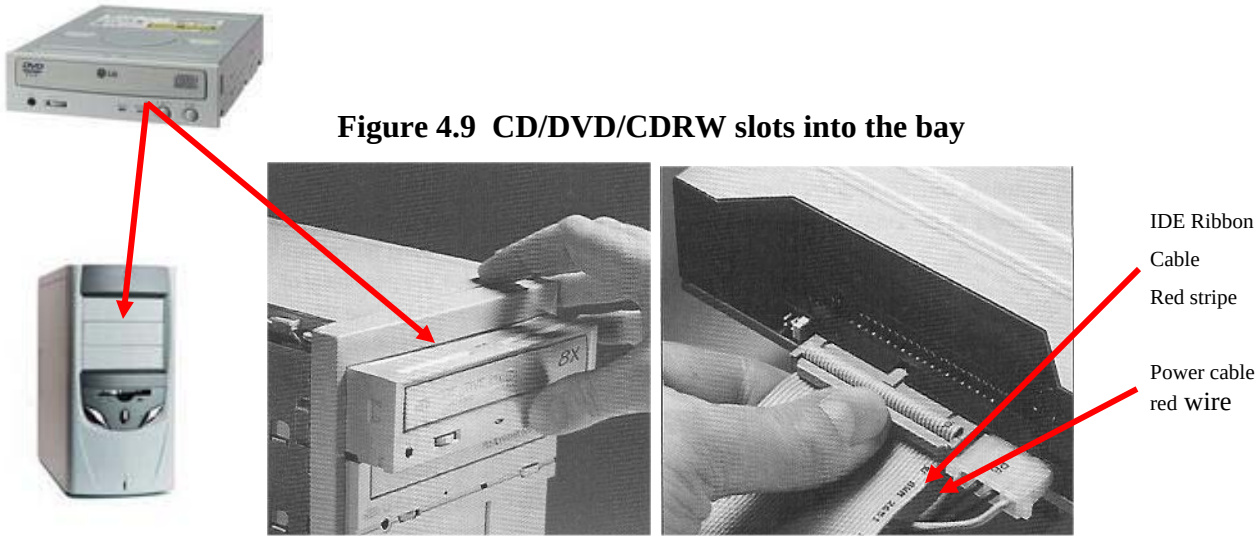


Figure 4.9 CD/DVD/CDRW slots into the bay

Figure 4.10 CD Bays push out from inside and the CD is pushed into the case from the front

Connect the IDE and power connector at the back, remember red – red.

I connect the audio wire and the IDE cable to the back of the CD/DVD etc. before I push the unit into place. It makes life a lot simpler.

The IDE cable has a notch in the middle so you should not go wrong connecting it. The power cable can only go in one way as one side is beveled. If in doubt, just remember **red to red** for IDE and power cables. The IDE cable has a red line that runs the full length of the cable and should be facing the red wire on the power cable.

The IDE cable attaches the CD, HDD and FDD to the MB. It is responsible for data transfer and generally comes as part of the MB package, folded like the one below.

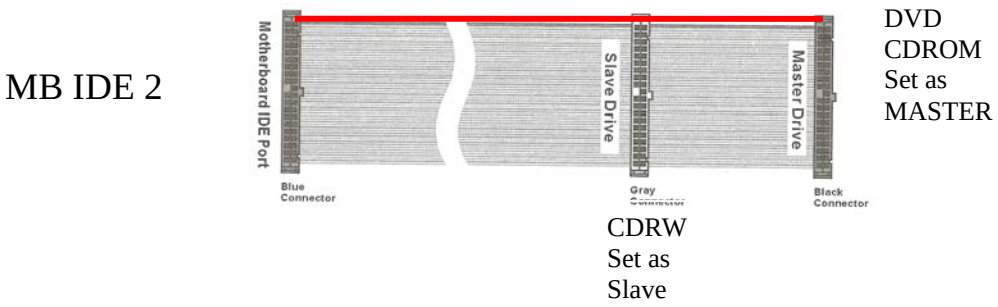


Figure 4.11 The IDE connection for CD DVD and CDRW

Figure 4.12. IDE UDMA ULTRA 100/66

The Memory – RAM

The standard memory for most Pentium and AMD boards is either DDR or SDRAM. The DDR module has one notch and the SDRAM has 2.

Figure 4.13. a DDR Ram Module, note the single notch

Figure 4.14. This is an SDRAM module with two notches

Some MB's only have sockets for one type. Others have sockets for both but you can only use one type in any machine at one time due to frequency and timing differences.

DDR RAM is reputed to be the best choice; it is faster in benchmark tests. Your system will not function without some kind of RAM installed and the more, the better.

What does RAM do?

It is short-term memory (your HDD is your long-term memory). Any data written to Ram disappears when the power is turned off. If you need to keep some information, save it to your HDD.

More RAM will allow your applications etc. to load more quickly. It will also increase the multitasking capabilities of your PC.

I recommend at least 256MB DDR or SDRAM MINIMUM and, preferably, 512MB. The prices of components are dropping so memory is becoming more affordable.

With your anti-static gear in place, you are ready to install the RAM!

This is an illustration of a DDR RAM module and its socket on the MB

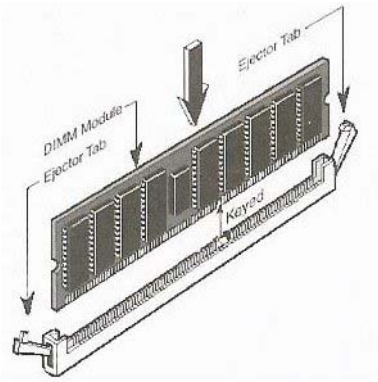
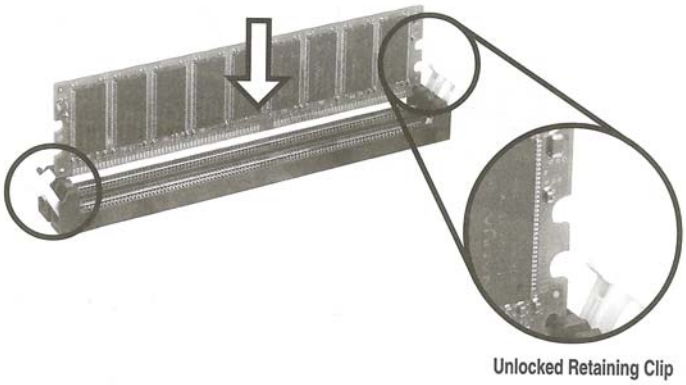


Figure 4.15 showing socket which is on the MB, and RAM chip

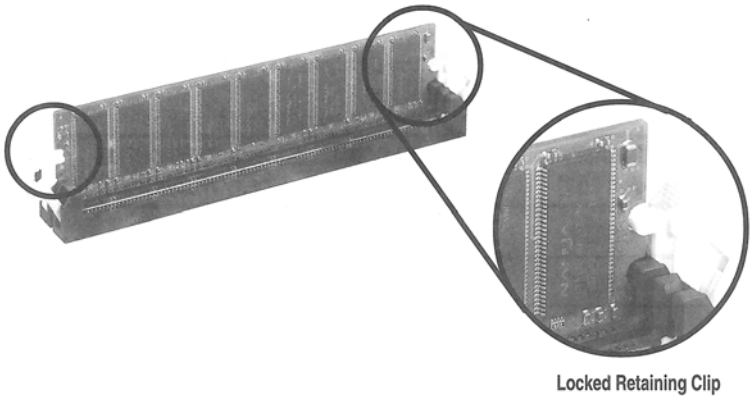
Unlock the socket latches by pushing them outward; align the memory module on the socket so that the notches match.

Figure 4.16. Inserting the RAM



Firmly insert the memory module into the socket until the retaining clips snap into place and the module is properly seated.

Figure 4.17. Locking the RAM



With the memory in place, start to install extra options. Many modern MB's are made for simplicity and ease of installation. The MB that is illustrated in this book has on-board audio, on-board graphics and even an on-board modem.

These inbuilt features may not meet your requirements, so we will now introduce the installation of AGP and PCI based cards.

Don't worry about the terminology - it's all in the jargon buster.

The Installation of AGP and PCI graphics cards.

You will find this is just as easy as installing the memory. Remember to remove the metal plate at the back of the case that lines up with your intended installation i.e. there will be a removable plate that lines up with the PCI and AGP sockets, some just screw off while others just push out.

