ALT-286/386SX
User Manual
and Guide to MS-DOS.
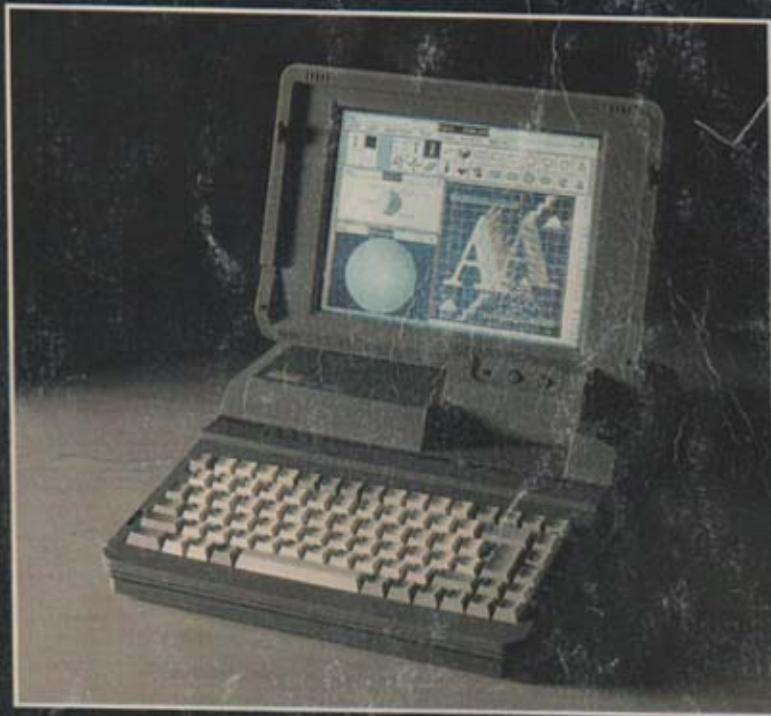
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All correspondence relating to the product or this manual should be addressed to:

Amstrad Information Centre
1 St. James's Road
Brentwood
Essex CM14 4LF

Telephone: (0277) 230222
Fax. (0277) 222117

Preface

This manual is in two parts:

Part 1 - **Guide to using ALT286 and ALT386SX**

Part 2 - **Guide to using MS-DOS (Microsoft® Disk Operating System).**

Each chapter in Part 1 gives an introductory description of a part, or parts, of the PC: how each part works and what it can be used for. Highly technical information is included in some chapters, to be used when writing programs and performing specialised tasks with the PC. This level of information is not comprehensive. It is supplied to supplement the Industry Standard documentation, where Amstrad PCs include additional features to Industry Standard PCs.

Do not worry if you do not understand the technical information; this would indicate that you do not need to use it. The majority of users most certainly will not need to understand this information.

The first thing you will probably want to do is install the PC, rather than read the manual! Chapter 3 describes the installation steps, so if you feel confident that you know how you want to set up your PC, you could start installing straight away.

If you are new to computing you may want to understand what you are doing during the installation process, in which case, you could read Chapter 2 first, which gives a broad view of the possible uses of the PC.

If you run into difficulties, you should look at "Troubleshooting" in Part 1 Chapter 14, and Part 2 Chapter 10 to see if you can find out what has gone wrong, and what to do about it. If you experience difficulties which are not covered in this manual, consult your dealer.

This book describes ALT286 and ALT386SX. Most of the information given applies to both machines but differences between the models are clearly indicated, where this is appropriate. Many of the example screen displays are taken from just one model, when the display would be almost identical for the other model.

Part One - Contents

1. Reference Information

1.1 Contents of the package

Before you start to use your PC, check that, in addition to this manual, the package contains the following items:

*   A portable PC, with a built-in keyboard and a built-in LCD screen
*   One 3.5 inch floppy disk - the part number stamped on the disk should be 33000
*   Two power cords: one fitted with a plug suitable for use in the UK and one suitable for European countries
*   A Ni-cad Battery
*   An extra set of keys including European keys
*   A pair of tweezers (for fitting and removing keys from the keyboard)
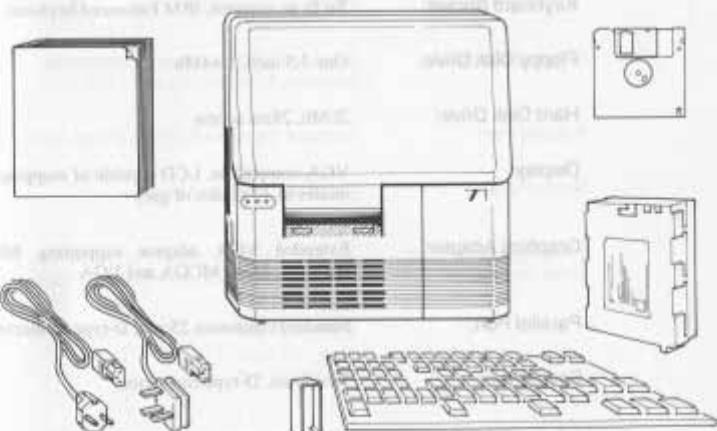
If any item is missing, consult your dealer.

Save all the packing materials in case you want to transport your PC at some later date.

1.2 Specifications of ALT286 and ALT386SX

This information will be required if you want to use application programs or additional hardware with your PC, for example, a printer, a monitor or expansion card.

Standard features of ALT286

Memory Size: 1Mb (640K of which is Base Memory)

Central Processing Unit: 16 MHz 80L286 (Low Power) processor (speed changeable between 8MHz and 16MHz)

Keyboard: 85 key, AT-compatible keyboard

Keyboard Socket: To fit an external, IBM Enhanced keyboard

Floppy Disk Drive: One 3.5 inch, 1.44Mb

Hard Disk Drive: 20Mb, 28ms access

Display: VGA-compatible, LCD capable of mapping 256 color modes to 32 shades of grey

Graphics Adaptor: Extended VGA adaptor supporting MDA, CGA, Hercules, EGA, MCGA and VGA.

Parallel Port: Standard centronics 25-pin, D-type connector

Serial Ports: Two 9-pin, D-type connectors

Expansion Slot: One reduced length, AT slot. Maximum card size 155mm x 106mm. The maximum height of the components on the card can be 19mm.

Battery: An internal, rechargeable, Ni-cad battery, rated at 12V 2400mAh.

External Floppy Disk Drive Connector: 36-pin, Centronics connector, to connect a self-powered, external floppy disk drive of one of the following sizes:

360K, 5.25 inch
1.2M, 5.25 inch
720K, 3.5 inch
1.44M, 3.5 inch

BIOS: Industry Standard AT-compatible, ROM operating system

Operating System: MS-DOS version3.30A

Standard features of ALT386SX

Memory Size: 1Mb (640K of which is Base memory)

Central Processing Unit: 16 MHz, 80386SX processor
(Speed changeable between 8MHz and 16MHz)

Keyboard: 85 key, AT-compatible keyboard

Keyboard Socket: To fit an External, IBM Enhanced keyboard

Floppy Disk Drive: One 3.5 inch, 1.44 Mb drive

Hard Disk Drive: 40Mb, 25ms access

Display: VGA-compatible, LCD capable of mapping 256 color
modes to 32 shades of grey.

Graphics Adaptor: Extended VGA adaptor supporting MDA, CGA
Hercules, EGA, MCGA and VGA

Parallel Port: Standard Centronics 25 pin, D-type connector

Serial Ports: Two 9 pin, D-type connectors.

External Floppy Disk
Drive Connector: 36 pin, Centronics port, to connect a self-powered
external floppy disk drive of one of the following sizes

360K, 5.25 inch
1.2M, 5.25 inch
720K, 3.5 inch
1.44M, 3.5 inch

Battery: An internal, rechargeable, Ni-cad battery, rated at 12V
2400mAh.

Expansion Slot: One reduced length, AT slot. The maximum card size is
155mm x 106mm. The maximum height of the
components on the card can be 19mm.

BIOS: Industry standard, AT-compatible, ROM Operating
System

Operating System: MS-DOS version 3.30A

1.3 Memory configuration

The memory in the PC may be divided between Base memory, Extended memory and Shadow RAM. There must be a minimum of 256K of Base memory, although normally 640K would be most suitable. Of the memory that remains, you may choose to allocate 384K for use as Shadow RAM. Then, any remaining memory will be used as Extended memory.

An explanation of the different types of memory, Base memory, Extended memory and Shadow RAM is given in Chapter 8, "RAM".

If you have 1Mb and you do not intend to upgrade the memory, it is recommended that you allocate 640K as Base memory and the remaining 384K for use as Shadow RAM, unless you have a particular use for Extended memory, for example, RAMDRIVE, SMARTDRV or HIMEM (included in MS-DOS 4.0 and Windows Presentation Manager) or any other programs which require Extended memory, such as a 'Limulator' or XENIX. See Chapter 8, for detailed information.

If you have upgraded the memory, or intend to upgrade the memory, to 2Mb or 4Mb, we recommend that you use Base memory, Extended memory and Shadow RAM, as suggested in the table below.

When deciding how to configure the memory, you should consider which type of memory is most advantageous to the programs you use. Shadow RAM allows your programs to run faster by copying the BIOS (and possibly other ROMs) into RAM which has a faster access speed. However, once you choose to use shadowing, although it is only for the 64K system BIOS, the full 384K will be reserved for the purpose.

When using MS-DOS the recommended settings are as follows:

Type and usage of PC	Base	Extended	Shadow RAM
512Kb PC or 512Kb PC	256K / 512K	256K / 0	0 / 0
1Mb PC or 1Mb PC	640 / 640	384 / 0	0 / 384
2Mb PC or 2Mb PC	640 / 640	1408 / 1024	0 / 384
4Mb PC or 4Mb PC	640 / 640	3456 / 3072	0 / 384

1.4 Important safety notices

Protecting the PC

IMPORTANT: when choosing a position for the PC, make sure that the equipment is NOT situated near an artificial heat source, such as a radiator, near a water supply, or in direct sunlight. These elements can damage your PC and destroy data.

PC Voltage

When connected to a mains supply, the PC operates from a supply in the range 120V - 240V AC, 50 - 60Hz. No voltage range adjustment is required. Alternatively, the PC may be powered from the rechargeable battery, inside the PC. Note that the battery can be replaced.

Fitting an alternative mains plug
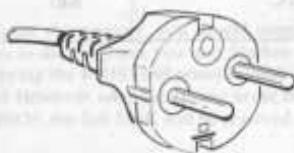
WARNING: This plug is intended for use only in the continent of Europe and must not be used in the United Kingdom.

CAUTION: This plug is intended for use only in the United Kingdom and must not be used in the continent of Europe.

For users in the UK, the mains lead that is fitted with the moulded 13Amp plug will be suitable for most uses. Certain locations, mainly old buildings, may not be equipped with the normal, 13Amp sockets. In which case, you may want to change the moulded 13Amp plug on the mains lead for an alternative type. The moulded plug may be cut away and the ends of the lead stripped, as required, to suit the plug to be fitted.

WARNING - IF YOU REMOVE THE MOULDED PLUG, DISPOSE OF IT IMMEDIATELY. THE PLUG IS NON-REWIRABLE AND WOULD CAUSE A SHOCK HAZARD SHOULD SUCH A PLUG BE INSERTED INTO A SOCKET.

If a fused plug is used, a 5Amp fuse must be fitted. Other size fuses must not be used. If a non-fused plug is used, a 5Amp fuse must be fitted either in the adaptor or at the distribution board.

WARNING - THIS APPARATUS MUST BE EARTHED

ALWAYS DISCONNECT THE MAINS PLUG FROM THE SUPPLY SOCKET, WHEN NOT IN USE.

IMPORTANT - The wires in the mains lead are coloured in accordance with the following code:

Green and Yellow : Earth
Blue: Neutral
Brown: Live

Inside the PC

WARNING - LIVE PARTS INSIDE. DO NOT REMOVE ANY SCREWS

Connecting the PC to the mains supply

Your PC has been supplied with two mains lead assemblies.

One is fitted with a standard European mains plug which is suitable for the continent of Europe. The other is fitted with a United Kingdom 13Amp (BS1363A) plug.

WARNING: WHEN POWERED FROM THE MAINS SUPPLY, THE APPARATUS MUST BE EARTHED

WARNING - DO NOT CONNECT TO an "IT" POWER SYSTEM.

Note: an IT power distribution system has no direct connection to earth; but the exposed conductive parts of the electrical installation are earthed.

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Amstrad Software licence agreement for all software described in this manual.

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General

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AMSTRAD PLC
169 Kings Road
Brentwood
Essex CM14 4EF

2. Guide to using the PC for new users

Introduction

This chapter gives a broad view of the activities which are fundamental to the PC: safety, and using an operating system. It also outlines optional activities: using a graphic interface, programming languages, application programs, configuring memory and additional hardware.

Each section tells you where to find more information and instructions for that particular activity.

2.1 Safety

There are two main aspects of safety that you should be aware of.

One of which is protecting your data. Data stored on a hard or a floppy disk can be lost for a number of reasons; it is almost certainly very inconvenient if this happens to you. You could lose programs and data which are irreplaceable, or at least, you may find that replacing the data means you are going to have to re-type or re-install everything you have lost. Therefore, you are advised to keep copies of your stored data.

There are various ways of making security copies: see Part One, Chapter 13, for information about copying data stored on a hard disk and refer to Part Two, Chapter 6 for information about copying floppy disks.

The various methods described in this manual for copying data involve using the MS-DOS commands **DISKCOPY**, **COPY** and **BACKUP**. Full details of these commands are given in Part Two, Chapter 8, where all the MS-DOS commands are listed alphabetically.

Secondly, you should pay attention to the safety warnings regarding fitting plugs and using power supplies. See the safety information in Chapter 1, which includes local standards, such as B.E.A.B.'s recommendations for plugs in the UK.

2.2 The Operating System (MS-DOS)

If you are new to computing, you will need to understand what an operating system

The computer is a collection of advanced electronics which cannot work without be
told what to do. The operating system is a set of programs which you can use to com
the PC and tell it what to do.

The operating system supplied with your PC is called MS-DOS (Microsoft® D
Operating System). You issue instructions, called commands, to the operating syste
and it, in turn, controls the electronics of the PC.

Once the operating system has been given instructions, it can make the compu
perform functions like running programs, storing and retrieving data from files on di
as well as controlling smaller operations like accepting characters from the keybo
and displaying them on the screen.

You could use an operating system other than MS-DOS. You could re-configure
hard disk and install one or more operating systems. It is also possible to load
alternative operating system from a floppy disk. See Chapter 3 for information ab
configuring the disk; and see Part 2 for a full description of MS-DOS.

2.3 Graphic Interfaces

A graphic user interface displays the operating system's activities, and the contents
your disks in a diagrammatic and pictorial form.

A graphic form of display makes it easier to issue commands; a mouse is used to con
a pointer which can be moved around the screen. The pointer is used to select ite
and operate menus. Although graphic interfaces may be desirable programs to u
they are not essential.