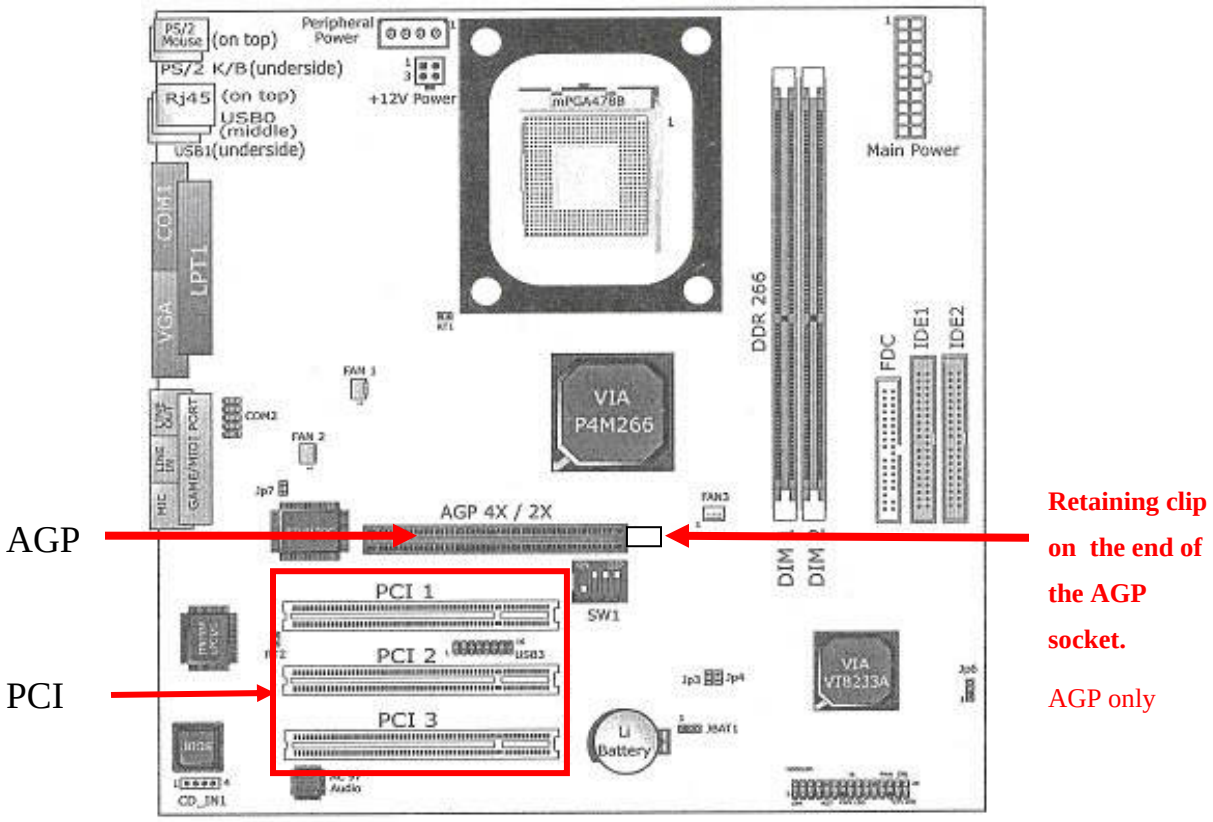
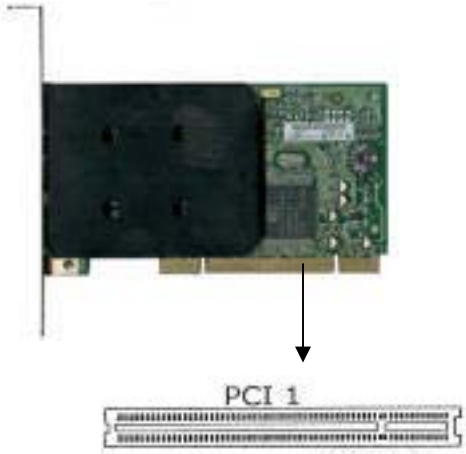


Figure 5.1. Where to install AGP graphics and sound/modem etc PCI cards

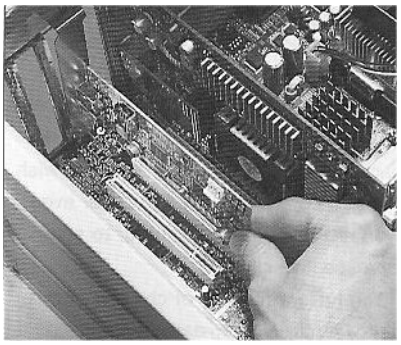
Installing a PCI card

The installation of these cards could not be much easier. Choosing the card you want to use is the difficult part!

PCI cards are usually sound cards, modems, LAN cards and some graphics cards.



5.2 Straight insertion of PCI card



5.3 PCI card in place

With PCI cards, just align the card on the socket and gently push it down. Unlike the IDE connectors, it doesn't matter which PCI slot you use. The computer will recognize the card in whatever slot you put it in.

Job done!

Installing the AGP card

The AGP Card is a little different. You will see a small white clip at the end of the AGP socket that is nearest the front of the case.

The clip does the same job as the clips on memory sockets, but you have to insert the card at an angle so that the clip catches the socket latch.

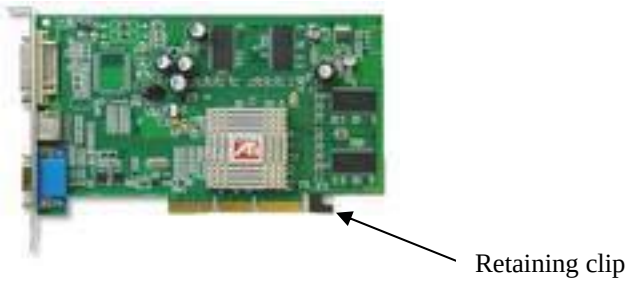


Figure 5.4. The AGP Graphics card

AGP graphics cards are notorious for becoming unseated, even just by moving your PC from one room to another. If you move it, then switch it on and hear loud beeps, that's a sure sign of unseated hardware. It will be the AGP card most of the time.

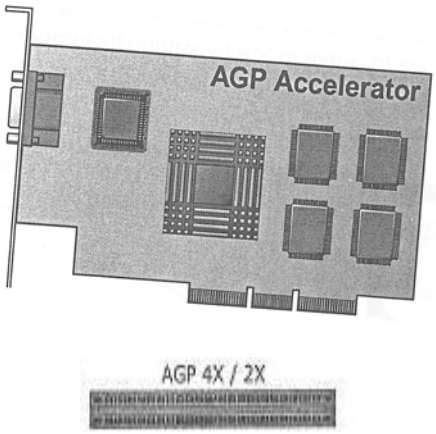


Figure 5.5. Fitting the AGP Graphics card

When you seat the card properly, you will hear a click similar to that when you installed the memory.

Most AGP cards come with the retaining clip, but not all MB have the latch to lock the card in place. Don't worry. It won't affect the performance of the card or the PC as a whole if your board doesn't have it.

Your choice of components are application-dependent, but a standard 32MB Graphics card and a reasonable sound card such as the Creative Labs SB Live 5.1 are reasonably priced and adequate for a home or small business system.

Modems, ISDN or broadband are personal choices:

- If you surf the web occasionally, a good 56k V90 modem is sufficient.
- If you run a business on the net, then broadband is the favored choice.