Like application programs, a graphic interface has to be used in conjunction with
appropriate operating system. Microsoft Windows is one such graphic interface wh
has to be used with MS-DOS. In fact, it is written to supplement MS-DOS and
provide additional facilities to those of the operating system.

Once you have learned how to use a graphic interface, you will realise the advanta
of being able to use a number of application programs which work with the sa
interface. It means that you will not have to learn how to control each applicati
program; you will control the interface and it will control the programs.

2.4 Application Programs

If you want to use word processing programs, spreadsheets or a database, you will need
to install a third level of programs onto your PC. These programs are called
"application programs", examples of which are: Wordstar, Supercalc, and Infomaster.

The primary use for your PC will possibly be to run application programs such as word
processors, databases, spreadsheets, accounting and invoicing systems and so on.

However, in order to use application programs on a PC, there must also be an operating
system installed on the computer (see Section 2.2, above).

When buying application programs, check the specification details of the PC, in
Chapter 1, against the specification details of the programs, or ask your dealer for
advice on buying suitable programs for your PC.

Your PC is compatible with one of the IBM models: either PC XT or PC AT, therefore,
a huge range of software already exists for you to choose from; virtually all of which
will run on your PC. The PC also supports most of the common graphics modes, thus
increasing the choice of software that you could use on it.

Instructions on how to install and use application programs should accompany the
programs.

2.5 Programming Languages

You may be interested in developing your own PC applications if the type you want is
not available. There are many computer languages available that allow you to
formulate a series of instructions that make the PC do a specific task, such as, BASIC,
COBOL, C, for example.

2.6 Configuring the PC's memory

There are four types of memory that can be used on PCs, namely, Base, Extended, Expanded and Shadow RAM. All PC models contain Base memory, this is where MS-DOS is normally loaded. The ALT286 and ALT386SX also contain Extended memory and Shadow RAM. If you needed to use Expanded memory, you could use a LIM (expanded) memory driver. The amount of each type of memory can be adjusted to increase the overall performance of the computer. The way in which you choose to apportion the available memory will depend upon the application programs that you intend to run: programs may be designed to use memory in different ways.

A full description of these memory types is given in Chapter 8. The recommended memory configuration for use with MS-DOS is given in Section 1.3.

2.7 Expanding the PC

The possibilities for expanding your PC are virtually limitless. You can upgrade and extend the facilities in your PC by adding hardware and using MS-DOS.

The parallel and serial ports will allow you to connect almost any printer to the PC; in addition, the serial ports may be used for connecting your PC to another computer, a terminal or modem, allowing you to access many large computers via the telephone system.

Within the system unit, there is an expansion slot which can take any of the reduced size cards designed to be used in the IBM PC. Expansion cards can be used to add various features to your PC: they could be used to provide more memory, further serial or parallel interfaces, or an internal modem, for example. See Chapter 11 in Part 1 and Chapter 4 in Part Two for information.

3.Installation and hardware configuration

Introduction

This chapter tells you how to set up and prepare your PC for future use. However experienced you are in using microcomputers, you are advised to follow these instructions: from step 1 to step 8. If you rush on to running programs too quickly, you risk corrupting the software supplied with your PC. The consequence of this will be that you will have to buy new copies of this software from your dealer.

Before you install the PC, make sure you have unpacked all the contents described in Chapter 1. Also, read the safety notices in Chapter 1, then proceed with steps 1 to 8, described in this chapter.

Setting up the PC

IMPORTANT: when choosing a position for the PC:

- when powering the PC from the mains supply make sure that all the equipment is installed close to, and within easy access of, the electrical mains supply socket.

3.1 Installation steps

The Installation steps are as follows:

1. Safety precautions

2. Upgrade or expand your PC

3. Fit the battery

4. The startup procedure

5. Configure the system using the SETUP program

6. Prepare the hard disk for use and install the operating system

7. How to reset the PC

8. How to switch off the PC properly

Some of the above steps are optional.

Each step is described in detail in the following pages.

Safety

The PC is supplied with two mains leads. Both leads have a plug which fits into the PC; one lead also has a three pin plug fitted at the other end which is suitable for connecting the PC to a power supply socket in the UK and Ireland; the other lead has a two pin plug which is suitable for use in European countries.

If the socket on your associated equipment is not suitable or, if for some reason you wish to change these plugs, the moulded plug may be cut away and the ends of the lead stripped as required to suit the plug to be fitted.

WARNING

IF YOU REMOVE THE MOULDED PLUG, DISPOSE OF IT IMMEDIATELY. THE PLUG IS NON-REWIRABLE AND WOULD CAUSE A SHOCK HAZARD IF IT WERE INSERTED INTO A SOCKET.

If a UK 13 Amp (BS1363) plug is used, a 5 Amp fuse must be fitted. The 13 Amp fuse supplied must not be used. If any other type of plug is used a 5 Amp fuse must be fitted, either in the plug or in the adaptor or at the distribution board.

IMPORTANT : The wires in the mains lead of this apparatus may not correspond with the coloured markings identifying the terminals in your plug, proceed as follows:

i) The wire which is coloured green and yellow must be connected to the terminal in the plug which is marked by the letter 'E' or by the safety Earth symbol ⏚ .or coloured green and yellow.

ii) The wire which is coloured blue must be connected to the terminal which is marked with the letter 'N' or coloured black.

iii) The wire which is coloured brown must be connected to the terminal which is marked with the letter 'L' or coloured red.

IMPORTANT: DO NOT PLUG YOUR PC INTO THE MAINS SUPPLY YET

WARNING
HIGH VOLTAGE INSIDE. DISCONNECT THIS EQUIPMENT FROM THE POWER SUPPLY BEFORE REMOVING ANY COVER

WARNING
DO NOT CONNECT TO an "I T" POWER SYSTEM

Note: An "I T" power distribution system has no direct connection to earth; the exposed conductive parts of the electrical installation are earthed.

Step 2 Upgrade and Expand your PC

Now is a good time to fit any additional hardware that you want to use. If you want to upgrade or expand your PC in any of the following ways, look up the information you need in the appropriate chapters, as indicated.

- Add a CRT monitor, see Chapter 6

- Upgrade memory, see Chapter 8

- Fit an expansion card, see Chapter 11

- Connect a printer or modem, see Chapter 12

- Fit a maths co-processor, see Chapter 7

- Fit an external keyboard, see Chapter 5

You may also need to adjust the DIP switches according to the adjustments you have made to the hardware. See Chapter 11 for details of the DIP switch settings.

Step 3 Fit the battery

Turn the PC upside-down, with the back panel facing you. Hold the battery over the recess in the unit, one centimetre from the end of the recess. Make sure that the notches on the battery align with the gaps inside the recess, then lower the battery into the recess. The arrow on the side of the battery should line up with the arrow on the system unit as the battery is lowered into the recess. Pull the catch leftwards and slide the battery to the end of the recess, closing the gap.
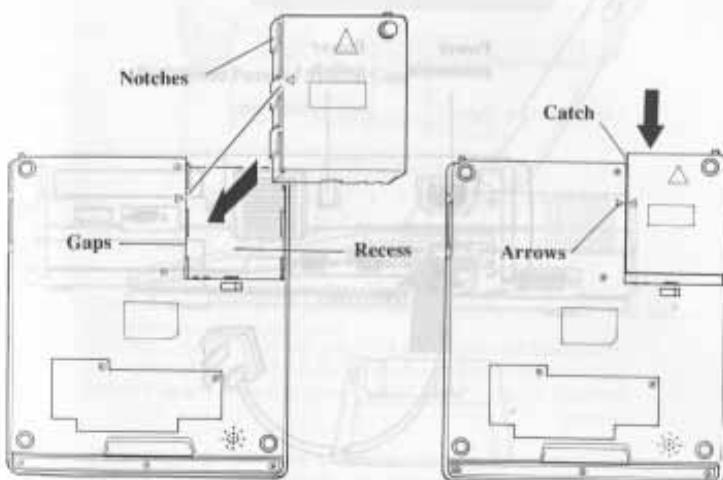
Next, turn the computer the right way up.

Open the lid of the PC and raise the screen into position, ready to use. The lid is released by pushing the catches, on both side panels of the unit, forward.

Note: Always have the battery fitted whilst the computer is in operation.

Step 4. The Startup Procedure

If, while you are following these instructions, things happen that are not explained h, or you see messages that are nothing like the ones described here, turn to Part 1 Cha 14, and Part 2 Chapter 10, to see if you can find out what has gone wrong. If you c consult your dealer.

Start with:

- the mains plug out of the supply socket

- the power switch, on the back panel, in the OFF position

Power
connector   Power
              switch
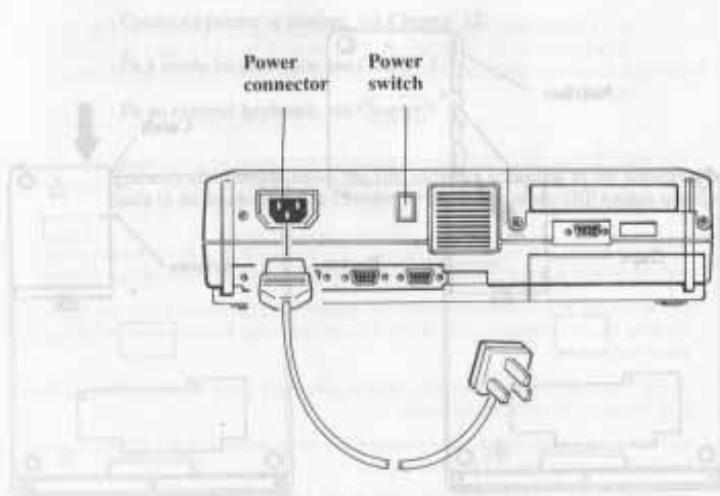
then

- Connect the AC mains supply cord to the power socket situated on the back pane the computer.

- Insert the System disk into the floppy disk drive, before you switch the computer on, so that the system is booted from the floppy disk automatically. Otherwise, the system will try to boot from the hard disk, which has not yet been prepared, and may not be acknowledged by the system as fitted.

Righthand Panel of System Unit
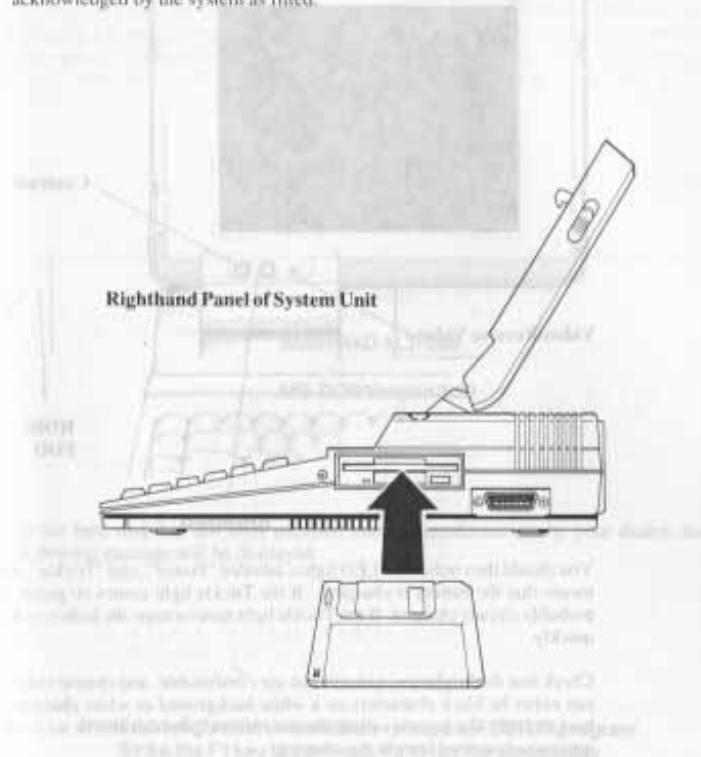
Then turn the power switch on.

Contrast

Video/Reverse Video

HDD/
FDD

Brightness

You should then notice the LED lights, labelled "Power", and "Trickle", come on. T ...
means that the battery is charging. If the Trickle light comes on green, the batter ...
probably already charged. If the Trickle light turns orange, the battery is being char ...
quickly.

Check that the brightness and contrast are comfortable, and choose video setting: T ...
can either be black characters on a white background or white characters on a bl ...
background. The latter is called "Reverse Video", and can also be set using the SET ...
program, described later in this chapter.

Note If you have already connected an external keyboard, it will automatically be operat ...
Any other hardware that you add will not be recognised until you have informed ...
system of its presence, using the SETUP or DISPLAY command. See Step 3 and St ...
for information.

Once switched on, the BIOS should display the following message on your screen:

AMSTRAD ALT-386SX

MS-DOS Version 3.30

or

AMSTRAD ALT-286

MS-DOS Version 3.30

If the hard disk has not been prepared during manufacture or by your dealer, the
following message will be displayed:

**Invalid configuration information - please run SETUP program
Strike the F1 key to continue, F2 to run the setup utility**

In this case, you should press the [F2] key to run the SETUP program. Continue with
SETUP as described in the next step.

If your hard disk has been prepared, you will see an MS-DOS system prompt on the screen

A:\>

In this case, you should proceed with the SETUP program, as explained in Step 5, to define the hardware settings for your particular computer, storing the information in the CMOS RAM.

Step 5. Configure the system using the SETUP program
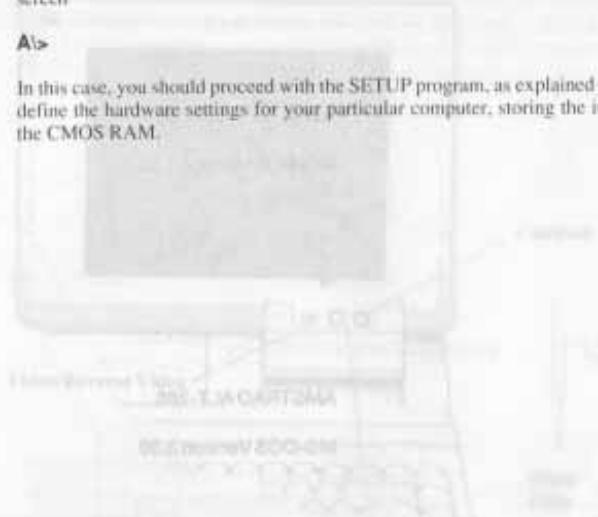
Having gone through the Startup procedure, hold down the **[Ctrl]** and **[Alt]** keys and press the **[S]** key. This will start the SETUP program running. After a few moments, you should see the following display on your screen. The display lists the features of the PC that can be configured and the parameters and values that are currently set for them.

```
                    Phoenix Technologies Ltd.   Version
                    System Configuration Setup  4.03.01
Time:   09:31:52
Date:   Thu Apr 19, 1990

Diskette A:            3.5 inch, 1.44 MB
Diskette B:            Not Installed         Cyl  Hd   Pre   LZ   Sec  Size
Hard Disk 1:           Type 17               977   5   300   977  17   40
Hard Disk 2:           Not Installed
Base Memory:           640 KB
Extended Memory:       3M KB
Display:               VGA/EGA
Keyboard:              Installed
CPU Speed:             Fast
BIOS Shadow:           Disabled
Video low-power delay 2 min
Disk power-save delay 2 min
Coprocessor:           Not Installed

Up/Down Arrow to select. Left/Right Arrow to change.
F1 for help. F10 to Exit. Esc to reboot.
```

The above information is stored in the CMOS RAM. This is an area of memory that is used to store information even when the computer is switched off. This information defines the configuration of the computer, that is, which hardware features or modes are to be used. The CMOS RAM is read when the machine is first switched on.

The CMOS RAM is sometimes referred to as just "NVR", "Non-Volatile RAM", "battery-backed RAM".

This configuration information defines the setting of the following features:

- The time and the date

- The size of the Drive A floppy disk drive

- The size of the Drive B floppy disk drive

- The hard disk type

- Memory configuration

- The graphics adaptor

- The keyboard

- The speed of the processor

- The BIOS shadow

- Automatic switching-off of video back-lighting at a predetermined interval

- Automatic switching-off of hard disk power at a predetermined interval

- The presence of a maths co-processor

Details of these options are given below. To change the values, position the cursor the appropriate field using the up and down cursor keys [↑] [↓]. Then to see possible values, use the left and right cursor keys [⇐] [⇒]. Some options require to enter the value of your choice using the numeric keys.

When you have finished, press the [F10] key to save your changes and then exit press the [Esc] key to save your changes and then re-boot the system.

If you require additional information while setting these parameters, press the [F1] key for help.

Set the time and date   As appropriate
                         NB. The time and date can also be set with the MS-DOS
                         TIME and DATE commands. (See Part 2, Chapter 8).

Diskette A   Enter the correct size of floppy disk drive you are using.
                         There are 5 options:

                         Not Installed
                         5.25" 360Kb
                         5.25" 1.2Mb
                         3.5" 720Kb
                         3.5" 1.44Mb

                         The default setting is 3.5" 1.44Mb

Diskette B   This setting is required to inform the system as to whether
                         or not an external floppy disk drive is connected to the
                         PC. The possible floppy disk drive sizes are the same as
                         for Diskette A above.

                         Note that it is also necessary to adjust DIP switch 10
                         according to the type of floppy disk drive that is
                         connected. See Chapter 11 for details.
                         The default setting is "Not Installed".

Hard disk 1   The possible options are:

                         Not Installed
                         Predefined types which are numbered 0 - 47
                         A hard disk type not listed, which therefore requires
                         definition. Use the cursor keys to position the cursor in
                         the hard disk type information fields, and enter the
                         required parameters. This information should be
                         supplied with your hard disk.

                         The default setting is Type 2 for a 20Mb hard disk,
                         supplied with ALT286, and Type 17 for a 40Mb hard
                         disk, supplied with ALT386SX.

Hard disk 2	The options are the same as defined for Hard disk above.

The default setting is "Not Installed".

Base Memory	The possible sizes are 256Kb, 512Kb or 640Kb. See the recommended memory configuration in Section 1.3.

The default setting is 640Kb.

Extended Memory	You should set up the Extended Memory and Shadow RAM as recommended in Section 1.3. Extended Memory can only be set in 64K increments. Values which are not a multiple of 64K will be rejected.

The default setting is "Not Installed"

Display	The supplied video adaptor is a VGA adaptor. The possible settings are:

Not Installed
VGA/EGA
CGA 40
CGA80
Mono
The default setting is VGA/EGA

Keyboard	The keyboard can be either Installed or Not Installed.

The default setting is "Installed".

CPU speed	You can set the CPU speed to either:

Fast - 16 MHz
Slow - 8MHz
If DIP switch number 6 is set ON, that is the slow speed, the SETUP program will not be able to overwrite this setting - the clock will run at 8Mhz even if this option is set to 16MHz. If DIP switch number 6 is set to OFF, 16MHz, the SETUP program could be changed to make the clock run at 8MHz. The DIP switches are situated on the back panel of the computer.
The default setting is "Fast".

BIOS Shadow	This facility can be enabled or disabled. See Chapter 8, RAM, for information about Shadow RAM.

The default setting is Enabled.

Video Low Power Delay	This option applies when the PC is powered by the battery, not when it is connected to the mains supply. Once a time has been set, the back-lighting of the display will turn off automatically after the specified time interval. This will prevent much battery energy being wasted while the PC is switched on, but not being used. Press any key to recover back-lighting. The possible length of time, between the PC being used and the automatic switch off, can be set to:

Never, 1, 2, 3, 5, 10, 20 or 30 minutes.
The default setting is 2 minutes.

Disk Power - Save Delay	This option is based on the same principle as that of Low Power Delay. Whilst the PC is powered by battery, energy can be saved by setting the hard disk to stop spinning after the PC has been unused for a given length of time. The next attempt to access the hard disk will make the disk spin again. The possible time intervals are:

Never, 1, 2, 3, 5, 10 or 20 minutes.
The default setting is 2 minutes.

Maths Co-Processor	The SETUP program can detect automatically whether a maths co-processor is fitted.

The default setting is "Not Installed".

You must remember to update the above settings if you change the system configuration later, for example if you fit a Maths co-processor or replace the built-in graphics adapter with an alternative, fitted in the expansion slot.

When you have finished selecting the options for your PC, press the [Esc] key to save your settings and exit the SETUP program. The system will automatically re-boot from the System disk that you should still have in Drive A (floppy disk drive).

Step 6. Prepare the hard disk for use and install the operating system

MS-DOS is the operating system supplied with your PC and is used in this step to prepare the hard disk for use. It will also be installed onto the hard disk.

Note This MS-DOS software is supplied strictly subject to the Licence terms and conditions printed in Section 1.5 of this manual. If you do not agree to comply with all the terms and conditions of the relevant Licence Agreement, you must destroy the software concerned. If you do agree to comply with all the terms of the Licence, then by loading, entering, utilizing, running, listing or otherwise manipulating the software in any way, you are deemed to accept the full terms and conditions of the Licence.

A description of MS-DOS is to be found in Part 2.

The preparation process involves formatting the hard disk and installing MS-DOS. Even if you do not understand the following explanation of formatting the disk, you can just follow the AMSFDISK instructions below.

If you have a hard disk of more than 32 megabytes, MS-DOS (version 3.30A) will not be able to recognise 32 of those megabytes as one unit. In order to use the full capacity of such a disk with MS-DOS, you must divide the disk into two sections. These sections are called "Partitions". You must create a Primary Partition, even if you are only going to have one section. The second section is called an "Extended Partition". It is possible to create further divisions on the disk. These would be made within the Extended partition and would be called "Logical Drives".

Logical drives are not physical drives; MS-DOS simply treats them as if they were separate drives. They are labelled Drive D:, Drive E:, Drive F: and so on.

No single partition or logical drive can be larger than 32 megabytes.

If you have a hard disk drive fitted which is 32 megabytes or less, you can format the disk as one single drive, that is, Drive C:, or as a number of logical drives, up to four.

A program is supplied on your PC System disk called "AMSFDISK" which provides some very simple steps to allow you to prepare the hard disk. An MS-DOS program called "FDISK" is also supplied on the disk, which is designed to prepare the hard disk. Details of this program are given in Part 2 Chapter 8. However, it is a more complex program to use, so you are recommended to run AMSFDISK if you are unfamiliar with MS-DOS.

AMSFDISK Instructions

The PC System Disk should still be in Drive A, if it isn't, insert it, then hold down the [Ctrl] key and the [Alt] key and press [Del].

The PC then reads from this disk. You will see the indicator light on the drive go on and off a few times while this is happening.

If you see a message similar to one of the following:

Non-system disk or disk error
Replace and strike any key when ready

OR

Not a boot disk
Replace and hit any key

Press the drive release button and withdraw the disk from the drive. Check that it is your MS-DOS System Disk.

If you had inserted the right disk, put it back in the drive slot and press the space bar. If it fails again, consult your dealer. If you had inserted the wrong disk, select the right disk and put this in the drive slot, then press the space bar. The system will re-boot.

When the DOS prompt appears, type

AMSFDISK

You will be asked to confirm that you wish to continue. Only type **Y** if you are sure there is no data on the hard disk that you require. AMSFDISK will destroy any existing data.

Whatever size of hard disk you are using, the program will detect the size of the hard disk and display a message offering you a number of drive sizes to choose from.

You can select one of these alternatives, or you can enter any other valid sizes that you think are appropriate for your work.

Once you have selected the drive sizes, AMSFDISK will begin scanning the disk for error tracks, that is, tracks which have been marked, during the manufacturing process, as containing errors. It will also be formatting the disk.

When this process is finished, any defects on the hard disk will be listed on the scr... in square brackets. Do not worry if your disk has some bad tracks. This is quite nor... in fact, these bad tracks are probably already listed by the manufacturer on the di...

MS-DOS will now ignore these bad tracks during all uses of the disk. You can, if ... wish, add more tracks to this list, if you want MS-DOS to ignore them also.

Follow the instruction on the bottom of the screen, which tells you how to edit thi...

Then press the space bar to continue.

The configuration you have selected will be displayed, and will look something ... the following:

```
** Drive Size is 39.7MB - (C: 781 Cyls/4 heads/26 Sectors) **

The current Drive Size(s) are as follows:

Drive Start End  Size
  C:    0   156  8.0MB
  D:  157   780  31.7MB

Press [Esc] to Edit the displayed list.

Press the <Space Bar> to continue HD Preparation
```

You could change your mind, at this point, and reconfigure the disk with different d... sizes.

Or, you can accept the configuration and re-load MS-DOS. This is an essential par... the disk preparation process, in which MS-DOS is installed onto the hard d... MS-DOS files would then be copied from the System disk onto the hard disk, int... directory, on drive C, called "DOS".

When this is completed, AMSFDISK will give you the choice of ending the computing session, or using MS-DOS. You will see a message similar to the following:

**Now remove your MSDOS disk and reset the computer
by pressing [Ctrl] [Alt] [Delete] simultaneously.**

Your hard disk is now fully prepared and the MS-DOS external commands have been copied to the C:\DOS directory on your hard disk. From now on, when you wish to use MS-DOS, you need only switch on your PC and MS-DOS will be loaded automatically. See Part 2 for a full description of MS-DOS.

Step 7. How to reset the PC

Resetting your PC clears its memory so that you can start using the machine afresh. [It] is often used to change from using one application software package to another, or [when] a program has failed.

Do not reset your PC before you have checked whether there is any information currently held in its memory, that you want to save to disk.

Resetting your PC clears its memory. Any information that has not been saved to [disk] will be lost.

The steps are as follows:

1. Press the drive release button(s) and withdraw the disk(s) from the disk drive(s).

2. Hold down both the [Ctrl] and [Alt] keys and press the [Del] key.

Note There is no need to insert a System (MS-DOS) disk, unless you want to override [the] operating system loaded automatically from hard disk.

Step 8. Switching off the PC

1. Check that your PC isn't reading any data from your disks or writing data to them.

2. Press the disk drive release button(s). This automatically releases the disks from [the] drive.

3. Withdraw the disk(s) from the drive(s).

4. Only then, switch off your PC.

When the PC is switched off, the heads are automatically parked by the drive mechanism, to protect the hard disk from being damaged when moved.

ALWAYS REMEMBER TO REMOVE YOUR DISK(S) FROM THE DISK DRIVE(S) BEFORE YOU SWITCH OFF. •

ALWAYS WAIT FOR AT LEAST FIVE SECONDS BEFORE SWITCHING BACK ON.

Software Configuration

Introduction

It is possible to set up the operating system, MS-DOS, to execute a number of instructions automatically, every time you switch on your PC by storing the configuration information in the CONFIG.SYS file and the AUTOEXEC.BAT file.

If you want to change the supplied configuration, you should edit the CONFIG.SYS file or the AUTOEXEC.BAT file. Changes can be made with any text editor. The simple screen editor, RPED, is ideal for this purpose. See Part 2 for instructions on how to use RPED.

CONFIG.SYS File

As MS-DOS loads from disk into your PC, it first examines a text file called CONFIG.SYS. There are three special commands, listed below, which are listed in the file supplied on your System disk. Detailed information about these commands is given in Part 2.

The contents of the file, as supplied on a floppy disk, are as follows:

```
COUNTRY=044,437
FILES=20
BUFFERS=20
```

The contents of the hard disk version of the CONFIG.SYS file are:

```
COUNTRY=044,437, C:\DOS\COUNTRY.SYS
FILES=20
BUFFERS=20
```

AUTOEXEC.BAT File

After MS-DOS has read the commands in CONFIG.SYS, it looks for a text file called AUTOEXEC.BAT. MS-DOS expects this file to contain a sequence of commands which it should read as its operational instructions.

Any of the MS-DOS commands, described in Part 2, may be included in this file. Chapter 4, in Part 2, describes many of the useful options. Also, you could include the necessary commands to run your favourite application program or perhaps some combination of the two, so that they are automatically loaded every time MS-DOS is loaded into your PC.

Normally, the AUTOEXEC.BAT file would at least contain the necessary KEYB command to instruct MS-DOS as to which type of keyboard is being used. It will then know which characters are represented by which keys.

The AUTOEXEC.BAT file supplied on your MS-DOS System disk contains the following commands:

```
@ECHO OFF
PATH \;
KEYB UK 437
\HDGETF
IF ERRORLEVEL 1 INSTALL
PROMPT $P$G
CLS
VER
```

Once MS-DOS has been installed on the hard disk, the AUTOEXEC.BAT file, in the root directory, will contain the following:

```
@ECHO OFF
PATH C:\DOS;C:\
KEYB UK 437 C:\DOS\KEYBOARD.SYS
PROMPT $P$G
CLS
VER
```

The Keyboard

Introduction

The keyboard is used to enter two types of information into your PC; data which is to be stored and manipulated, for example, letters, reports and accounts; and instructions which tell the computer how to process the data, for example, MS-DOS command lines. Both types of information require the use of character keys and numeric keys.

The built-in keyboard is an 85-key, AT-compatible keyboard.

1 Connecting an external keyboard

There is also a socket on the lefthand panel of the computer, marked "Keyboard", which can be used to connect an Industry Standard, Enhanced keyboard. If you do connect a keyboard to this socket, it will automatically be operative, that is, you will not need to adjust any switches.