Bringing it all together

Connecting to the MB

Let's connect everything to the Motherboard

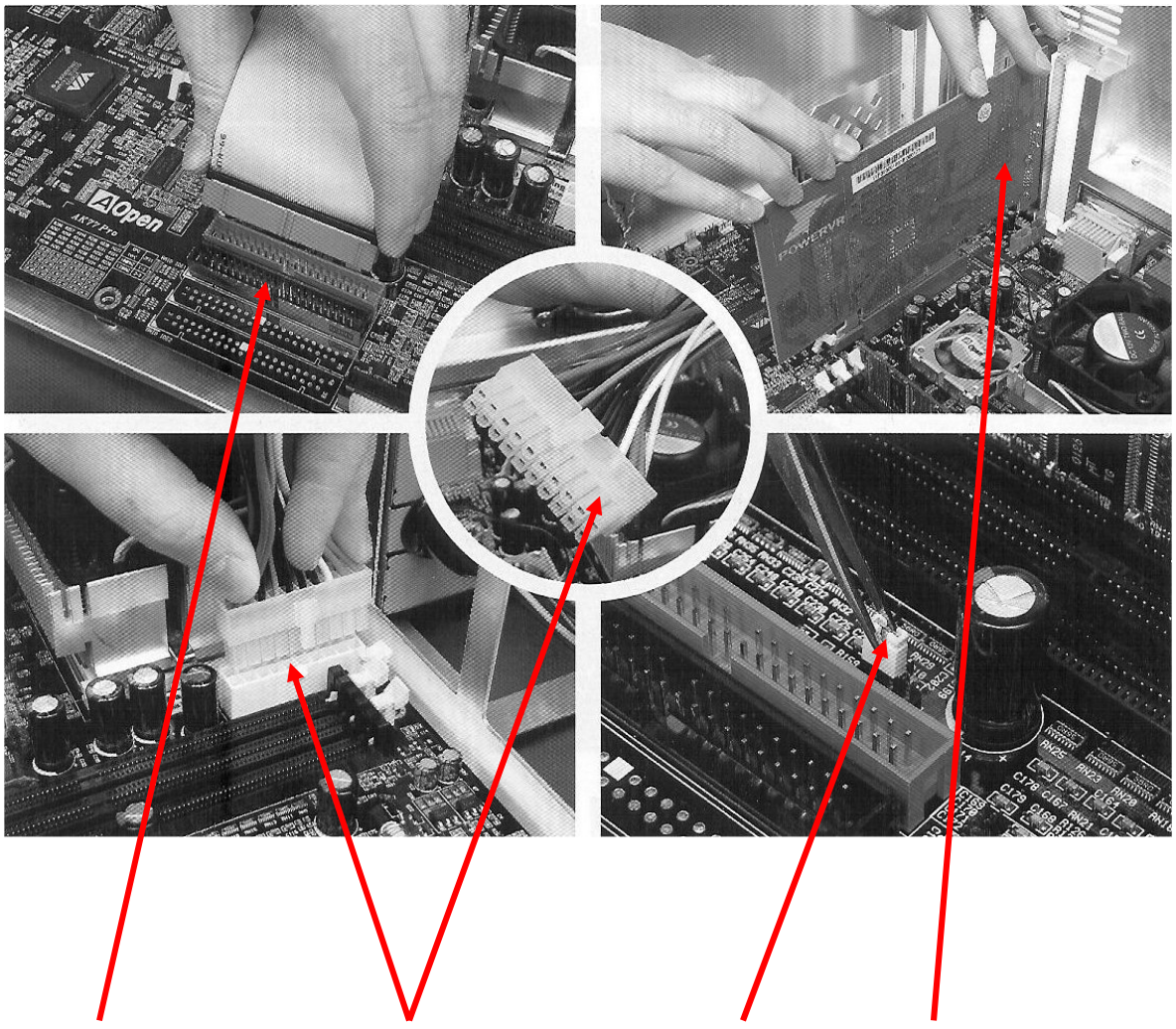


Figure 6.1 Depicts insertions of IDE cable to socket, ATX power connector to socket, the CMOS jumper and an AGP card. Nearly there!

The CMOS should be set to normal. The location is marked on this board.

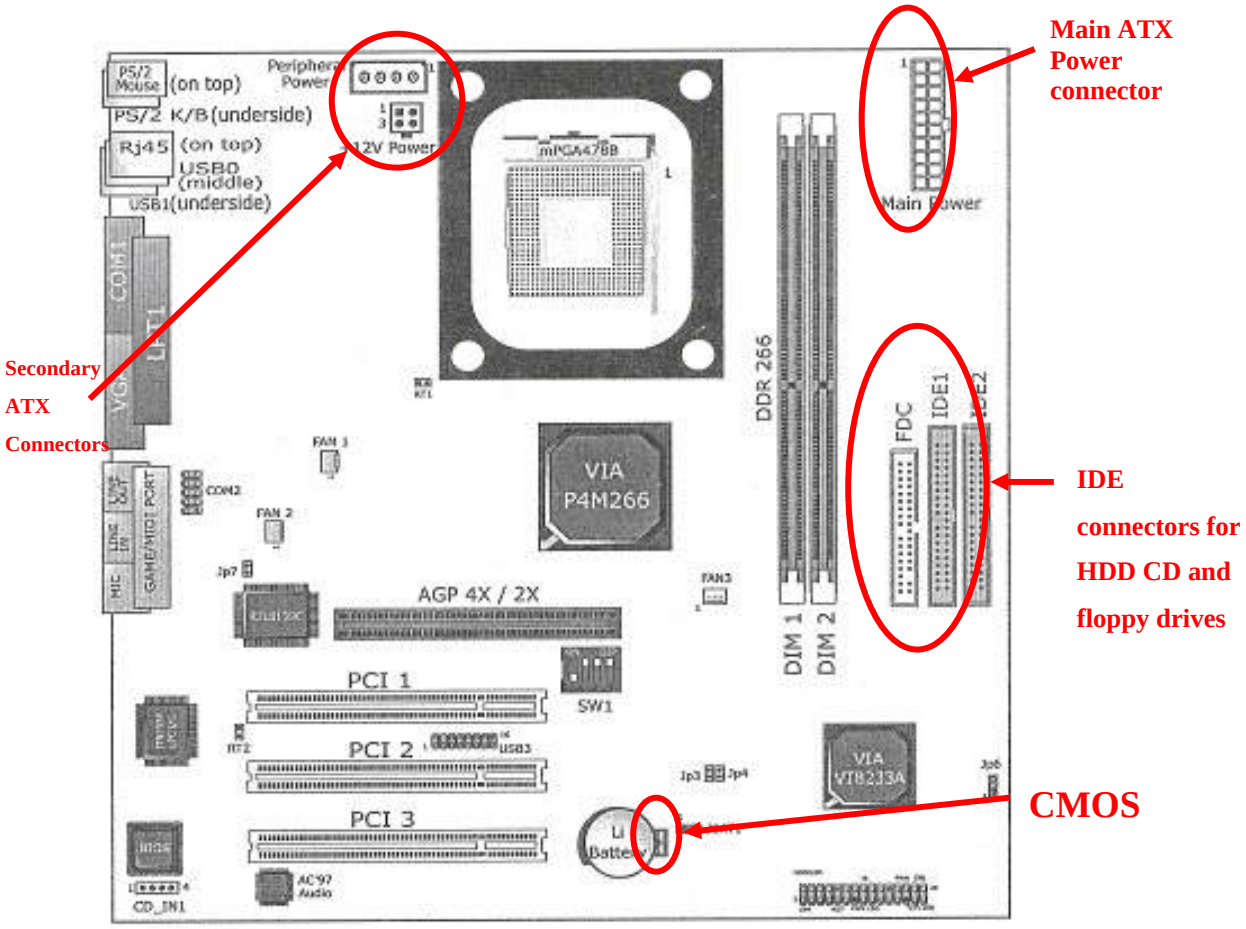


Figure 6.2. The main power unit and IDE connectors

Simply plug the main power supply to the MB. You can't miss the connection (see figure 6.1). It's the biggest connector coming out of the power unit and can only go in one way.

Next, connect the IDE ribbon cables we looked at before:

- From the HDD to IDE1
- From the CD or DVD to IDE2 and
- The floppy drive to the FDC.

All the cables are notched so they only go in one way with the exception of the floppy drive.

The IDE cable for the FDD has one end where the ribbon is split. This end goes to the actual drive. The other end goes to the MB. The power supplies to the HDD and the CD are the standard 4-pin white connectors. There are usually 4 of these connectors with an ATX power supply. They have red, black and yellow wires; the red faces the IDE. Remember **red-red** and they can only go in one way!

The connector for the floppy drive is the smallest flat one that just slides on to the pins on the FDD. The secondary ATX connector is to feed the board extra power. Not all boards have these but this one does, in fact it has two; one is exactly the same as that of the CDROM and HDD, the other is a small square connector. DO NOT CONNECT BOTH! One is enough!

That's the hard work done. We just need to let the MB know what is connected to it. We do that in the BIOS.

We must make sure some settings on the motherboard are correct before we power up. Check your manual for the CMOS settings. Most MB's have the default CMOS setting as normal. That's fine.

If, however, the default is to clear CMOS and you switch your PC on, it will kill your MB stone dead!

MAKE SURE THAT YOUR CMOS IS SET TO NORMAL before you ever connect the external power-lead! It will be stated clearly in your manual where the CMOS is and what the default is.

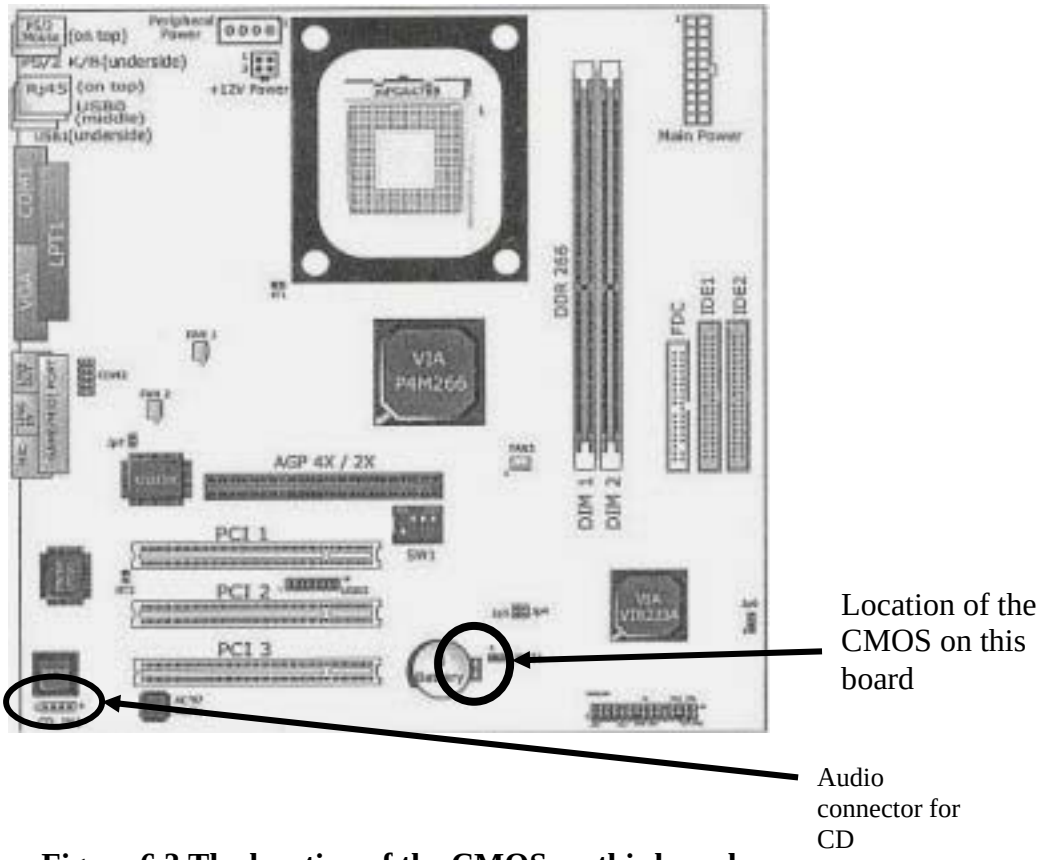


Figure 6.3 The location of the CMOS on this board

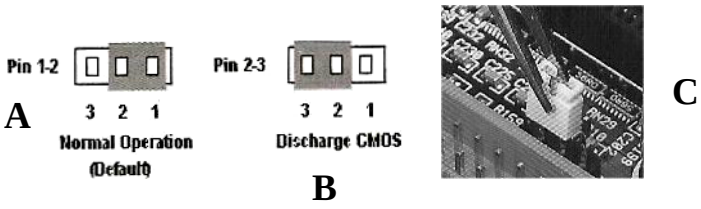


Fig 6.4 The jumper settings for (A) Normal and (B) clearing (discharge) settings

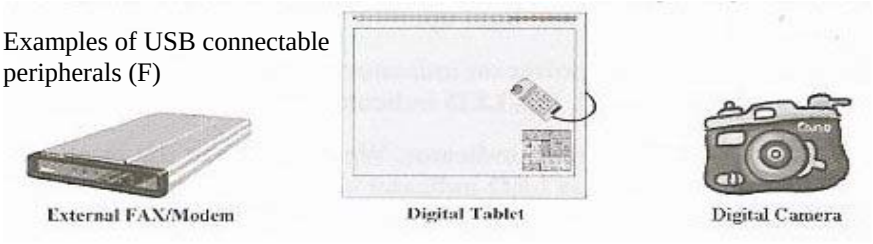
(C) If you need to reset use tweezers to move the jumper.

Connecting to external peripherals

On the left of the MB are the modules for connection to monitor, speakers, printer, PS/2 connectors for keyboard and mouse, USB. There is also an RJ45 module for LAN connection on the board we are using as an example.

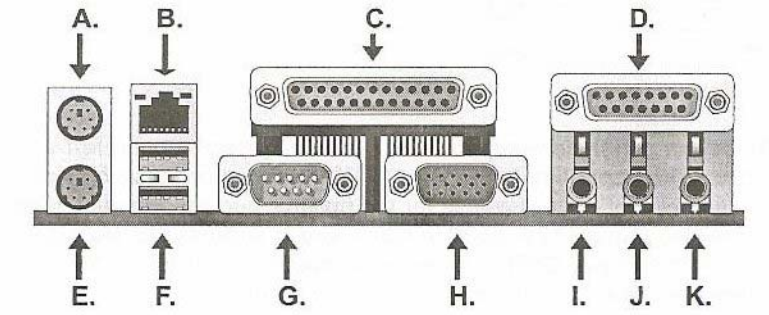
Figure 6.5 Examples of standard peripherals connectable to external ports

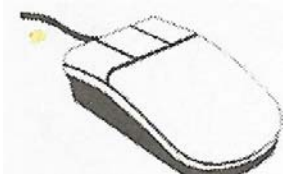
Examples of USB connectable peripherals (F)



The Keyboard and mouse are normally PS/2 but can come with USB connectors also, (A, E F)

Figure 6.6. top view MB





A : PS/2 MOUSE PORT
B : Rj45 LAN Port (on top)
C : LPT1 PORT
D : GAME/MIDI PORT
E : PS/2 KEYBOARD PORT
F : USB 1(underside) / USB0 (middle)

G : COM1 PORT
H : VGA Connector
I : LINE/SPEAKER OUT
J : LINE IN
K : MICROPHONE INPUT

Figure 6.7 view of external peripheral connections

The Final Stages – BIOS Setup

BIOS (Basic Input and Output System) is the first program that runs when you turn your computer on.

Connect a monitor to the VGA port [(H) above] and switch your computer on.

Run BIOS setup.

Wait 2 seconds and hold the DEL key down until a blue screen appears.

This is where CMOS comes into play. CMOS memory stores your BIOS settings and it is maintained by a battery.

Until now, the MB did not have anything connected to it so we have to update these settings through various menus, then it "knows" what peripherals we have installed.

Focus on the standard CMOS features and advanced BIOS features for now. You can explore the rest at your leisure. I do not recommend that you change settings in any of the other menus.

BIOS SETUP -- CMOS Setup Utility

Warning and Tips: If you have difficulty in rebooting the system after changing the CMOS configuration:

1. Press the "Insert" key at the same time as you press the power button to reboot. When the screen displays the booting message, release the "Insert" key and hold down the "Delete" key to enter the CMOS Setup Utility.

Choose the "Load Optimized (Optimal) Defaults" menu to restore the default values for a new start.

Or,

2. Open your machine's case and clear CMOS by resetting the jumper(s) as shown in the Jumper Setting Section of your Manual.

CMOS Setup Utility

This Board has the AWARD BIOS from AWARD Software Inc.

Enter the CMOS Setup Utility Main Menu:

1. Turn on, or reboot your system. The following message will appear after a series of diagnostic checks:

PRESS <DEL> To ENTER SETUP

Standard CMOS Features	1, Frequency/Voltage Control
Advanced BIOS Features	Load Optimized Defaults
P Advanced Chipset Features	Set Supervisor Password
S Integrated Peripherals	Set User Password
Power Management Setup	Save and Exit Setup
® PnP/PCI Configurations	Exit without Saving
E SmarLDoc Anti-Burn Shield	
Esc : Quit F9 : Menu in BIOS: Select Item	
F10 : Save & Exit Setup	
Time, Date, Hard Disk Type...	

2. Press the <DEL> key. The main program screen will appear like this.

Table 1 Award BIOS

- Select an option by using the arrow keys, then press <Enter>. Modify the system parameters to reflect the options you installed in your PC.
- You may return to the Main Menu anytime by pressing <ESC>.
- In the Main Menu:

  "SAVE AND EXIT SETUP" saves your changes, and then reboots the system.

  "EXIT WITHOUT SAVING" ignores your changes and exits the set-up program.

Standard CMOS Setup

Standard CMOS Setup records some basic system hardware configuration, sets the system clock and error handling.

You only modify the configuration values of this option if,

- you want to change your system hardware configuration or
- the data stored in the CMOS memory gets lost or damaged.

Run the Standard CMOS Setup:

1. Choose "Standard CMOS Setup" from the Main Menu and a list of options will appear:

CMOS Setup Utility - Copyright (C) 1984 - 2001 Award Software Standard CMOS Features

Date (mm:dd:yy)	Wed, Aug 22 2001	Item Help
Time (hh:mm:ss)	9 : 52 : 15	Menu Level
IDE Primary Master	Press Enter 60GB	Change the date
1DE Primary Slave	Press Enter None	month, year and
IDE Secondary Master	Press Enter None	century
IDE Secondary Slave	Press Enter None	
Drive A	1.44M, 3.5 in.	
Drive B	None	
Video	EGA/VGA	
Halt On	All, but Keyboard	
Base Memory	640K	
Extended Memory	65472K	
Total Memory	66112K	

Table 2 Standard CMOS setup

Pressing <Enter> when a field is highlighted will cause the system to search for the component on that IDE connection.

For example, if you have installed a 60GB HDD in 1 IDE Primary Master, this is what you will see when you hit <Enter>:-

1. IDE Primary Master 60GB 15cylinder ……

The secondary master on the MB is IDE2. This what you will see when you press <Enter> there:-

2. IDE Secondary Master e.g. - CDROM/DVD

If you have more that one CD, DVD or CDRW connected, you set the second to slave and the setup utility will show, for example):-

3. Secondary Slave CDRW

Then the MB knows what components have been added and will act accordingly. Now, press <ESC> and go into Advanced BIOS Features.

The only thing you have to do now is to specify the FIRST BOOT DEVICE (This is how you load your operating system).

Scroll down to "**first boot device**". Use "Page Down" (or the space bar) to select CDROM. Press ESC, then press F10 and choose "Yes" to save your settings.

CMOS Setup Utility - Copyright (C) 1984 - 2001 Award Software

Virus Warning	Disabled Item
CPU L1 & L2 Cache	Enabled Menu Le
CPU L2 Cache ECC Checking	Enabled
Quick Power On Self Test	Enabled
First Boot Device	**CDROM**
Second Boot Device	**HDD-0**
Third Boot Device	**Floppy**
Boot Other Device	Enabled
Swap Floppy Drive	Disabled
Boot Up Floppy Seek	Enabled
Boot Up NumLock Status	On
Typematic Rate Setting	Disabled
x Typematic Rate (Chars/Sec)	6
x Typematic Delay (Msec)	250
Security Option	Setup
OS Select For DRAM > 64MB	Non-OS2

video BIOS Shadows	Enabled
Small Logo (EPA) Show	Disabled

Table 3 Advanced Bios Features

Restart your system and then put your operating system software CD into the drive.