Lefthand Panel

of Computer

Keyboard Socket
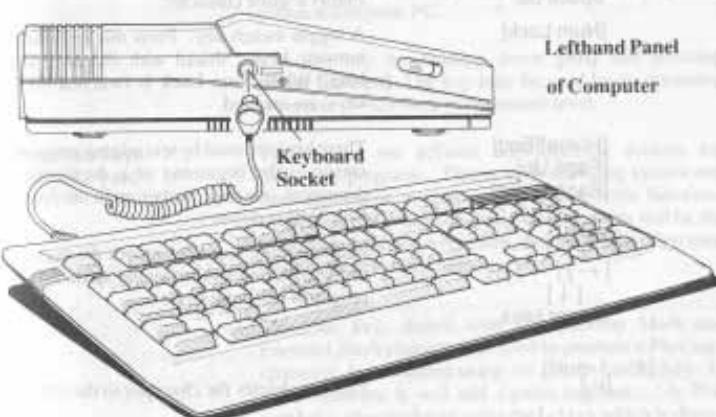
5.2 Functions of the keys

Character keys

In the centre of the keyboard, the character keys [are] organised in the QWERTY layout, that is, the most [common] typewriter layout. Press the keys **[A]** to **[Z]** to enter [lower] case characters (a - z) or the character on the lower [half] of the key, where there are two. Use the shift key [to] enter upper case characters (A - Z) or the character [on the] upper half of the key.

[Caps Lock]

A toggle-switch key. Press once to produce upper [case] letters with the character keys; press once again to [return] to producing lower case letters with the character [keys.]

[⇧]

Hold down the shift key whilst pressing the cha[racter] keys, **[A]** - **[Z]**, to produce upper case letters, [or the] character printed on the upper half of the key; hold [it down] whilst pressing **[Alt]** or [Ctrl] to give special char[acters] or computer codes.

[Ctrl] [Alt]

Ctrl stands for Control; **Alt** stands for Alternative. [Hold] down whilst pressing other keys to give special char[acters] or special computer codes.

[Alt gr]

Press this key together with the second key on the [lower] row of the keyboard, to produce the symbol in the [lower] left corner of the key.

Space bar

Enters a space character.

[Num Lock]

A toggle-switch key. Press this key once to enab[le the] numeric keys, shared with character keys, print[ed in] blue. While **Num Lock** is switched off, the cha[racter] keys are enabled.

[Home][End]
[Page Up]
[Page Down]

These keys are used by text editing programs to mo[ve the] cursor to the beginning of a document, the en[d of the] document, one page further up in the document, an[d one] page further down.

[↑]
[←][→]
[↓]
Cursor keys

Pressing these four keys moves the cursor on the [screen] in the direction shown by the arrow. Note that [most] programs use these keys.

[←]

This key deletes the character to the left of the cur[sor.]

[Delete]

Deletes the character under/to the right of the cursor. It is also used with **[Ctrl]** and **[Alt]** to reset the PC.

[Esc]

Esc stands for escape. Whilst using programs, you can often press the **[Esc]** key to return to the previous level of the program, and eventually to exit the program.

[Insert]

A toggle-switch key. Press once to switch to overwriting existing text. Press again to return to inserting text.

[Scroll lock]

This key is for use with word processors. It enables the cursor keys to move the text on the screen behind the cursor, rather than move the cursor over the text. With some programs it has no effect.

[Break]

Use with the **[Ctrl]** key to abandon the program that is currently being run. Note that **[Break]** will sometimes abort everything you are using, and with some programs, will not work at all.

[Pause]

Pressing **[Pause]** once will stop the program you are using. Pressing any other key will allow the program to continue.

[Print Screen]

Use this key to print out an image of the screen on your printer. It must not be pressed if there is not a printer connected to your PC.

[Sys Rq]

Use this key by holding down **[Alt]** and pressing **[Print Screen]**. The key may be used by an operating system to switch back to command level.

Function keys
[F1] [F2] etc.

These keys are defined with specific actions for individual programs. That is, each operating system and each application program will assign specific functions to each key. It is unlikely that these functions will be the same from program to program, though **[F1]** is often used to access a programs help function.

[+]

The Plus key, shared with the Question Mark and Forward Slash characters, is used to produce a Plus sign character. It is enabled using the **[Num Lock]** key. In some software it will add figures together. A Plus symbol is also produced using the [+] key which is shared with the Equals symbol.

[→|]   The Tab key moves the cursor to the next Tab, inserting spaces as necessary.

[↵]   Pressing the Return key has two effects. One places the cursor on a new line, like the carriage return key on a typewriter; the other enters information you have typed, sending an instruction to your computer. The effect this key has, depends on the context in which it is used: if you press this key whilst typing a letter, using a word processor, the cursor will simply move to the beginning of the next line; if you type an MS-DOS command line for example, you must then press the key to make MS-DOS read the instruction you have typed. When [Num Lock] is enabled, the Return functions as an Enter key: a key normally associated with the numeric keyboard. While many programs do differentiate between the Return key and the Enter key, for some programs it is essential to have both functions.

[-]   The Minus key. There are two minus keys: one which is on the same key as the underline symbol, and a second which is shared with the colon and semi-colon characters. Both are used to produce a Minus sign character, but the second will also subtract figures in some software. The second is enabled using the [Num Lock] key.

Notes on using the keyboard

The number 0, on the top row of the keyboard between the 9 and - keys, is not interchangeable with the letter O between the characters P and I, even though these characters look the same.

Not all programs use the keys in the same way. For example, [←] sometimes just moves the cursor back one position; [Del] sometimes deletes the character under/to the right of the cursor. With some programs, the cursor keys and the [Home] [End] [Page Up] [Page Down] [→|] [Ins] and [Break] keys may have no effect.

A numeric keypad is incorporated into the main body of keys. The numbers are printed blue and are enabled by pressing the [Num Lock] key. It has a similar layout to an adding machine, with numeric keys, [+] and [-] keys. It is therefore useful for fast entry of figures.

The cursor keys were added to the keyboard when the need for them became apparent. Before then, an application program would control the cursor's movements by the use of, for example, the [Ctrl] key with the [E] [S] [D] [X] keys. The positions of these keys on the keyboard indicates the direction the cursor should move.

```
      E
  S       D
      X
```

To move the cursor further in these directions the following keys were used:

```
      R
  A       F
      C
```

Combinations of keys

Combinations of keys are used to provide many extra functions. The keys used are [Ctrl] and [Alt] pressed together with a character key or a function key. This means that although your keyboard has 85 keys, it is able to effect more than 102 functions through various combined keystrokes. Operating systems and application programs all assign different functions to these combined keystrokes: the meaning can change from program to program.

However, some programs will use keystrokes that are used by other programs, so it's useful to be aware of patterns in key usage. You may find mnemonical uses of keys, that some keys are relevant in some way to the functions, for example pressing the [←] key for a backwards movement.

Your keyboard can also produce more characters than those marked on the keys. Although the keyboard appears to offer 72 characters, as on a usual QWERTY keyboard, it can actually produce 256 characters, that is, 184 more than are marked on the keyboard. The following table shows all the characters that can be produced, using the United States code page. (This is the default setting for your keyboard.) For an explanation of code pages and how to use them, see Part 2, Section 4.4.

The table on the following page shows all the characters available on your PC (unless you have switched to a different code page). A number of the characters are directly available by pressing the appropriate key on the keyboard. For those characters that are not on the keyboard you may type them in as follows: hold down the **[Alt]** key and at the same time, using the numeric keypad, type the number of the character that you require. When you release the **[Alt]** key the chosen character should appear. You can work out the number for the character you wish to type by adding together the decimal row and column numbers shown in the following table.

Table of all characters

Character sets

You can use combinations of keys to produce single characters because the comp... differentiates between characters by giving them each a numerical value: each char... has a numerical value to represent it, even though it may have been input/prod... using more than one key.

The value which represents each character is different for each set of character... character set contains 256 characters with values appropriate to that particular...

The internal code is always written either as a Decimal number or as a Hexade... number (numbers to the base 16)

ASCII - American Standard Code for Information Interchange

ASCII is the name for a common character set that has been used for many comp...

The numerical values assigned to the 128 characters in the first half of each code... (see Part 2, Section 4.4) are the same as those in the ASCII character set. The full characters in code page 437 is sometimes referred to as the 8-bit ASCII table.

ASCII Table

DEC		16	32	48	64	80	96	112
	Hex High	0-	1-	2-	3-	4-	5-	6-	7-
0	-0	NUL	DLE		0	@	P	`	p
1	-1	SOH	DC1	!	1	A	Q	a	q
2	-2	STX	DC2	"	2	B	R	b	r
3	-3	ETX	DC3	#	3	C	S	c	s
4	-4	EOT	DC4	$	4	D	T	d	t
5	-5	ENQ	NAK	%	5	E	U	e	u
6	-6	ACK	SYN	&	6	F	V	f	v
7	-7	BEL	ETB	'	7	G	W	g	w
8	-8	BS	CAN	(	8	H	X	h	x
9	-9	HT	EM	)	9	I	Y	i	y
10	-A	LF	SUB	*	:	J	Z	j	z
11	-B	VT	ESC	+	;	K	[	k	{
12	-C	FF	FS	,	<	L	\	l		
13	-D	CR	GS	-	=	M	]	m	}
14	-E	SO	RS	.	>	N	^	n	~
15	-F	SI	US	/	?	O	_	o	⌂

The order of the first 128 characters is, therefore, the same order as character sets used on many other non-PC computers.

When data is read from a disk produced on, say, a CP/M machine, the characters 0..127 appear exactly right and thus allow data to be transferred from one machine to the other.

Note, however, that most computers have a character set consisting of 256 characters and the ASCII character set only sets a standard for the first 128 characters - so it is very unlikely that data from other computers, which contains characters with codes above 128, will make any sense on your PC.

5.3 Adapting the built-in keyboard

Your PC should be supplied to you fitted with the keyboard appropriate to the United Kingdom. However, a number of additional keys have been supplied which you can use to make a keyboard appropriate to the following countries:

USA
Australia
France
Germany
Spain
Italy

If you want to use any of these keyboards, you must first fit the correct keys for country. See the diagrams for the country of your choice, on the following pages.

Two diagrams are given for each country: the first is a diagram of the built-in keyboard after the correct keys have been fitted. The keys which were taken from the set of spare keys are highlighted.

The second diagram is of the set of spare keys. The keys which you should take and put on your built-in keyboard are also highlighted.

Once you have fitted the correct keys, you must install the correct keyboard support software. The keyboard works in conjunction with the operating system to produce the correct character for any of the keys. Use the MS-DOS KEYB command where described in Part Two, Chapter 8, to prepare MS-DOS for use with the keyboard you wish to use.

Removing the keys from the keyboard

Use the tweezers to remove the keys, as illustrated in the diagrams below.
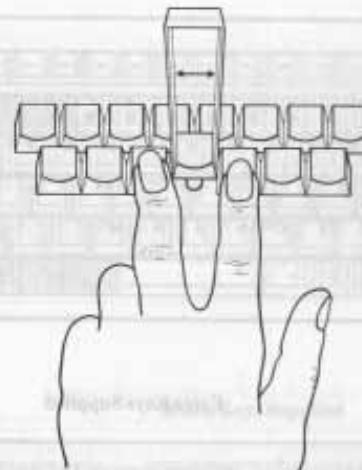
Grip a key with the tweezers and simply pull upwards.
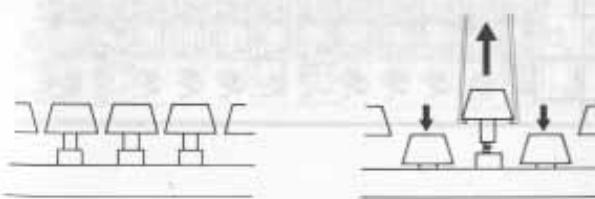
Extra Keys Supplied

Extra Keys Supplied
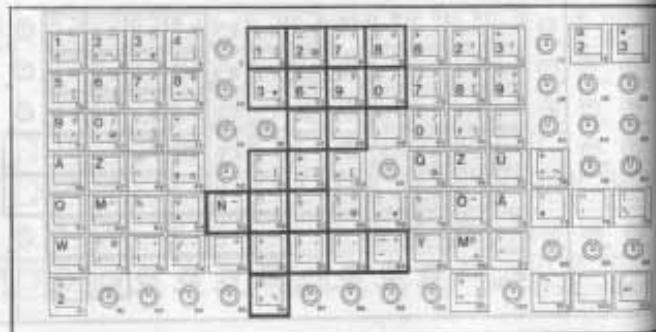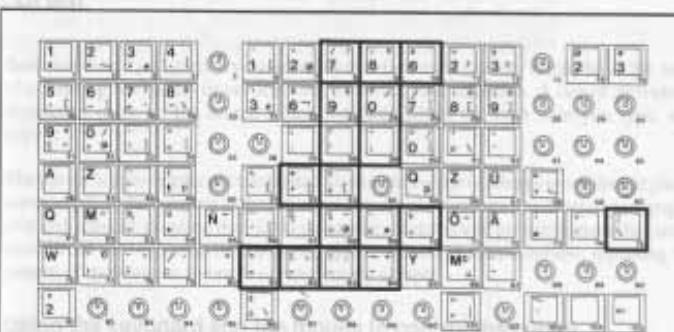
French Keyboard

Extra Keys Supplied

German Keyboard

Extra Keys Supplied

Spanish Keyboard

Extra Keys Supplied

Italian Keyboard

Extra Keys Supplied

6. The Display
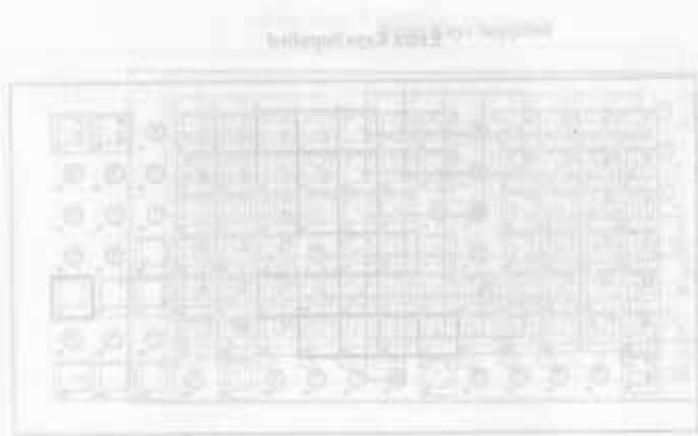
Introduction

A CRT monitor or an LCD screen allows you to see the data you are typing in, the changes you are making to the data, and the end results of the data manipulation.

Software controls the layout of the data on the screen. There are two types of software:

- Software which gives an overall display of text and/or graphics, for example Microsoft Windows

- Software which makes the screen work in electronic analogue mode: text is displayed from left to right and from top to bottom, in the same way that text is produced on an electronic typewriter. For example, MS-DOS allows you to type a command, such as DIR, to list the contents of a directory on the screen. The list is displayed with the first item written across the top line of the screen, from left to right, and the last item at the bottom of the screen.

6.1 The cursor

Both text-based and graphics-based software often use a cursor. It may be in the form of a flashing horizontal or vertical line, to attract your attention. A cursor provides a distinctive mark on the screen which indicates where the next item you type, will appear.

The cursor's movements are controlled so that the cursor is always in a sensible place: for example, if the cursor is at the top of the screen, and there are a number of paragraphs of text displayed, pressing the [↓] key a number of times will probably make the cursor move from the beginning of one paragraph to the end of the paragraph: repeating the pattern of movements for each subsequent paragraph.