You will see the prompt, "PRESS ANY KEY TO BOOT FROM CDROM".

Press any key and your operating system will start loading and you are on your way!

Follow your "operating system setup" instructions during which you will be prompted to input regional settings and language settings. You just input your time zone and choose English (American) or English (UK). NOTE: this is only for keyboard layout and will not change the language of the system. When the software has loaded, remember to reset the first boot device to HDD-0 before you power down the system again. This ensures that on power up, it will boot from the HDD. You can set the second and third boot device to CD/DVD/CDRW or FDD. If you set the second Boot Device to FDD, you probably will be able to use an MSOS boot disk or, say, a system restore floppy disk created with your anti-virus software if there is ever a problem with starting from your HDD.

There is a lot more about the BIOS setup in your manual, but this is all you need to get your PC up and running!

Recommendations

I've already mentioned two of the best cases currently available, the FOX and the NOKIA.

I have found these other components easy to use:

Motherboards

These boards will suit beginners as they have Graphics, sound and LAN facilities onboard:

For Pentium 4

Soltek SL-85MIV-L Socket 478 P4 VGA Audio LAN

Figure 8.1

Pentium 4 ECS MB-L4S5MG/LAN (478) SiS650 Micro-ATX Audio/Video/Lan

Figure 8.2

AMD MOTHERBOARDS

Figure 8.3.1 PC Chips 841LMR Skt

A 266FSB Video Audio LAN Modem

Figure 8.3.2. Shuttle MK20N Skt

A Via Chip VGA Audio Lan

The CPU – Pentium 4

The choice of CPU depends on your specific need. Pentium 4's range from 1.6GHz – 2.8GHz

The CPU – AMD

AMD CPU's are available from the AMD Duron 1.2GHz to the AMD Athlon XP 2400+.

Be careful when buying AMD CPU's. Check the actual speed rating. For instance, the speed of the 1700+ CPU is actually only 1.4GHz.

Some tests have shown that AMD processors are faster than Pentium processors, but I find that Pentiums are more reliable and less likely to burn out.

The HDD

I recommend IBM and MAXTOR HDD's over any other. Both are reliable and do not have complicated jumper settings. The IBM HDD's are however, from my experience, the easiest to set up. They are also the cheapest.

The Floppy Drive

I use Panasonic FDD's as they are reliable and cheap!

CD, DVD players , CDRW, DVD writers

The new range of LITEON drives are generally my choice.

However, I recommend the PIONEER 401 DVD writer as it's cheap and accepts almost all known media.

NOTE: With CDRW, ensure that the media you use matches your drive speed. To use the full capability of a 48x speed writer, you need CDR's that match this speed. Most CDR and CDRW media is okay with 32x drives, but I always copy at lower speeds to ensure an error-free disk after burning.

I have used media that wasn't up to the task when writing at 32x speeds. The disks are usually corrupted or unreadable. Use quality media, rated for the speed of your writer, or record at lower speeds that are within the capacity of the media.

Sound cards

If you're just going to use your PC's sound system for listening to music CDs or MP3s, the on-board audio codec will serve your purpose.

If you want to expand this to a surround sound system, the Creative Labs Sound Blaster LIVE 5.1 Dolby is an excellent card that is quite affordable.

If you're a pro musician or just need a high quality sound system, I suggest the Creative Labs Sound Blaster AUDIGY with eight speakers and midi.

Graphics cards

If you don't have any professional requirements regarding graphics, the on-board graphics system will serve your needs.

If you're an avid game player or want to edit video, you will need something like the ATI RADEON, a great 128MB card that runs ANY game at the time of writing. It's half the price you'll pay for a Nvidia GeForce!

For video, you'll need a good spec card and a capture card. The choice of capture card depends on whether your camcorder is analog or digital.

For analog, WinTV Primo is my choice.

I recommend a Pinnacle system, such as DV Studio 10, for DV.

Modems

Make sure the modem you choose is compatible with your operating system! Rockwell do the best chipsets for modems, so any brand of modem that is based on this chipset should be okay.

You need a "56K V90" for standard dial-up connections. You can buy these in both internal and external (USB) models.

Conclusion

Now that you've built your own PC, enjoy the feeling. You have accomplished something that the ''experts'' tell you, "Do not try this yourself because it's too complicated!"

You know now that almost anyone can build a PC!

I will be at hand to answer your questions and help you solve any problems. I will give you my personal email hamill122@msn.com

At my website, you can leave detailed queries and ask for my help. You will also find a lot of resources on my site relating to components and full systems. Enjoy your new PC!

Website http://www.lifebitspcs.com and http://www.lifebits-ie.com

I'll probably get some flames for this, but I don't care because it's one of the ways a so-called expert can scam you. This is the web address of a supplier that is supposed to be kept hush-hush but I've gone this far, so I'm not going to leave you hanging without a good supplier – *www.ebuyer.com*

I will be launching a related ezine soon along with more books on:

- PC diagnostics and repair
- upgrading your PC, and
- an advanced manual (this will include networking and home/small business wireless networks).

If you followed me through this book, I have no doubt that you have built yourself a better, more powerful PC than you would have got if you had paid the same money for a basic production-line model!

I told you it was easy! Now ***you*** are an expert!

Now you know exactly what you need and how to install whatever components you want to have.

This is only the beginning, because this book gives you the knowledge to build ANY PC, from the most basic to a super computer!

It's up to you what you do with that knowledge; start building PC´s and selling them on eBay as I did or you might be content with the PC you just built.

I hope you enjoyed the experience, whatever you decide.

I wish you well in your future ventures.

Dr. Alan Hamill

Glossary of Technical Terms

AC' 97: AC'97 is a device designed to include a digital processor for modem plus an audio CODEC for analog I/O. These two parts are linked together by AC'97 link bus. Putting the digital processor in the main system chipset will reduce the cost of sound/modem onboard solutions.

ACPI (Advanced Configuration & Power Interface): ACPI is developed jointly by Intel, Microsoft and Toshiba. This interface provides a channel for management of the PC system and its hardware (such as CPU and BIOS), pushing PC power management to a more advanced and user-friendly level.

AGP (Accelerated Graphic Port): AGP is a bus interface for high-performance 3D graphics. AGP takes advantage of both the rising and falling edges of the 66MHz clock. For 2X AGP, the data transfer rate is 66MHz x 4byte x 2 = 528MB/s. AGP 4X mode is 66MHz x 4byte x 4 = 1056MB/s.

AMR (Audio/Modem Riser): AMR is an interface to connect the CODEC circuit of AC'97 sound/ modem solution to the mainboard through an AMR card and an AMR connector.

APM (Advanced Power Management): APM is developed by Intel and Microsoft and intended for PC power management through the system BIOS. Through APM, the PC power consumption can be reduced to 5W or lower.

UATA (Ultra AT Attachment), ATA/66, ATA/100, ATA133: ATA is the specification of a disk drive interface that integrates the controller on the disk drive itself with the IDE technology.

UATA/66 uses both rising edge and falling edge to provide a data transfer rate of 16.6MB/s x4 = 66MB/s. You need special UATA/66 IDE cable to use UATA/66.

UATA/100/133 also uses both the rising edge and falling edge as ATA/66, but clock cycle time is reduced to 40ns. The data transfer rate is (1/ 40ns) x 2 bytes x 2 = 100MB/s. To use UATA/100/133, you need special 80-wire IDE cable, the same as UATA/66.

ATAPI (AT Attachment Packet Interface): This is the extension of the EIDE (extended IDE) that enables the interface to support CD-ROM players and tape drives.

BIOS (Basic Input/Output System): BIOS is a set of assembly routine/program that resides in EPROM or Flash ROM. BIOS controls Input/output devices and other hardware devices on the motherboard. Generally, the operating system and drivers will access BIOS before accessing hardware devices, to enhance the portability of the hardware devices.

Bus Master IDE (DMA mode): An IDE interface is for mass storage devices in which the controller is integrated in to the disk or CD-ROM itself.

To reduce the workload of the CPU, the bus master IDE device transfers data from/to memory without interrupting CPU and releases CPU to operate concurrently while data is transferring between memory and IDE device.

You need the bus master IDE driver and the bus master IDE HDD to support bus master IDE mode.

CAS (Column Address Strobe): CAS is a technology of DRAM writes and reads. The number of clock cycles of the CAS signals is dependent on the DRAM timing.

CMOS Chip (Complementary Metal Oxide Semiconductor Chip): CMOS Chip is built on CMOS Technology with very low power requirements. The CMOS Chip stores operating system data.

CNR (Communication and Networking Riser): CNR interface provides a cost-reducing method of implementing LAN, home networking, DSL, USB, wireless, audio and modem subsystems through a CNR card and a CNR connector.

CODEC (Coder and Decoder); Normally, CODEC means a circuit that can do digital to analog conversion and vice versa. It is part of the AC'97 sound/modem solution.

DDR (Double Data Rated) SDRAM; DDR SDRAM essentially doubles the memory speed of SDRAMs without increasing the clock frequency.

DIMM (Dual In Line Memory Module); A DIMM socket is built with a 168-pin assignment and supports 64-bit data. DIMM can be single or double sided. The golden finger signals on each side of the module are different; that is why it is called Dual In Line. Almost all DIMMs are made with SDRAM now, which operate at 3.3V. Some old DIMMs were made by FPM/EDO and only operate at 5V.

DMA (Direct Memory Access); Channel for communications between memory and surrounding devices.

ECC (Error Checking and Correction): The ECC algorithm can detect double-bit errors and automatically correct single-bit error while parity mode can only detect single-bit error.

ECP (Enhanced Communication Port): ECP is a technology designed to improve Input/Output for parallel ports.

EPP (Enhanced Parallel Port): EPP is a standard that supports data transfer rates of up to 500 kps for parallel printers

EDO (Extended Data Output) Memory: Unlike traditional FPM (Fast Page Mode) memory that tri-states the memory output data to start the pre-charge activity, EDO DRAM holds the memory data valid until the next memory access cycle. This is similar to pipeline effect in reducing one clock state.

EEPROM (Electronic Erasable Programmable ROM): Both EEPROM and Flash ROM can be re-programmed by electronic signals, but the interface technology is different. Size of EEPROM is much smaller than flash ROM. BIOS is now generally stored in EEPROM or Flash ROM.

EPROM (Erasable Programmable ROM): Traditional mainboard stores BIOS codes in EPROM that can only be erased by ultra-violet (UV) light.

If BIOS has to be updated, you need to remove the EPROM from the motherboard, clear data by UV light, re-program and then insert it back in the socket.

FC-PGA (Flip Chip-Pin Grid Array): FC means Flip Chip, while FC-PGA is a new package of Intel for Pentium III CPU. It is compatible with SKT370 socket, but requires the mainboard to add some signals on socket 370.

Flash ROM: Flash ROM can be re-programmed by electronic signals. It is easier for BIOS to upgrade by a flash utility, but it is also easier to be infected by some viruses. Because of the increase of new functions, BIOS size is increased from 64KB to 256KB (2M bit) or more.

FSB (Front Side Bus): FSB is the data channel connecting the Processor to chipset, RAM, mainboard busses, AGP socket etc. Its speed is rated in MHz and is talked of as "FSB clock":

FSB Clock means CPU external bus clock.

CPU internal clock = CPU FSB Clock x CPU Clock Ratio.

IEEE 1394: IEEE 1394 is a low-cost digital transfer interface with transfer rated at 100, 200 or 400 Mbps.

It provides solutions for connecting digital television devices and Serial Bus Management. There are two type of IEEE 1394 data transfer: asynchronous and isochronous.

Isochronous data channels provide guaranteed data transport at a pre-determined rate. This is especially important for time-critical multimedia data where just-in-time delivery eliminates the need for costly buffering.

Parity Bit: The parity bit mode of error detection uses 1 parity bit for each byte.

Normally it is even parity mode; each time the memory data is updated, the parity bit will be adjusted to have an even count "1" for each byte. Next time the memory is read with odd number of "1", the parity error has occurred. This is called single bit error detection.

PC-100 DIMM: SDRAM DIMM that supports 100MHz CPU FSB bus clock.

PC-133 DIMM: SDRAM DIMM that supports 133MHz CPU FSB bus clock.

PC-1600 or PC-2100 DDR SDRAM: PC-1600 DDR SDRAM with a 64-bit data bus doubles the data transfer rate of PC100 SDRAM and provides data transfer bandwidth up to 100x64/8x2=1600MB/s. PC2100 DDR SDRAM doubles the data transfer rate of PC-133, providing data transfer bandwidth up to 133x64/8x2=2100MB/s.

PCI (Peripheral Component Interface) Bus: A high-speed data channel for the internal connection of peripheral devices and the computer system through a PCI expansion card.

PnP (Plug and Play): The PnP specification is a standard register interface for both BIOS and operating system (such as Windows 95).

These registers are used by BIOS and the operating system to configure system resources and prevent conflicts. PnP BIOS or operating system will automatically allocate the IRQ/DMA/Memory.

Currently, most PCI cards and most ISA cards are PnP compliant.

POST (Power-On Self Test); The BIOS self test procedure after power-on. It is generally the first or the second program shown on your monitor screen during system boot.

RAID (Redundant Array of Independent Disks); A group of hard disks set up in a PC system for data fault tolerance and better performance. RAID is used more in servers than in personal computers. Different levels of RAID are for different functions and performance requirements:

- **RAID 0** provides data striping (spreading out blocks of files across multiple disks), and improves performance but not fault tolerance.
- **RAID 1** provides disk mirroring for data backup.
- **RAID 0+1** provides a dedicated disk for error correction of data which means better performance and some fault tolerance.

RAS (Row Address Strobe): RAS is a technology where DRAM writes to and reads the Row addresses, while a CAS (Column Address Strobe) signal is used to validate the column address.

The signals are generally sent CAS before RAS. (In the Network field, RAS stands for Remote Access Services).

RDRAM (Rambus DRAM): Rambus DRAM is a memory technology that uses large burst mode data transfer of up to 1.6GHz.

RDRAM technology helps to set up a system level improvement, not just a component upgrade.

RIMM (Rambus Inline Memory Module): RIMM is built with a 184-pin architecture module that supports RDRAM memory technology. A RIMM memory module may contain up to maximum of 16 RDRAM devices.

SDRAM (Synchronous DRAM): SDRAM is one of the Dynamic Random Access Memory (DRAM) technologies that allow DRAM to use the same clock as the CPU host clock (EDO and FPM are asynchronous and do not have a clock signal). SDRAM comes in 64-bit 168-pin DIMM and operates at 3.3V.

SIMM (Single In Line Memory Module): SIMM socket is only 72-pin and only single sided. The golden finger signals on each side of the PCB are identical. That is why it is called Single In Line. SIMM is made of FPM or EDO DRAM and supports 32-bit data. SIMM for mainboard design is being phased out.

SPD (Serial Presence Detect): SPD is a small ROM or EEPROM device resided on the DIMM or RIMM. Memory module information such as DRAM timing and chip parameters can be stored in SPD so that the BIOS can access it and use it to decide the best timing for this DIMM or RIMM.

UART (Universal Asynchronous Receiver/transmitter): UART is built in a chip that controls the data sent to and received from a serial port. A 16550 UART is now standard in most PCs. This supports modem speed up to 57,600 bps and beyond, and direct connect speed of 115,200 bps.

Many UARTs have built-in errors in the internal code and do not work correctly with many external modems. UART is also found as the serial interface on internal modems.

Ultra DMA: Ultra DMA (or, more accurately, Ultra DMA/33) is a protocol for transferring data at 33.3MB/s between a hard disk drive through the computer's data path (or bus) to the computer's random access memory (RAM).

The transfer data is twice as fast as the previous Direct Access Memory (DMA) interface. Ultra DMA technology has advanced to Ultra DMA/66 and Ultra DMA/100.

16.6MB/s x2 = 33MB/s 16.6MB/s x4 = 66MB/s

16.6MB/s x6 = 100MB/s.

USB (Universal Serial Bus): USB is a 4-pin serial peripheral bus that is capable of cascading low/medium speed peripherals (less than 10 Mbit/s) such as keyboard, mouse, joystick, scanner, printer and modem.

VCM (Virtual Channel Memory): NEC's Virtual Channel Memory (VCM) is a new DRAM core architecture that dramatically improves the memory system's ability to service multimedia requirements.

VCM increases memory bus efficiency and performance of any DRAM technology by providing a set of fast static registers between the memory core and 1/O pins.

Using VCM technology results in reduced data access latency and reduced power consumption.

VRM (Voltage regulator Module): This is a small module installed on a mainboard to regulate the voltage fed to the processor on board. Voltage regulation can be built on board in various ways.

VRM is a socketed type of regulator module that is easier to change when needed.

Zero Wait State: When memory is operating at its fastest speed in the course of fetching and yielding data, it allows no "no-op" cycle; this is called a zero wait state.

On the other hand, when a memory is in a wait state after it gets a command to fetch data, it waits for one , two or more cycles to assure that the expected data is in the buffer.

ZIP file: a patented type of compressed file used with Iomega Zip Drives.

Zoom: make a window or screen larger or smaller in the Graphical User Interface of a computer system. Usually, to "zoom in" means to enlarge, and to "zoom out" means to reduce the displayed size of objects.

Jargon Buster

A

AMD Athlon: AMD are the world's second largest processor manufacturer. Their Athlon range provides cutting-edge technology processors.

They are ideal for all home-computing applications and give a superb computing experience.

AV Socket: for those who want to connect the TV to a games console or a camcorder.

Active Matrix Display: A type of flat-panel display where the screen is refreshed more frequently than conventional passive-matrix displays. The most common type of active-matrix display is based on TFT (thin film transistor) technology.