Using the keyboard and the mouse to control the cursor

There is usually a mechanism for moving the cursor around the screen: in most applications programs, you can use both the cursor keys [↑] [↓] [←] [→] and a mouse to move the cursor up and down, to the left and to the right, on the screen. Mouse software and a mouse driver relate the movements of the mouse on the table to the movements of the cursor on the screen.

In text-based programs, you will probably find it easier to control the cursor using the cursor keys, whereas in graphics-based programs, a mouse is usually most useful.

Using just a mouse, or the **[Esc]** key, will allow you to do a considerable amount of work; text-based software is often designed so that the **[Esc]** and Return [⏎] keys are very powerful keys. The Return [⏎] key can often take you to a deeper level of the program, while **[Esc]** takes you back to the previous level of the program. Similarly, graphics-based software will often use the left mouse button to take you to a deeper level of the program.

Using the cursor and the pointer in graphics based applications

In graphics based applications, like Digital Research Gem, for example, there is a pointer as well as a cursor. In the same way that the mouse moves the rectangular cursor on a text screen, it moves the pointer on a graphics display. Pressing the mouse button issues instructions to act on the information on that part of the screen. In practice, this function is normally obvious. It is also possible to move the pointer using the cursor keys, though this is much slower than using the mouse.

As well as the mouse, the tab key [→|] can be used to move the cursor from one field to another.

In addition, a graphics program such as Microsoft Windows will allow the tab key and the mouse to move the text cursor while you are typing in text. For example, the Windows program uses "dialog" boxes to display a menu of options, leaving spaces where you are required to type in information, here you can use the mouse to move the pointer to select the option and then the tab key to move the cursor to the field within the box.

6.2 Using a CRT monitor

The LCD screen, built into both ALT286 and ALT386SX, is automatically used to display computer output. It is also possible to use a CRT monitor with the computer, but if you do connect a monitor, you will need to inform the system that a monitor is present, and that output should be redirected, as described below.

Monitor cables and connectors

Make sure that your monitor cable has the correct connector, for your PC, fitted to it. The built-in VGA adaptor has a 15-pin connector for PS/2 type (e.g. Amstrad VGA) analogue monitors and multi-frequency monitors. Always configure your CRT monitor for analogue operation.

You must also take the following precautions:

1. All multi-frequency monitors must be set to analogue operation, if this option is available.

2. The VGA adaptor has the same 15-pin connector as that available from monitor manufacturers to interface with IBM PS/2 monitors. Using an incorrect cable may result in damage to the monitor and/or adaptor. If you have an older multi-frequency monitor with a 9-pin analogue connector, you must use a 9-to-15 pin adaptor.

3. Cables from different monitor suppliers are not interchangeable. Contact your dealer or the monitor manufacturer for specific cable information.

PIN Assignments

A list of the PIN assignments for the 15-pin monitor connector used with your VGA adaptor are given below:

PIN No.	ASSIGNMENT	PIN no.	ASSIGNMENT
1	Red (out)	2	Green (out)
3	Blue (out)	4	Mon ID (2) (in)
5	Ground	6	Red return
7	Green return	8	Blue return
9	(no pin)	10	Sync return
11	Mon ID (0) (in)	12	Mon ID (1) (in)
13	Horizontal Sync (out)	14	Vertical Sync (out)
15	(Reserved)		

Installing the monitor

Before you connect the monitor, make sure that the power to the computer and monitor is switched off.

Connect the monitor's cable to the 15 pin connector, labelled **Monitor**, on the panel of the computer.

Back Panel of Computer

Monitor Connector
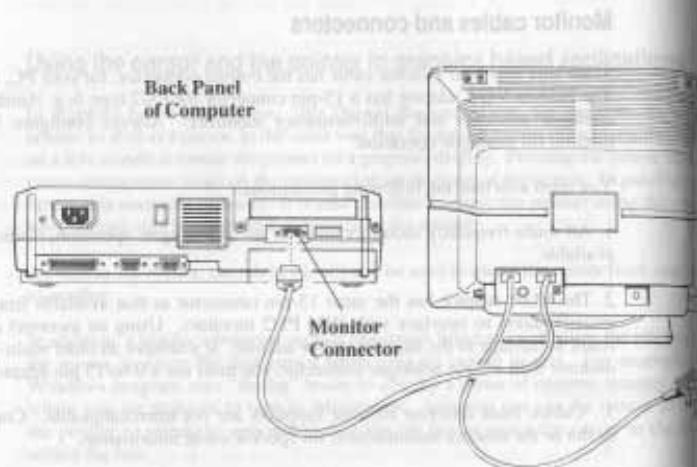
Switch on the computer and the system will display messages on the LCD screen. You will now need to inform the system that a monitor is present by issuing a command to the operating system. At the MS-DOS prompt type:

CRT

then press the Return [↵] key.

To change back to using the LCD screen, type the following command at the MS-DOS prompt:

LCD

then press the Return [↵] key.

6.3 Display power saving facility

When the computer is powered by battery, the back-lighting to the display can be switched off without turning the whole computer off, thus saving energy. Hold down the **[Ctrl]** and **[Alt]** keys and press the **[End]** key to make the back-light go off immediately. The back-light can be resumed by pressing any key. Note that these keystrokes will also make the hard disk stop spinning.

It is also possible to set the computer to switch off either the back-lighting to the display, the hard disk, or both, automatically, whenever the computer is not being used, but is still switched on. You have to specify the period of time that you want to lapse between the last keystroke and the back-light switching off. Use the SETUP program to define this option. The possible time intervals are:

Never, 1, 2, 3, 5, 10, 20 or 30 minutes.

The default setting is 2 minutes.

To restart the display's power, press any key.

Note Although the back-light and hard disk power will normally be restored by pressing a key, this relies on the software you are using reading the keyboard via the operating system. Some software, for example Microsoft Windows, performs its own keyboard scanning and therefore, power cannot be restored from within the program, by simply pressing a key. However, power may also be restored if the software has to access the hard disk, thus, it may be possible to restore the back-lighting by performing an operation in which the hard disk is read.

Full details of the SETUP program are given in Chapter 3.

6.4 The Display Adaptor

Your PC contains a sophisticated multi-mode, 8 bit, graphics display adaptor, called VGA (Video Graphics Array) as a built-in feature. The features of the adaptor are as follows:

* **Support for LCD screen**

  640 x 480 with 16 shades of grey

  Automatic mapping of 16 or 256 colours into 16 or 32 shades of grey, respectively, with no software required

  320 x 200, with 32 shades of grey

  640 x 350, expanded to 640 x 475, with 16 shades of grey

  640 x 200, expanded to 640 x 475, with 16 shades of grey

* **Monitor support**

  The display adaptor supports any VGA analogue monitor, including Amstrad VGA monitors and multi-frequency monitors (15 KHz to 35 KHz). VGA monitors are available with a monochrome or colour display and with a choice of screen sizes and resolution.

* **The graphics modes available on analogue and/or multi-frequency modes**

  The built-in VGA adaptor supports analogue graphics modes, including:

  640 x 480 high-resolution graphics

  360 x 480 or 320 x 200 resolution, with 256 colours from a palette of 262,144 (256...

  800 x 600 high-resolution graphics, with 16 colours, with multi-frequency colour monitor

  720 x 540 high-resolution graphics using either an Amstrad VGA monitor or multi-frequency colour monitor

  640 x 350, 16 colour graphics

  640 x 200 16 colour graphics

  320 x 200 16 colour graphics

* **Advanced text features**

  High resolution fonts on LCD screens, using an 8 x 19 character cell. Supported by MS-DOS for international character sets

  132 columns by 30, 50 or 60 lines (requires a multi-frequency monitor)

  100 columns by 75, 60, 50 or 30 lines (100 x 75 requires a multi-frequency monitor; all others work with either a PS/2 (or Amstrad VGA) 31.5 KHz monitor or a multi-frequency monitor)

  80 columns x 60 lines on LCD screens

* **A hardware graphics cursor**

  This feature increases performance

* **CMOS VLSI chips**

  These chips provide increased speed, reliability and compatibility

* **256Kb of on-board video memory**

Enabling and disabling the built-in graphics adaptor

The graphics adaptor in your PC can be enabled or disabled using DIP switch number 1, in the set of switches labelled **DIP Switch B** on the back panel of the computer. When Switch 1 is in the ON position, that is, switched down, the built-in VGA adaptor is enabled. When the switch is in the OFF position, the built-in VGA adaptor is disabled.

Co-resident video adaptors

An additional display adaptor can be fitted in the expansion slot, however, the built-in VGA adaptor always operates as the primary video adaptor, and any co-resident adaptor is always the secondary. It is not possible to change the primary video adaptor.

The basic rules for co-residency are:

* Your PC does not allow two video adaptors of the same type to operate at the same time.

* The built-in VGA CANNOT emulate a Monochrome Display Adaptor (MDA or HGC) if another MDA or HGC board is co-resident in the system.

* The built-in VGA CANNOT emulate a Color Graphics Adaptor (CGA) if another CGA board is co-resident in the system.

* The built-in VGA CANNOT co-reside with an EGA board.

* The built-in VGA CANNOT co-reside with a second VGA board.

Note With a co-resident CGA card, the built-in VGA's CRTC registers are addressed at I/O address 3Bx. The CGA's 6845 CRT controller is addressed at I/O address 3Dx. The only defined modes of operation at 3Bx are 7, 7+, F* and HGC. With a CGA card installed, HGC programs can only use the first memory page. The VGA BIOS only allows modes 7, 7+ and F* to be entered when a CGA card is co-resident. Hercules programs do not test for co-residency and cause failure if they use the second memory page.

Recommendations

If you fit an additional adaptor, and at some later time switch back to using the built-in VGA adaptor, we recommend that you remove the expansion card so as not to constrain the video modes available from the VGA. For example, a co-resident CGA card will restrict the VGA to using only monochrome modes 7, 7+ or F*. Also note that some application programs may have problems running in the presence of co-resident cards.

The adaptors that can co-reside with the built-in adaptor are CGA, MDA or Hercules adaptors, restriction details are as follows:

Type of Co-Resident Card	VGA Subsystem configured as:			
	CGA	MGA	EGA	VGA
None	OK	OK	OK	OK
CGA	OK (Notes 1,4)	OK	OK (Note 3)	OK (Note 1)
HGC	OK	OK (Note 2)	OK	OK
EGA	OK (Note 5)	OK (Note 5)	OK (Note 5)	OK (Note 5)
VGA	OK (Note 6)	OK (Note 6)	OK (Note 6)	OK (Note 6)

Notes to the above table

1. A system cannot have two cards with a 3Dx address (colour video configuration). The VGA board will run in mode 7+, as if the attached monitor were an IBM 8503-compatible monochrome monitor.

2. A system cannot have two cards with a 3Bx address (monochrome video configuration). The VGA board will change to the VGA-locked state, and run as if the attached monitor were an 8512/8513-compatible colour monitor, even if it really is an IBM 8503-compatible.

3. The VGA subsystem will change to VGA-locked state and then come up in mode 7.

4. The VGA subsystem will change to VGA-locked state.

5. The VGA subsystem is automatically disabled when a co-resident EGA card is installed in the system, and is automatically reactivated when the EGA card is removed.

6. Two VGA cards cannot operate simultaneously. When a second VGA card is installed in the system, one can be active while the other is inactive. The SWITCHER utility, described later in this chapter, can be used to switch between cards.

Display adaptor and software compatibility

Use of colour or monochrome software with VGA

The design of the VGA adaptor, allows software that was written for a monochrome monitor to be used with a colour monitor, and software that was written for a colour monitor to be used with a monochrome monitor. When using an LCD panel, the VGA display adaptor will show both colour and monochrome software in up to 32 shades of grey.

Earlier PCs also had a choice of monochrome or colour monitor, but software usually had to be chosen according to the type of monitor used: software written for a colour monitor could not be used with a monochrome monitor and software written in monochrome would not work with colour. If the wrong version of software were used, nothing would appear on the screen.

The differences in the design of the software were not significant to text based programs but did affect graphics software.
However, a VGA adaptor will work with all software, regardless of whether it was written for a colour or a monochrome display. Colour software will appear as shades of grey on a monochrome display or LCD panel, and monochrome software will produce a black and white picture on a colour display.

Two problems which might occur are:

• if you have a colour monitor and attempt to run monochrome software which has been designed for use with a VGA adapter, you may find it necessary to issue the command MODE MONO.

• if you have a mono monitor or LCD panel and attempt to run colour software which has not been designed for use with a VGA adapter, you may find it necessary to issue the command MODE CO80.

See the MODE command listed in Part 2, Chapter 8, for more information.

Use of CGA, EGA, MDA or Hercules software with VGA

The PC will also be able to run software written for the older EGA, CGA, MDA or Hercules graphics adaptors, irrespective of whether the output is sent to an LCD panel, monochrome monitor or a VGA colour monitor. This is because the display adaptor has the ability to adapt to the mode of the software being used.

You will need to know what graphics adaptors your software can work with and then how to get your PC to work in that mode. Use the DISPLAY utility, described in the following section.

Note   Whilst installing some software, you will be asked to specify the type of adaptor you have. There will be a number of options to choose from. If VGA is one of the options, select it, but if not, select EGA. If there is no EGA option, select Hercules. If there is no Hercules option, select CGA.

Available display modes

The following tables show the available BIOS modes when the video adaptor is used with the various different output devices that it supports, that is, LCD panel, VGA monitors, multi-synch monitors.