B

BUS: The collection of chips and wires through which data is transmitted from one part of a computer to another. There are several different bus types (known as architectures), which transport data at different speeds and between different devices.

PCI Peripheral Component Interconnect. A bus standard common to many PCs. There are probably several PCI ports at the back of your PC.

Base Unit: Desktop PCs consist of a base unit, which contains the computers processor, hard disk etc, plus a separate keyboard and monitor.

If you buy a base unit you get the base unit plus the keyboard, but not a monitor. This is ideal if you are upgrading from another machine, or want a special monitor.

If you want a complete PC ready to use you should look at desktop PCs or desktop packages that may also include other items such as a printer, scanner or digital camera.

Bi Directional: (PC cables) Input and Output are carried on the same cable.

Bluetooth: Bluetooth is the latest in low-power radio technology to connect electronic devices without the need for cables.

This can be achieved with devices up to 10 meters apart even if they are not in line of sight.

C

CD ROM: A CD-ROM (Compact Disk - Read only Media) can contain over 600Mb of information. You can read information from a CD-ROM but not write to it.

CDR: (Recordable CD) offers Digital quality in a format that's probably equal to your home CD player. When recording on Recordable CDs, there is no loss of sound quality; it reproduces the sound exactly and there is no deterioration in sound quality over time.

Recordable Compact Disc also allows up to 650Mb of data to be stored very cheaply on a Compact Disc.

Data is written to the CDR using a special CD Writer but, once written, is permanently burned into the CD. If you need to be able to record, erase and re-record data, use CDRW instead.

CDRW: (Recordable and Re-writeable) Compact Disc - this allows up to 650Mb of data to be stored very cheaply on a compact disc using a CD Writer. Unlike CDR, data can be written to the CDRW more than once.

Client: The name given to a program or computer that requests a service from another program or computer.

Clipboard: A special area of memory that Windows uses as a temporary store for any items you copy or cut from a document.

Compatible File: File saved in one program that can be read in another.

D

DPI: (Dots Per Inch) - A measure of the output quality from a printer - the greater the number of DPI the better the printer.

DS Screen Laptops: A Dual Scan Screen is divided into simultaneously-refreshed sections, giving a fast refresh rate. This means a low power consumption, but inferior sharpness & brightness.

DVD: Digital Versatile Disk. The most widely known DVD format is currently DVD-Video, the digital version of VHS. It is designed to store full-length movies on a single disc similar in size to a CD.

DVD can give earth-shaking digital surround sound playback that has 540 lines of resolution, which makes a crisper, sharper image than VHS (around 240 lines).

DVD Player/Drive: Hardware that reads and plays DVD discs; a DVD drive is used with your PC. A DVD player is used with your television set.

DVD+RW: A new standard for rewritable DVD disks that is being promoted by Hewlett-Packard, Philips and Sony.

It competes with another standard called DVD-RAM that was developed by the DVD Consortium. The two standards are incompatible. DVD+RW disks have a slightly higher capacity -- 3 GB per side, versus 2.6 GB per side for DVD-RAM disks.

DVD-RAM: A new type of re-writable compact disc that provides much greater data storage than today's CD-RW systems.

The specifications for DVD-RAMs are still being resolved by the DVD Consortium.

DVD-ROM: A new type of read-only compact disc that can hold at least of 4.7GB (gigabytes) of data, enough for a full-length movie.

The DVD-ROM specification supports disks with capacities from 4.7GB to 17GB and access rates of 600 KBps to 1.3 MBps. One of the best features of DVD-ROM drives is that they are backward compatible with CD-ROMs. This means that a DVD-ROM players can play CD-ROMs, CD-I disks, and video CDs as well as new DVD-ROMs.

Newer DVD players can also read CD-R disks.

DVD-ROMs use MPEG-2 to compress video data.

Desktop: This is the workspace on your computer where the icons, such as My Computer, My Documents and any shortcuts you create are displayed.

Digital: All the data in a digital device is, at its most basic level, distinguished by one of two values: 0 or 1 (on or off). This allows any type of data to be encoded and also means that the data is not open to misinterpretation. The result is "a perfect reading every time".

Dolby Digital: Dolby Digital brings cinema quality sound to your home. Sound is divided into 5 channels, 3 at the front (including one center channel) and 2 at the rear to completely surround you with sound. You also get a sub-woofer to fill the room with bass.

Dolby Pro Logic: Dolby Pro Logic takes Nicam Stereo Sound & adds 3 extra speakers to create a true Cinema at Home Sound System. Virtual surround sound creates a surround-sound effect from your TV's stereo speakers.

Dolby Pro Logic Surround: Dolby Pro Logic surround sound uses 5 speakers to recreate the sound used in the cinema. 2 speakers for the front left and right sound, 2 speakers for the rear left and right sound and a fifth central speaker for any dialog.

Double Click: A double click, achieved by pressing the left mouse button twice quickly, is used to open files and folders in Windows. Some people have trouble timing their clicks properly but you can click once and then press the <Enter> key or increase the time Windows waits for the second click.

Drag and Drop: This phrase describes the ability to pick up an icon by clicking the left mouse button and, while holding down the button, ‘drag’ it

to another location on the Desktop. This was revolutionary when invented by the Apple computer company in the 1980's.

E

E-Mail: Electronic mail – a way of sending short text messages and other files to anyone with an Internet-based e-mail account.

F

FMV: (Full Motion Video). This term is used to refer to video playback on a computer and to a display, made up of individual frames, that play back at a rate comparable to videotape.

Font: Different styles of text

Format (Disk): The preparation of storage media (hard disk drive, floppy) so that information can be stored on it.

Format (Text): To arrange your text or document.

FTP: (File Transfer Protocol). system of uploading and downloading files

File Extension: The three-letter label Windows attaches to the end of every file name, denoting what type of file it is.

Flatscreen: Flatscreen improves picture definition and minimises screen reflection. Unlike ordinary screens, they do not distort the picture if you are sitting in a part of the room that is out of the optimum viewing area.

Floppy Disks (FDD): Removable disk used for storing information for a PC. These disks used to be "floppy" but are now encased in a rigid plastic case. Standard floppy disks hold 1.44Mb of data.

Folder: The yellow boxes on your computer screen that you can place files, programs and other folders in. They are like folders you might keep stationery in but very versatile.

Format: The aspects of text that governs its appearance, such as the font, style, highlighting and position on the page.

G

GB (Gigabyte): A measure of computer data storage capacity that is approximately 1000Mbytes or 1 billion bytes. A conventional floppy disc has a storage capacity of 1.44Mb, a powerful PC hard drive may have a capacity of 20Gb or more.

Graphics Card: **H**ardware that is linked to the monitor & enables the screen-based output of a program to be visible to the user.

H

HPA screen (High Performance Addressing) – Laptops: HPA is Short for High-Performance Addressing. A passive-matrix display technology that provides better response rates and contrast than conventional LCD displays.

Although HPA displays aren't quite as crisp or fast as active-matrix (TFT) displays, they're considerably less expensive to produce. Consequently, HPA is being used by a number of computer manufacturers for their entry-level notebook computers.

Hacker:

a) A person with an enthusiasm for programming or using computers as an end in itself.

b) a person who gains or tries to gain unauthorized access to computer files or networks.

Hard Disk Drive (HDD): This is your computer's permanent memory. The hard disk usually contains the computer's system software and applications.

I

INDEX: One or more tab stops in from your normal left margin

ISP: Internet Service Provider. A company that provides access to the Internet (either free or for a monthly fee) via a modem and your telephone system.

Icon: An icon is the small picture on a button that is used to make the function of that button quickly recognizable. For example, the Print Preview button has a small picture of a magnifying glass on it and the icon for saving a piece of work is represented by a floppy disk.

Import Filters: Parts of your word processor program that convert files created in other word processors so that they can be used in yours. They may be activated automatically when you open a document from the File menu.

In Place Editing: Enables an object from one program to be edited in a document created by another program.

J

Joysticks – games: Controller that may be enhanced with programmable buttons, hat switches, throttle control and force feedback technology to make games feel more real.

L

LCD Screen: A digital camera's Liquid Crystal Display screen can be used as a viewfinder and to immediately review your images.

Landscape: The orientation of a sheet of paper where it is wider than it is tall. Landscape is the alternative to portrait – the orientation used for letters.

M

MBps: Short for megabytes per second, a measure of data transfer speed. Mass storage devices are generally rated in MBps.

MP3: The current thing in digital music technology.

MP3 is a file format that allows sounds to be compressed and stored digitally. Music can be downloaded from the Internet on to a PC more quickly than would otherwise be the case. The compression process works mainly by removing noise that is outside the range of human hearing so loss of quality is minimized.

MPEG: 'Moving Picture Experts Group'. MPEG is a computer file format (usually digital video and audio files) that reduces the disk space needed to store the information.

MPEG-2: Motion Picture Expert Group version two is one of a set of digital video compressor and file formats. Video information is reduced in a way that achieves very high levels of compression before encoding and storage.

Margin: The unused white space that surrounds a page or a text box. You can change the amount of space Word leaves blank.

MB (megabyte): A megabyte (Mb) is a measure of computer data storage capacity, approximately a million bytes. Conventional floppy discs have a capacity of 1.44 Mb.