Output to VGA monitor or LCD Panel

Mode No.	No. of Colors	Char. x Row	Char. Cell	Video Mode	Display Mode	Screen Format	Buffer Start	CRT H/V Sync.	Dot Clock
0	4/256K	40x25	8x8	CGA	Text	320x200	B8000	31.5KHz/70Hz	25.172M
0*	16/256K	40x25	8x14	EGA	Text	320x350	B8000	31.5KHz/70Hz	25.172M
0/1+	16/256K	40x25	9x16	VGA	Text	360x400	B8000	31.5KHz/70Hz	28.332M
1	4/256K	40x25	8x8	CGA	Text	320x200	B8000	31.5KHz/70Hz	25.172M
1*	16/256K	40x25	8x14	EGA	Text	320x350	B8000	31.5KHz/70Hz	25.172M
2	4/256K	80x25	8x8	CGA	Text	640x200	B8000	31.5KHz/70Hz	25.172M
2*	16/256K	80x25	8x14	EGA	Text	640x350	B8000	31.5KHz/70Hz	25.172M
2/3+	16/256K	80x25	9x16	VGA	Text	720x400	B8000	31.5KHz/70Hz	28.332M
3	4/256K	80x25	8x8	CGA	Text	640x200	B8000	31.5KHz/70Hz	25.172M
3*	16/256K	80x25	8x14	EGA	Text	640x350	B8000	31.5KHz/70Hz	25.172M
4	4/256K			CGA	Graphics	320x200	B8000	31.5KHz/70Hz	12.586M
5	4/256K			CGA	Graphics	320x244	B5000	31.5KHz/70Hz	12.586M
6	2/256K			CGA	Graphics	640x200	B8000	31.5KHz/70Hz	25.172M
7	4	80x25	9x14	HGC/MDA	Text	720x350	B0000	31.5KHz/70Hz	28.332M
7+	4	80x25	9x16	VGA	Text	720x400	B0000	31.5KHz/70Hz	28.332M
HGC	2			HGC	Graphics	720x348	A0000	31.5KHz/70Hz	28.332M
D	16/256K			EGA	Graphics	320x200	A0000	31.5KHz/70Hz	12.586M
E	16/256K			EGA	Graphics	640x200	A0000	31.5KHz/70Hz	25.172M
F*	4			EGA	Graphics	640x350	A0000	31.5KHz/70Hz	25.172M
10*	16/256K			EGA	Graphics	640x350	A0000	31.5KHz/70Hz	25.172M
11	2/256K			VGA	Graphics	640x480	A0000	31.5KHz/60Hz	25.172M
12	16/256K			VGA	Graphics	640x480	A0000	31.5KHz/60Hz	25.172M
13	256/256K			VGA	Graphics	324x200	A0000	31.5KHz/70Hz	25.172M
40	16/256K	100x30	8x13	Extended	Text	800x390	B8000	31.5KHz/70Hz	32.514M
41	16/256K	100x50	8x8	Extended	Text	800x440	B8000	31.5KHz/70Hz	32.514M
42	16/256K	100x60	8x8	Extended	Text	800x536	B8000	31.5KHz/56.2Hz	32.514M
53	16/256K	80x60	8x8	Extended	Text	640x480	B8000	31.5KHz/70Hz	32.514M
63	16/256K			Extended	Graphics	720x540	A0000	31.5KHz/56.5Hz	32.514M
70	256/256K			VGA	Graphics	360x480	A0000	31.5KHz/70Hz	28.332M

All the above modes are supported on the LCD panel. In addition to these the following modes are also supported:

61	16/256K	80x25	8x16	Extended	Graphics	640x400
62	16/256K	80x28	8x16	Extended	Graphics	640x450
74	256/256K	40x30	8x8	Extended	Graphics	320x240

Note: Modes 40-52 and 63-64 require at least a 32.514MHz dot clock and 100nS DRAM or faster. In monochrome modes, 4 colors is defined as Black, White, "Blinking" White, and "Intensified" White.

Output to Enhanced Color (ECD) Monitor

Mode No.	No. of Colors	Char. x Row	Char. Cell	Video Mode	Display Mode	Screen Format	Buffer Start	CRT H/V Sync.	Dot Clock
0	4	40x25	8x8	CGA	Text	320x200	B8000	15.75KHz/60Hz	14.318MHz
0*	16/64	40x25	8x14	EGA	Text	320x200	B8000	21.85KHz/60Hz	16.257MHz
1	4	40x25	8x8	CGA	Text	320x350	B8000	15.75KHz/60Hz	14.318MHz
1*	16/64	40x25	8x14	EGA	Text	320x200	B8000	21.85KHz/60Hz	16.257MHz
2	4	80x25	8x8	CGA	Text	320x350	B8000	15.75KHz/60Hz	14.318MHz
2*	16/64	80x25	8x14	EGA	Text	640x200	B8000	21.85KHz/60Hz	16.257MHz
3	4	80x25	8x8	CGA	Text	640x350	B8000	15.75KHz/60Hz	14.318MHz
3*	16/64	80x25	8x14	EGA	Text	640x200	B8000	21.85KHz/60Hz	16.257MHz
4	4			CGA	Graphics	320x200	B8000	15.75KHz/60Hz	14.318MHz
5	4			CGA	Graphics	320x200	B8000	15.75KHz/60Hz	14.318MHz
6	2			CGA	Graphics	640x200	B8000	15.75KHz/60Hz	14.318MHz
10*	16/64			EGA	Graphics	640x350	A0000	21.85KHz/60Hz	16.257MHz
D	16/64			EGA	Graphics	320x200	A0000	21.85KHz/60Hz	16.257MHz
E	16/64			EGA	Graphics	640x200	A0000	21.85KHz/60Hz	16.257MHz
F*	4			EGA	Graphics	640x350	A0000	21.85KHz/60Hz	16.257MHz

Output to Color (CD) Monitor

Mode No.	No. of Colors	Char. x Row	Char. Cell	Video Mode	Display Mode	Screen Format	Buffer Start	CRT H/V Sync.	Dot Clock
0	4	40x25	8x8	CGA	Text	320x200	B8000	15.75KHz/50Hz	14.318MHz
1	4	40x25	8x8	CGA	Text	320x200	B8000	15.75KHz/60Hz	14.318MHz
2	4	80x25	8x8	CGA	Text	640x200	B8000	15.75KHz/60Hz	14.318MHz
3	4	80x25	8x8	CGA	Text	640x200	B8000	15.75KHz/60Hz	14.318MHz
4	4			CGA	Graphics	320x200	B8000	15.75KHz/60Hz	14.318MHz
5	4			CGA	Graphics	320x200	B8000	15.75KHz/60Hz	14.318MHz
6	2			CGA	Graphics	640x200	B8000	15.75KHz/60Hz	14.318MHz
D	16/64			EGA	Graphics	320x200	A0000	15.75KHz/60Hz	14.318MHz
E	16/64			EGA	Graphics	640x200	A0000	15.75KHz/60Hz	14.318MHz

Note: In monochrome modes, 4 colors is defined as Black, White, "Blinking" White, and "Intensified" White.

Output to Monochrome (MD) Monitor

Mode No.	No. of Colors	Char. x Row	Char. Cell	Video Mode	Display Mode	Screen Format	Buffer Start	CRT H/V Sync.	Dot Clock
7	4	80x25	9x14	HGC/MDA	Text	720x350	B0000	18.4KHz/50Hz	16.257MHz
F*	4			EGA	Graphics	640x350	A0000	18.4KHz/50Hz	16.257MHz
HGC	2			HGC	Graphics	720x348	B0000	18.4KHz/50Hz	16.257MHz

Note: In monochrome modes, 4 colors means Black, White, "Blinking" White, and "Intensified" White.

Output to Multi-Frequency Monitor

Mode No.	No. of Colors	Char. a Row	Char. Cell	Video Mode	Display Mode	Screen Format	Buffer Start
0	4/256K	40x25	8x8	CGA	Text	320x200	B8000
0*	16/256K	40x25	8x14	EGA	Text	320x350	B8000
0*1+	16/256K	40x25	9x16	VGA	Text	360x400	B8000
1	4/256K	40x25	8x8	CGA	Text	320x200	B8000
1*	16/256K	40x25	8x14	EGA	Text	320x350	B8000
2	4/256K	80x25	8x8	CGA	Text	640x200	B8000
2*	16/256K	80x25	8x14	EGA	Text	640x350	B8000
2*3+	16/256K	80x25	9x16	VGA	Text	720x400	B8000
3	4/256K	80x25	8x8	CGA	Text	640x200	B8000
3*	16/256K	80x25	8x14	EGA	Text	640x350	B8000
4	4/256K			CGA	Graphics	320x200	B8000
5	4/256K			CGA	Graphics	320x200	B8000
6	2/256K			CGA	Graphics	640x200	B8000
7	4	80x25	9x14	HGC/MDA	Text	720x350	B0000
7+	4	80x25	9x16	VGA	Text	720x400	B0000
HGC	2			HGC	Graphics	720x348	A0000
D	16/256K			EGA	Graphics	320x200	A0000
E	16/256K			EGA	Graphics	640x200	A0000
F*	4			EGA	Graphics	540x350	A0000
10*	16/256K			EGA	Graphics	640x350	A0000
11	2/256K			VGA	Graphics	640x480	A0000
12	16/256K			VGA	Graphics	640x480	A0000
13	256/256K			VGA	Graphics	320x200	A0000
40	16/256K	100x30	9x13	Extended	Text	900x390	B8000
41	16/256K	100x50	8x8	Extended	Text	800x400	B8000
42	16/256K	100x60	8x8	Extended	Text	800x480	B8000
43	16/256K	10x75	8x8	Extended	Text	800x600	B8000
50	16/256K	132x30	8x13	Extended	Text	1056x390	B8000
51	16/256K	132x50	8x8	Extended	Text	1056x400	B8000
52	16/256K	132x60	8x8	Extended	Text	1056x480	B8000
53	16/256K	80x60	8x8	Extended	Text	640x480	B8000
63	16/256K			Extended	Graphics	720x540	A0000
64	16/256K			Extended	Graphics	800x600	A0000
70	256/256K			VGA	Graphics	360x480	A0000

Note: Modes 40-52 and 63-64 require at least a 32.514MHz dot clock and 100nS DRAM or faster. In monochrome modes, 4 colors is defined as Black, White, "Blinking" White, and "Intensified" White.

Compression/Expansion used to fit display onto full-size LCD panel

Mode	CRT Color		Type	Color Emulation	Video Clock	Compatible Mode		Expansion/Compression Mode	
						Display Area	Cell Size	Display Area	Cell Size
0,1	16/256K	40x25	CGA text	Color Attr. emul	14.17	640x400	16x16	640x475	16x19
2,3	16/256K	80x25	CGA text	Color Attr. emul	28.33	640x400	8x16	640x475	8x19
0*,1*	16/256K	40x25	EGA text	Color Attr. emul	14.17	640x350	16x14	640x475	16x19
2*,3*	16/256K	80x25	EGA text	Color Attr. emul	28.33	640x350	8x14	640x475	8x19
0+,1+	16/256K	40x25	VGA text	Color Attr. emul	14.17	640x400	16x16	640x475	16x19
2+,3+	16/256K	80x25	VGA text	Color Attr. emul	28.33	640x400	8x16	640x475	8x19
4,5	4/256K	320x200	CGA gr	4 Gray Scl-ACB	14.17	640x400	2x2	640x475	2x2
6	2/256K	640x200	CGA gr	2 Gray Scl-ACB	28.33	640x400	1x2	640x475	1x2
7	Mono	80x25	MGA text	Mono Attr. emul	28.33	640x350	8x14	640x475	8x19
7+	Mono	80x25	VGA text	Mono Attr. emul	28.33	640x400	8x16	640x475	8x19
D	16/256K	320x200	EGA gr	16 Gray Scales	14.17	640x400	2x2	640x475	2x2
E	16/256K	640x200	EGA gr	16 Gray Scales	28.33	640x400	1x2	640x475	1x2
F*	Mono	640x350	EGA gr	On,Off & Halftn	28.33	640x350	1x1	640x475	1x1
10*	16/256K	640x350	EGA gr	16 Gray Scales	28.33	640x350	1x1	640x475	1x1
11	2/256K	640x480	VGA gr	2 Gray Scl-ACB	28.33	640x480	1x1	640x480	1x1
12	16/256K	640x480	VGA gr	16 Gray Scales	28.33	640x480	1x1	640x480	1x1
13	256/256K	320x200	VGA gr	32 Gray Scales	14.17	640x400	2x2	640x475	2x2
Mono	720x348		HGC gr	Image comp/pan	28.33	640x350	1x1	640x475	1x1

Note1: ACB - Automatic Contrast Balancing

Note2: Color Attribute Emulation: - when foreground and background colors are different, they are mapped to high contrast gray scales.

- when foreground and background colors are the same, then different gray scales are selected to enhance contrast.

Mono Attribute Emulation: - straightforward mapping of monochrome attributes to gray scales similar to CRT case.

Software to control the VGA adaptor

There are four utilities supplied on your System disk, which allow you to control the built-in video adaptor and specify various screen display features.

These utilities are:

DISPLAY   allows you to change the graphics configuration options using menus and keyboard commands

SWITCHER   allows you to change the graphics configuration quickly using 3-key keystrokes

RAMBIOS   allows you to execute the VGA BIOS out of 16-bit or 32-bit system memory

PANEL.CPI   provides enhanced support for the Code Page facility provided by MS-DOS

Full details of these utilities are given in the following pages.

The DISPLAY Utility - using menu options

The DISPLAY utility options can be selected from its menu or by the use of commands at the MS-DOS command line. The DOS commands are listed in the next section. To select any of the DISPLAY options using the menu, first be sure that MS-DOS can access the DISPLAY.COM file from the directory you are about to use. If you have been through the installation procedure in Chapter 3, the utility will be accessible from any directory. Then type:

DISPLAY

and press the Return [↵] key. The following output will be displayed on your screen

```
DISPLAY, VGA Controller Utility Version 4.00 F7.  VGA Video BIOS Version 2.21.
     Copyright (C) Cirrus Logic Inc., 1987-1989.  All Rights Reserved.

          Current Selections    Alternate Selections
          VGA Locked            Select CGA State
                                Select MGA State
                                Select EGA State
          Color                 Select MONO mode
          Normal                Enable FAST mode
          Panel                 Switch the display to the CRT
          Expanded              Disable EXPAND mode
          Reversed              Disable REVERSE VIDEO
          Bold                  Disable BOLD mode
          Attribute Emulation   Enable AUTOMAP
          Centered              Display unexpanded modes from TOP
                                Display unexpanded modes from BOTTOM
          Left                  Skip every 9th pixel
                                Display MGA modes from RIGHT
                                Or 8th and 9th pixel
          Allow16               Force 8 bit operation
                                Exit to DOS
```

To select an option, move the cursor using the cursor arrow keys [←] [→], then make your selection using the return [↵] key.

The main options are as follows:

Graphics state option | **VGA locked** - is the default setting for your PC. If you want to select CGA, MGA, or EGA states, use the up and down cursor keys [↑] [↓] to display and set the required state.

Color or monochrome mode option | **Color** is the default setting, but you can change this to Mono.
Note that when the LCD screen is in use, the Color selection will display output in shades of grey and the Mono setting will display output in black and white. Screen displays can only be seen in colour on an analogue or a multi-frequency monitor.

Bandwidth Ratio option | **Normal** provides standard VGA access to CPU memory. This can be changed to **Fast** which provides improved video faccess to CPU memory.

Flat Panel (LCD) or CRT display-mode option | This option allows you to use the LCD screen with the built-in VGA adaptor. It can be changed to CRT to use an analogue monitor. Note that this option has the same effect as the LCD and CRT utilities.

Expanded or normal display option | The built-in LCD screen comprises 640 x 480 pixels. When displaying modes with 480 scan lines, they will always fill the entire panel area. However, when modes with fewer scan lines are used, for example 640 x 400, you have the option of either displaying this in **Normal** mode, so that the 400 line display only uses 400 of the available 480 lines, or, if the Expanded option is chosen, the 400-line display has extra lines painted in, so that the full 480 -line area of the LCD panel is used.

Normal or reversed video option | **Reverse Video** - This option applies only to the LCD screen. It displays screen output in black characters on a white background. When **Reverse Video** is disabled (Normal video enabled), screen output is displayed as white characters on a black background. Note that "black" and "white" refer to the type of display, while, in fact, the screen is actually blue.

Selecting Bold or Normal | **Bold** - This option applies to the LCD screen only (flat panel mode). This feature can be used to thicken the width of characters when using a program that would highlight characters on a CRT monitor. When text is set to **Bold**, characters will appear thicker. When **Bold** is disabled, characters selected to be made bold show no change.