Minimize: Reduce a program window that is available, but not currently in use. A minimized program appears as a button on your taskbar.

Modem: Modulator-Demodulator. It is a device for transforming a digital signal from your PC into an analog signal that travels down a normal telephone line. It also converts signals received from your phone line to a digital signal that your PC can understand.

A modem in your laptop computer lets you use of email and the Internet via a compatible mobile-phone or telephone line. Most laptops are Internet ready with built-in modems.

Monitor: The "TV" that is used to display the images which are generated by a PC or Mac Base Unit.

Multimedia Software: Combines text, pictures, sound and movies. Most educational CD-Roms are multimedia.

N

NTSC Playback: The ability to play back pre-recorded video tapes which are in the NTSC format used in the USA.

Network: A series of wires & cables that connects a number of computers. Data is exchanged between computers via these cables. The maximum speed that the data can be transmitted is called the bandwidth.

Newbie: Internet jargon for a beginner.

Newsgroup: An online discussion forum devoted to a particular subject. They are used to debate issues, share views, ask for assistance and exchange information.

O

OLE: Object Linking and Embedding. The technical term for the Windows facility that allows in-place editing and automatic updating.

Object: A special type of item, such as text, picture and so on, that was created by an OLE-compliant program. Only objects can be edited in place.

Operating System: Software that is responsible for running the PC, e.g. DOS, Windows 95, Windows 98, Windows NT, XP.

P

PIP: (Periodic Information Posting) A relative of the FAQ (Frequently Asked Questions list) – a regular posting of updated information to one or more newsgroups.

Parental Lock: Allows discretionary 'locking' of software using a code so that undesirable or inappropriate sections are automatically skipped (software dependent).

Peripheral: A device that can be attached to a PC and controlled by its Processor. e.g. Printer, Scanner, Joystick.

Plug & Play: This inbuilt software will detect and automatically update your system files when adding new hardware to your PC.

Print Preview: A function that lets you look at your document in its entirety on screen, so you can get an overall impression of how it will appear when printed.

Processor: The 'brain' of a PC - a key factor in deciding which PC is right for you. The faster the processor, the faster the PC will work, which is especially important for surfing the Internet or for games. The speed of a processor is measured in Megahertz (MHz) or, with later machines, GHz

Program: Any piece of software that does a particular task. Programs may be as complex as Word or as simple as Calculator.

R

RDRAM – Memory: Short for Rambus DRAM, a type of memory (DRAM). The fastest current memory used by PCs (SDRAM) can deliver data at a maximum speed of approx 133MHz, RDRAM transfers data at up to 600 MHz.

RTF: 'Rich Text Format'. A good option if you want to save a word processing document in a format that other word processors can open.

Recycle Bin: Desktop icon that looks like a waste-paper bin and holds deleted files.

Region Code – DVD: Playback management system making discs specific to a particular region. The UK is within region code 2, so only region 2 or region-free discs will play on most DVD players bought in the UK.

Restore: To undo the act of deleting a file and make it useable again

S

SCART Socket: A 21 pin electrical lead that connects one audio-visual product to another (e.g. television and a video recorder). Essential when linking stereo video and stereo TV.

SD RAM/RAM: Synchronous Dynamic Random Access Memory increases the number of instructions a computer can perform at one time. For example, the more ram you have, the more applications that can be run at the same time.

Scanner: Device with accompanying software that lets you 'photocopy' any picture directly to your PC in a variety of graphic formats. You can then use the image as a part of your work document or design.

Scroll Bar: The vertical or horizontal slider control that lets you view the contents of a window or an options menu by scrolling up or down.

Shortcut: Icons which can be placed anywhere on your Desktop and that, when activated, open a program. This is a quick route to a program. You can also place it in a folder for convenient access.

Software: **T**he various kinds of programs used to operate computers and related devices. (The term hardware describes the physical aspects of computers and related devices.)

Software is a variable part of a computer.

Software includes application programs that do work users are directly interested in and system software which includes operating systems and any program that supports application software.

The term middleware is sometimes used to describe programs that mediates between application and system software or between two different kinds of application software (for example, converting data from one file format to another file format).

An additional and difficult-to-classify category of software is the utility, a small useful program with limited capability. Some utilities come with operating systems. Utilities tend to be separately installable and capable of being used independently from the rest of the operating system.

Applets are small applications that sometimes come with the operating system as "accessories." They can also be created independently using the Java or other programming languages.

Software can be purchased or acquired as shareware (usually intended for sale after a trial period), liteware (shareware with some capabilities disabled), freeware (free software but with copyright restrictions) and public domain software (free with no restrictions).

Software is usually packaged on CD-ROM and diskettes. Today, much software, shareware, and freeware is downloaded over the Internet.

Some general kinds of application software include:

Productivity software, including word processors, spreadsheets, and tools for use by most computer users

- Presentation software
- Graphics software for graphic designers
- CAD/CAM software Specialized scientific applications

- Vertical market or industry-specific software (for example, for banking, insurance, retail, and manufacturing environments)
- Firmware or microcode is programming that is loaded into a special area on a microprocessor or read-only memory on a one-time or infrequent basis so that thereafter it seems to be part of the hardware.

Sound card: An expansion card that the PC utilizes to play and record sound from a variety of different file types such as MIDI files.

Spam: The e-mail equivalent of junk mail. Spam is any unsolicited e-mail that arrives in your e-mail inbox.

Start Menu: A selection of files, folders, options and controls that appear when you click on the Start button.

Storage: All PCs use a Hard Drive for storage of software, files and images. The higher the capacity of the Hard Drive, the more filing space you have. Hard Drive capacity is measured in Gigabytes (GB).

Surge Protection: Prevents electrical power surges from affecting an electrical item when it is connected to a power source.

Symbol Keys: Keys showing punctuation marks and other signs.

System Requirements: The minimum specification your PC must meet to run the software. The faster your PC and the more memory it has, the smoother the program will run.

T

TFT (Thin Film Transistor): A very thin, bright, color pc screen as used on laptops for superb resolution, crispness, sharpness and brightness with minimum size and weight.

Taskbar: A bar along the bottom of your screen displaying a series of buttons, each indicating an open program. Click on a button and that program's window will open up.

Text Box: A free-floating box which contains text. You can make text in a text box flow either horizontally or vertically.

Toggle: A word used instead of switch when referring to computer functions. For example, you can toggle the **bold-text** feature on or off by pressing Ctrl+B on the keyboard. Many functions can be toggled using keyboard shortcuts

Touchpad: A stationary pointing device which has a small, flat surface that you slide your finger over, using the same movements as you would with a mouse. You can tap on the pad's surface as an alternative to pressing one of the touchpad keys.

U

USB (Universal Serial Bus): A form of HOT PLUG AND PLAY; the system lets you add or remove peripherals via the USB socket/s, without turning off or restarting your PC.

V

Video Conference: A video setup using special software that enables several users in different locations to see and hear each other at the same time.

Virus: Any sequence of code capable of propagating itself within the memory of a computer or across a network, usually with detrimental results.

W

WPM: Words per minute – a measure of typing speed. An average word is five characters or symbols. Initially aim at 12 wpm (1 keystroke per second). A good average speed is 50 to 60 wpm.

Wallpaper: The background of your Desktop.

Watermark: A faint background image or, occasionally, section of text. It is most often used as a background to text.

Wattage/Watts: Wattage/Watts refers to a unit of electrical power. The higher the wattage, the more power a product consumes.

White Space: Gaps or unused spaces between words.

Wildcard: Characters that represent just about anything in your search field. Use wildcards to fine-tune your search for specific characters, words or symbols – a full list of wildcards and their usage is available in the help menu.

Wireless Application Protocol (WAP): wireless application protocol is designed to bring the Internet, in a modified form, to mobile phones and

some personal organizers. WAP sites are tailored for small screen sizes and slower download speeds.

Z

Zip Disc: Removable disc used for storing information for a PC, only used in a Zip Drive. Has a capacity of 100Mb or 250Mb compared to a conventional floppy disc which has a capacity of just 1.44Mb

Zip Drive: Special disc drive for use with Zip discs. Most Zip discs have a capacity of 100Mb compared to conventional floppy discs, which have a capacity of just 1.44Mb.

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Figure 4.7 The IDE Ribbon cable showing master, slave and MB connectors

Figure 4.8 Depicts the MB socket (top) the IDE cable is slimmer that HDD IDE cables and the floppy drive

Figure 4.9 CD/DVD/CDRW slots into the bay

Figure 4.10 CD Bays push out from inside. The CD is pushed in the case from the front Connect the IDE and power connector at the back, remember red – red.

Figure 4.11 The IDE connection for CD DVD and CDRW

Figure 4.12. IDE UDMA ULTRA 100/66

Figure 4.13. a DDR Ram Module, note the single notch

Figure 4.14. This is an SDRAM module with two notches

Figure 4.15 showing socket which is onboard the MB and RAM

Figure 4.16. inserting the RAM

Figure 4.17. Locking the RAM

Figure 5.1. Where to install AGP graphics and sound/modem PCI cards