Attribute emulation or Automap modes option | **Attribute Emulation** - Used in text mode only. All attributes are mapped into black or white, for maximum contrast and readability. The **Automap** option allows colours to be automatically mapped to corresponding shades of grey. Thus, 16 colours are mapped to 16 shades of grey. Also, a larger range of colours, 256, maps to 16 or 32 shades of grey. The Automap option is always used in graphics modes.

Display-centering mode | The **Top** option aligns the top of unexpanded modes with the top edge of the panel.
Centered is the default setting. It centres unexpanded modes between the top and the bottom of the panel.
Bottom aligns the bottom of unexpanded modes with the bottom edge of the panel.

Flat panel width-compression mode | When it is necessary to drive an LCD flat panel (640 pixels wide) with either a CRT display that is 720 pixels wide, (i.e. HGC graphics mode), or a CRT output in that is 360 pixels wide and in double-display mode (VGA graphics mode 70 with a resolutionn of 360 x 480 and 256 colours), then some form of width compression or compensation is necessary in order to accomodate the wider display to the narrower panel. The DISPLAY utility menu provides four options for doing this. They are as follows:

Left - This is the default setting. The leftmost 640 pixels are displayed on the panel. The rightmost 80 pixels are not displayed.

Right - The rightmost 640 pixels are displayed on the panel. The leftmost 80 pixels are not displayed.

Skip9 – In this mode, every ninth pixel is skipped, reducing the 720-pixel horizontal display by one-ni[nth] and producing a resultant 640 pixel horizontal displa[y].

OR8and9 – In this mode, the eighth and ninth pixe[ls] the display are compressed into a single pixel. Again,[it] has the effect of reducing the width of the horizo[ntal] display by a ninth, that is, from 720 pixels to 640 p[ixels].

Cold Boot State

When the computer is switched on, all of the above default settings will be sele[cted] automatically. Any alternative settings, that were selected during previous comp[uter] sessions, will have been abandoned when the computer was switched off.

Warm Boot State

The term "Warm Boot" means restart the system without switching the PC off and [on] again, that is, by holding the [Ctrl] [Alt] keys and pressing the [Delete] key. Du[ring] this type of system restart, any selected settings, of the options listed above, will rem[ain]

If you want to see what the current configuration is for the built-in VGA adaptor, use the DOS command line, **DISPLAY-S**, rather than just **DISPLAY**, which will show the menu.

The DISPLAY command options are as follows. Type **DISPLAY** followed by the option you require:

Options to select	Type DISPLAY [Space] followed by:
Help screen	-? OR -H
System ROM BIOS Date	-D
Graphics status information	-S
Extended status information	-V
Dot clock information	-C
CGA-Locked state (CGA)	CGA
MGA-Locked state (MGA)	MGA
EGA-Locked state (EGA)	EGA
VGA-Locked state (VGA)	VGA
Improved video access to CPU memory	FAST
Standard video access to CPU memory	STANDARD
Color video modes	COLOR
Monochrome video modes	MONO
Flat-panel (LCD) display	PANEL
CRT display	CRT

Display utility - using command line options

Options to select	Type DISPLAY [Space] followed by:
Enable expanded modes	**EXPAND**
Enable reverse video	**REVERSE**
Disable reverse video	**NOREVERSE**
Enable bold mode	**BOLD**
Disable bold mode	**NOBOLD**
Enable attribute emulation	**ATTREMUL**
Disable attribute emulation/enable automapping	**NOATTREMUL**
Center unexpanded modes	**CENTER**
Display unexpandedmodes from top	**TOP**
Display unexpanded modes from bottom	**BOTTOM**
Width compression: skip every 9th pixel	**SKIP9**
Width compression: OR 8th and 9th pixel	**OR8AND9**
Width compression: show left 640 pixels	**LEFT**
Width compression: show right 640 pixels	**RIGHT**

If you want the system to start up using a CRT display rather than the LCD screen, add the following two lines to your MS-DOS AUTOEXEC.BAT file:

DISPLAY CRT
IF ERRORLEVEL 2 DISPLAY PANEL

The second line ensures that if there is no CRT monitor connected, the system will automatically start up on the LCD screen.

The SWITCHER Utility

The SWITCHER utility is used to reconfigure the built-in VGA adaptor, quickly. It is a "terminate and stay resident" program, which means that once it is loaded, it remains in RAM and can be called whenever the correct commands are given.

To start SWITCHER, type

SWITCHER

and press the [↵] key.

Once this command is issued, you can use any of the following commands to achieve more specific effects. Each of the commands below is used to toggle between two options:

Function	SWITCHER keystrokes
Toggle Automap ON/OFF	[Ctrl] [↑] [A]
Toggle Bold ON/OFF	[Ctrl] [↑] [A]
Toggle between top/centred/bottom centring choices	[Ctrl] [↑] [C]
Toggle between CRT and LCD panel	[Ctrl] [↑] [D]
Toggle between expanded and normal LCD panel	[Ctrl] [↑] [E]
Toggle between colour and monochrome	[Ctrl] [↑] [F]
Toggle between reverse and normal video	[Ctrl] [↑] [R]

Toggle between screen
power ON and screen
power OFF   [Ctrl] [⇧] [S]

Toggle between the four   [Ctrl] [⇧] [W]
flat-panel width
compression options

Toggle between the   [Ctrl] [⇧] [V]
built-in VGA adaptor and a
Each time the [Ctrl] [shift]
[V] command is issued,
the video adaptor
currently in use will be put
into a dormant state until
this command is issued
again.

Notes When running an extended-mode driver, you must exit the application before use
SWITCHER to toggle between CRT and LCD panel display.

Before toggling between a CRT and LCD panel display, make sure that your selec
video mode is actually compatible with both displays.

RAMBIOS Utility

The RAMBIOS utility allows you to execute the VGA BIOS out of 16 bit or 32 bit
system memory, instead of out of ROM using the 8 bit video bus. This allows most
operations, that use the VGA or EGA BIOS, to run much faster.

An improved performance will be most noticeable when text scrolling is used.

The RAMBIOS utility will make this VGA run as fast or faster than other VGAs,
regardless of whether that VGA has an 8 or 16 bit interface, or uses DRAM or expensive
video RAM. It is important to note, however, that most applications do not use the
BIOS frequently, so actual performance increases may vary between applications and,
in some cases, may not be significant.

The RAMBIOS utility is called "RAMBIOS.SYS" and should be installed in the
CONFIG.SYS file, for example:

DEVICE=RAMBIOS.SYS

This will automatically install itself in system memory at the correct address, shortly
after power-on or warm boot.

Note Make sure that the RAMBIOS.SYS file is copied into:

- the root directory

or

- a subdirectory .

If RAMBIOS.SYS is put into a subdirectory, you will need to include the path details,
which define the route to this subdirectory, in the **DEVICE=** command line in your
CONFIG.SYS file, for example:

DEVICE=[D:][\PATH\]RAMBIOS.SYS

where:

  D: is the drive letter

  \PATH is the directory path

The RAMBIOS will only work with MS-DOS or PC DOS and will not work with OS/2,
Unix, or Xenix.

PANEL.CPI

PANEL.CPI is the code page file which provides enhanced support for the code page facility, provided with MS-DOS.

PANEL.CPI is a direct replacement for the DOS EGA.CPI code page file that provided with MS-DOS 3.30 or higher. PANEL.CPI includes all of the features of the DOS EGA.CPI file, as well as all of the LCD panel enhancements included in the built-in VGA adaptor. For detailed information about code pages, see Part two of this manual.

Note Code page fonts do not function when in extended modes, nor when bold is enabled.

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7. Processors

Introduction

The processor is central to the PC: it is a sophisticated calculating device. It is set apart from a simple calculator by its ability to conditionally process a sequence of instructions. That is, to only perform certain functions on the successful completion of another calculation.

The processor is fundamental to the computer: the design of any Personal Computer is based on the type of processor used. There are several families of processor: ALT286 uses an 80286 processor and ALT386SX uses 80386SX processor.

7.1 Processor speed

The 80286 processor is a 16 bit processor and the 80386SX is a 32 bit processor. Both processors can operate at speeds of 8 or 16 megahertz.

The processor's speed gives an indication of its computing power but the speed of the computer's clock sets the rate at which the processor operates. For example, a processor which operates at a speed of 16 megahertz will execute approximately 4 million instructions per second; it is receiving 16 million ticks of the clock per second and it takes an average of 4 ticks to complete an instruction.

Changing the processor speed

The default speed of the processor is 16MHz, that is, with DIP switch number 6 set to OFF. While the switch is in this position, the speed can be changed using three keystrokes within an application program, as defined in the first method described below, or by using the SETUP program (see Chapter 3). While switch 6 is set to 8MHz, (DIP Switch 6 set to ON) the speed cannot be changed. The three ways of changing the processor speed are:

1. Whilst using an application program, you can change the processor speed by holding down the **[Ctrl]** and **[Alt]** keys and pressing either the cursor-up key [↑] , to increase the processor speed to 16MHz, or by pressing the cursor-down key [↓] to reduce the speed to 8MHz. This method of setting the speed is the least permanent, since the setting will revert to the default, 16MHz, once you re-boot the system.

2. If you know that you are going to require a certain speed, whilst using a number of application programs, you can change the processor speed with the SETUP program which instructs the hardware and BIOS directly. Hold down the **[Ctrl]** and **[Alt]** keys and press the **[S]** key to initiate the SETUP program. Use the cursor keys to reach the required field, CPU Speed, select the speed you require and reboot the system for the changed configuration to take effect. Full details of SETUP are given in Chapter 5.

3. Before starting the system, you can set the speed by turning DIP switch 6 on or off. Turn the switch to the ON position by pushing it down and OFF by pushing the switch up. The default settings are the OFF position for both models of computer. The default speed setting is therefore 16 megahertz. Details of the DIP switches are given in Chapter 11.

7.2 Maths Co-Processors

The effective speed of the 80286 can be increased by adding an 80287 mathematics co-processor to the PC. The 80386SX processor would likewise benefit from the addition of an 80387SX co-processor. Maths co-processors are sometimes referred to as NDP chips (Numeric Data Processor).

Fitting a maths co-processor

Your PC is not supplied with a maths co-processor chip. However, there is an empty socket on the circuit board where one can be fitted. You can reach the socket as follows:

Firstly, turn the unit upside down.

Undo the screws on the small detachable panel on the underside of the unit.

Remove the small, detachable panel.

Underneath this cover, and on the lefthand side of the revealed circuit board, you will see a socket:

Underside of System Unit

Front of Unit

Detachable Panel and Screws

Maths Co-processor

Maths Co-processor

Maths Co-processor Socket

Maths Co-processor Socket

ALT-286 Motherboard

ALT-386SX Motherboard
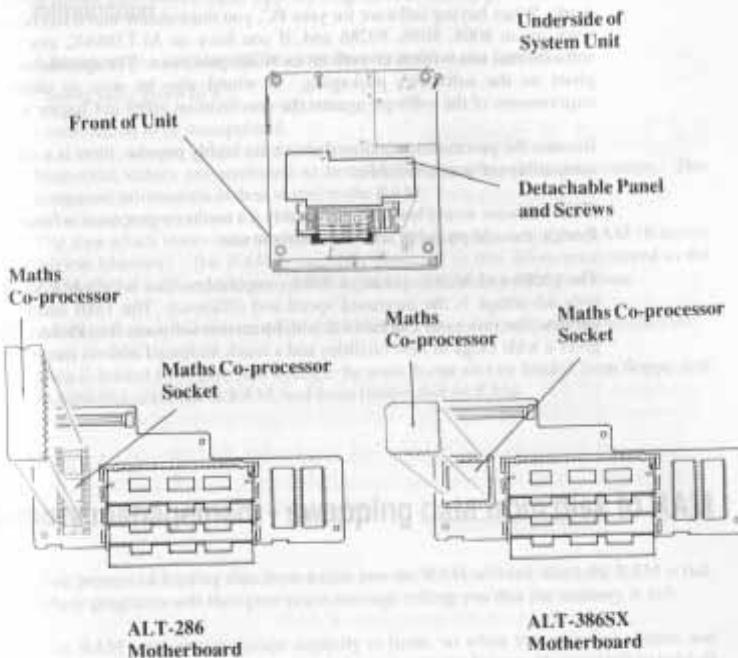
If you have difficulty fitting a co-processor, ask your dealer to fit one for you.

The co-processor is effectively a second processor that will take some of the existing processor's workload. It is designed to perform certain mathematical functions far quicker than the processor alone could achieve.

Not all software can make use of a co-processor; but if software which performs a lot of arithmetic (for example spreadsheets, CAD/3D programs, etc) has been designed to make use of it, the program will run faster.

7.3 Processor and software compatibility

Software is specified according to the type of processor with which it is designed to work. When buying software for your PC, you must ensure that it has been written to work on an 8088, 8086, 80286 and, if you have an ALT386SX, you can also use software that was written to work on an 80386 processor. The specification should be given on the software's packaging. It would also be wise to check the other requirements of the software against the specification given in Chapter 1.

Because the processors mentioned above are highly popular, there is a vast amount of compatible software available.

Some software would benefit considerably if a maths co-processor is fitted for it to use, though it would probably still work without one.

The 80286 and 80386 operate as 8086 compatibles. This is called "Real Mode". The only advantage is the increased speed and efficiency. The 1MB address limit still applies. The processor can be switched, by certain software, into Protect Mode which gives a wide range of new facilities and a much increased address range.

8. RAM

Introduction

A computer is a calculating device: within its ambit it can handle

- instructions given to it

- information to be manipulated

Numerical values are attributed to both of the above types of information. This numerical information is then stored in the RAM.

The area which stores information, while it is being processed, is the RAM (Random Access Memory). The RAM is specially designed so that information stored in the RAM can be accessed and manipulated quickly and easily by the processor.

All the information contained in the RAM is lost once the computer is switched off.

Data is loaded from disk into RAM to be used. It can also be loaded from floppy disk to hard disk and then to RAM, and from floppy disk to RAM.

8.1 Memory management - swapping data from disk to RAM

The process of loading data from a disk into the RAM will fail when the RAM is full. Many programs will then give you a message telling you that the memory is full.

The RAM's maximum storage capacity is finite, so when the operating system and application programs have been loaded, there may not be enough space left to hold all the data that needs to be processed.

However, some programs use a technique of loading only that data which is being processed, then as soon as the processing is finished, this data is put back onto the disk and the next item of data to be processed is loaded into RAM.

This process of moving data, as it is needed, from hard or floppy disk to RAM is called "swapping". Swapping is not the same as simply loading data into RAM; it is a memory management activity: the RAM holds only the data that is currently being processed, then as soon as it is finished, it is put back on the disk, and the next unit of data to be processed is loaded.

The swapping facilities within UNIX, OS/2, Desqview and WINDOWS for example, are not apparent to the user: the programs handle data transfer from hard disk to RAM and back again, without instructions from the user.

It takes a lot of time to swap data from RAM to floppy disk and back and it is therefore impractical to attempt to use software that makes use of swapping techniques with floppy disks.

8.2 Types of memory

Base memory

The 8086 microprocessor, on which the Industry Standard PC architecture is based, can only access the contents of 1MB of Memory. Long ago, decisions were made to apportion that 1MB of address space between RAM (for programs and video adaptors) and ROM. This resulted in the maximum amount of RAM available for application programs being 640K. This area of RAM is known as the Base Memory.

The RAM fitted in both models of PC may be configured to allocate 256K, 512K or the maximum of 640K as Base Memory.

It is not possible to fit additional, or substitute, Base Memory on an expansion card.

Extended memory

The 80286 and 80386SX microprocessors can address more than 1MB of memory. The additional addressing capability is called Extended Memory. This is exploited by fitting more RAM, usually up to a limit of 16MB.

MS-DOS and MS-DOS application programs, as well as all software that uses 8086 Real Mode, can make only limited use of Extended Memory as they are restricted to the 1MB address space of the 8086. More recent operating systems such as OS/2, UNIX and XENIX do make full use of Extended Memory. The MS-DOS v.4.0 installable device drivers, HIMEM, SMARTDRV and RAMDRIVE, make use of a special trick to use Extended Memory for storage of data only; additionally, HIMEM will also allow a small area for program use.

To increase the amount of Extended Memory, you can add to that which is provided on the motherboard by adding a half-length expansion card containing Extended Memory, or by fitting bigger SIMMs.

The Extended Memory, built into the motherboard of your PC, has a better performance than would be possible on an expansion card because it is accessed at the full computer speed, not restricted by interfacing to a slower expansion bus.

Shadow RAM facility

Most of the PC's memory can be assigned to Base memory and Extended memory. In addition, a fixed amount of 384K can be set aside to be used to increase the speed of access to ROM-based code in your PC.

The BIOS copies the contents of the PC's ROM into the RAM. This copy becomes the Shadow RAM. The processor must then be instructed to read this copy rather than the original ROM. This Shadow RAM can be accessed faster than the ROM, so the speed at which the programs run is increased.

In the standard PC design, the area between 640K and 1Mb is not normally filled with system RAM but contains RAM and ROMs on adapter cards such as video cards, hard disks, networks, etc. It is this 384K region that can be "shadowed" in up to six, 64K divisions.

Use the SETUP program to shadow the main system ROM (the BIOS). Once you have chosen to shadow the ROM, you commit the full 384K to be used for shadowing. However, initially, only the 64K region containing the selected ROM will be shadowed.

If you select the option which shadows the system ROM, and then run the Shadow utility, it will search through the 640K to 1Mb region and will enable shadow RAM in any 64K regions in which a ROM is detected.

8.3 Upgrading Memory

ALT286 is supplied with 1 Mb of 80ns DRAM memory, giving a wait state of 1.0.

ALT386SX is supplied with 1 Mb of 100ns, Page Mode DRAMs, giving 0.6 of a wait state.

If you wish to upgrade memory you can do this by replacing the SIMMs (Single Inline Memory Modules) which are already fitted in the sockets provided on the motherboard, inside the PC.

Both models can be upgraded to either 2Mb or 4Mb, using 1Mb SIMMs. Zero wait states can be achieved by using 60ns RAMs.

The steps to take to upgrade memory are:

1. Replace the existing SIMMs in the sockets on the motherboard of the PC, inside the system unit. Instructions on how to do this are given below.

2. Set the DIP switch B, numbers 1, 2 and 3 accordingly. The DIP switches are on the back panel of the system unit. The possible settings are given below.

3. Run the SETUP program to make the system aware of the configuration changes. The SETUP program is started by holding down the [Ctrl] and [Alt] keys and pressing the [S] key. Full details of the SETUP program are given in Chapter 3.

Fitting SIMMs onto the motherboard

Make sure that the computer is switched off.

Turn the unit upside down.

Undo the screws on the small panel, on the underside of the unit, and remove the panel.

You will see the SIMMs that are already fitted, in the sockets in the centre of the exposed part of the motherboard.

Underside of System Unit
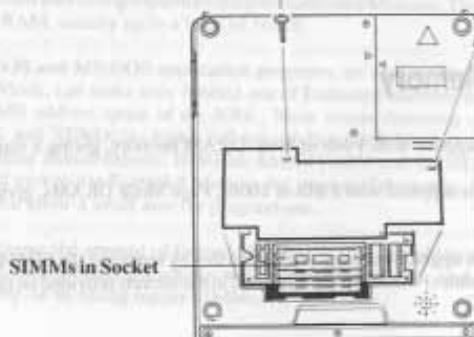
SIMMs in Socket

Replace these SIMMs accordingly.
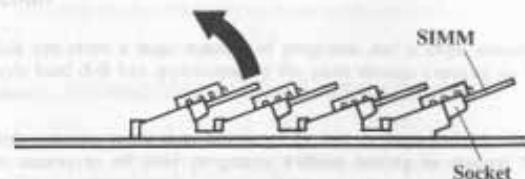
SIMM

Socket

Transverse View of SIMMs in Sockets

Motherboard
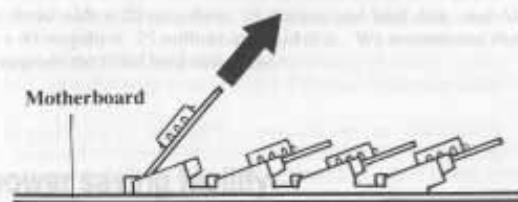
When you have fitted the SIMMs, replace the small panel. You will now need to adjust the DIP switches according to the size of RAM in the PC. See the set of switches labelled "DIP switch A" on the back panel of the computer. Set switches 1, 2 and 3 as indicated in the table below:

	Switch 1	Switch 2	Switch 3
512K	OFF	ON	ON
1Mb	ON	OFF	ON
2Mb	OFF	ON	OFF
4Mb	ON	OFF	OFF

9. Hard Disks

Introduction

A hard disk can store a large number of programs and a large amount of data: a 40 megabyte hard disk has approximately the same storage capacity as 28 (1.44Mb) floppy disks.

A hard disk operates more than ten times as fast as floppy disks. It also allows immediate access to all your programs without having to change floppy disks frequently.

It is important to keep the data on your hard disk well organised, with related data and programs grouped together; otherwise your data will be difficult to manage.

ALT286 is fitted with a 20 megabyte, 28 millisecond hard disk, and ALT386SX is fitted with a 40 megabyte, 25 millisecond hard disk. We recommend that you do not replace or upgrade the fitted hard disk drive.

9.1 Hard disk power saving facility

While the PC is powered by battery, energy can be saved by making the hard disk stop spinning while the PC is switched on, but not being used. To turn this motor off hold down the **[Ctrl]** and **[Alt]** keys and press the **[End]** key. Note that these keystrokes will also turn off the power to the screen.

The first attempt to access the hard disk will make the motor switch back on.

This power-saving facility can be set automatically. The hard disk's motor can be set to switch off, after the PC has been unused for a given length of time. The first attempt to access the hard disk, after the power switches off, will make the disk's motor switch back on.

Use the SETUP program to define this option. SETUP is described in Chapter 3. The possible time intervals are: **Never, 1, 2, 3, 5, 10 or 20 minutes**. The default setting is **2 minutes**.

9.2 Preparation of a hard disk

This section explains the various stages involved in preparing a hard disk.

It then goes on to explain alternative configurations: why you may want to use a different configuration and how to reconfigure the disk.

The recommended hard disk configuration

Instructions are given in the installation section to prepare the disk to use MS-DOS, the operating system. The program, AMSFDISK, is recommended for this preparation process. If you are already familiar with MS-DOS, you may be aware of the FDISK command which is normally used for this purpose. AMSFDISK is recommended as a much simpler, alternative program.

If you want to use the disk with any other operating system, you will need to follow the hard disk format and system installation instructions supplied with that software.

Often, it will be possible to partition the disk to accomodate two operating systems simultaneously - selecting which is to be used when the computer is switched on.

AMSFDISK defines the layout of the disk by specifying the number and size of the partitions. This program also builds directory structures in a way similar to the FORMAT command and finally, copies the DOS files to the hard disk.

If the hard disk is 32Mb or less, a primary DOS partition is created which uses the entire disk for MS-DOS. This single partition is automatically made active. If the hard disk is larger than 32 Mb, the available space is divided between two or more logical drives in the way you choose.

A root directory is created and the hard disk is checked for bad sections. Special entries are made in the directory, if any bad sectors are found. They are marked so that those sectors are never used. Up to 1% of bad sectors is acceptable.

The contents of the CONFIG.SYS and AUTOEXEC.BAT files are described in Part 1, Chapter 4.

Reconfiguring the hard disk

It is possible that the default configuration, given in the installation section, is not the most suitable to your requirements. Or, perhaps you wish to change your current configuration. This section outlines alternative configurations.

If you want to reconfigure the hard disk, you could use the AMSFDISK instructions in Chapter 3, or the MS-DOS command, FDISK, described in Part 2, Chapter 8.

Be sure to make copies of any files existing on the hard disk, that you want to keep, as any existing files will be destroyed.

You will need to reconfigure the hard disk if you wish to use any of the following:

* an operating system other than MS-DOS

* a version of MS-DOS other than the one supplied with the PC

* additional logical drives

* other operating systems as well as MS-DOS

If you intend to use an operating system other than the supplied MS-DOS, use that operating system to configure the disk.

Otherwise, use the AMSFDISK command, described above, or the MS-DOS command, FDISK to define the layout of the disk by defining the number and size of the partitions.

Before you start to prepare the disk, you should decide whether you want to create a single partition or more than one partition; you will have to create a primary DOS partition first and the menu used to make this selection will also ask you whether you wish to use the maximum size for a DOS partition and make the DOS partition active. If you say yes, you will not then be able to make an extended partition, unless you start the command again.

Using logical drives

Logical drives provide a means of breaking up a physical hard disk into distinct areas which may be treated as if they were separate physical storage units.

This is useful for keeping different types of data apart. If, for example, application programs are kept in one logical drive and data files in another, it would be easy to manipulate collections of data: the contents of a logical drive could be wiped off the disk by reformatting just that drive. But the contents of the whole hard disk would not be lost; you can re-format a disk or a logical drive, but not a directory.

This is, therefore, a more powerful division than that provided by subdirectories, which is another way of organising and separating data on a hard disk.

Any size of disk can use logical drives.

You can apportion disk space to the logical drives as appropriate to your requirements. For example, if you have a 40Mb hard disk you could apportion the space with a logical drive having 30Mb and a second having 10Mb. Or, 4 logical drives with 10Mb each and so on.

First, you should create a primary DOS partition and then an extended DOS partition and then logical drives.

You can create up to 16 logical drives. Given that drives A and B refer to the floppy disk drive, the letter 'C' will be assigned to the first logical drive, then D to the second logical drive, then E and so on.

Using more than one operating system

If, for some reason, you wish to use more than one operating system, you will find that it is supplied with a program equivalent to the MS-DOS FDISK command. A partition on the hard disk reserved by such a program will be described by FDISK as a "non-DOS partition".

FDISK options

You can use FDISK to:

- Check whether a hard disk is configured or formatted
- Create a primary or single DOS partition
- Create an extended DOS partition
- Create logical drives in extended partitions
- Change the active partition
- Delete a primary DOS partition
- Delete an extended DOS partition
- Delete logical drive in an extended DOS partition
- Display partition information
- Select the next hard disk drive for partitioning on a system with multiple fixed disks

When you have configured the hard disk, you must format the disk. For the drive in the active, primary partition, use the FORMAT command with the /S option.

The FORMAT command checks the hard disk for bad sectors and marks entries in the directory so that these sectors (areas) will not be used.

This involves making decisions about how you intend to use the disk for all your future work. If you should need to change this at a later date, you would have to save all the work held on the disk and re-format and re-configure the disk. They are also useful for transferring data from one computer to another.

However, processing and using floppy disks is time consuming: formatting, loading and saving of data is much slower using floppy disks.

Although you still need to use floppy disks with hard disk PCs, the majority of your work will be done on the hard disk.

Buying floppy disks

The type of floppy disk you should buy to use on your PC is:

- 3.5 inch
- double sided
- soft sectored
- 720 kilobyte or 1.44 megabyte formatted capacity

and, if you have a 5.25 inch external floppy disk drive:

- 5.25 inch
- double sided
- soft sectored
- 360 kilobyte or 1.2 megabyte formatted capacity

Preparing floppy disks

Before you can use a new disk for the first time you must format it. If you are using MS-DOS as the operating system on your PC, see Part 2 for instructions on how to do this. The command you will need to use is the MS-DOS FORMAT command which is listed alphabetically with all the other commands, in Chapter 8.

If you intend to store 1.44 Mb of data you should buy disks designed for this amount. Such disks are identified as High Density disks (HD).

If, however, you buy non-High Density disks, it is unwise to attempt to format them to store 1.44Mb of data. Be sure to use the correct syntax of the FORMAT command. You should always format such a disk to store 720Kb of data, or 360Kb if they are 5.25 inch disks.

The command to use to format the disk to store 720Kb, when using a 1.44Mb floppy disk drive is as follows:

FORMAT A: /T:80 /N:9

If you are using a 5.25 inch, 1.2Mb external floppy disk drive, the command to use to format the disk to store 360Kb is as follows:

FORMAT A: /T:40 /N:9

This command will format the disk with 9 sectors per track, rather than the FORMAT command's default value which would be 18 sectors per track.

If you are using a 5.25 inch, 360Kb drive, or a 3.5 inch, 720Kb drive, you should simply use the command,

FORMAT B:

Once formatted for high-density, it is unwise to re-format at low density.

Care of disks

You should take care of your disks by not putting them near any magnetic sources such as televisions, telephones or hi-fi loudspeakers.

Disks should not be subjected to excessive heat or cold and should not be left in direct sunlight.

Take care not to allow your disks to become dusty, and never touch the magnetic surface beneath the protective metal shutter of the disk.

If you want to write-protect the data on a floppy disk (which prevents the contents from being accidentally wiped off or overwritten, on a 3.5 inch disk, OPEN the write-protect shutter. This is the small slider at the bottom righthand corner of the disk. Similarly, protect data on a 5.25 inch disk by sticking a tab over the notch in the top, righthand side of the disk.

Write-protect shutter   Write-protect notch
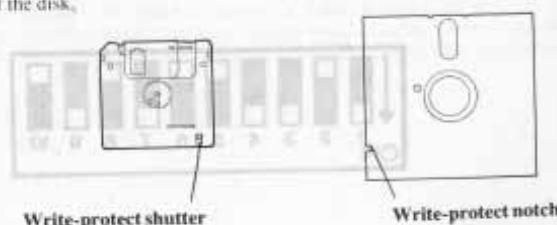
10.2 External floppy disk drive connector

An external floppy disk drive connector makes disk handling generally more convenient, for example, with disk copying processes, but more importantly, it gives the PC the facility to exchange data from a disk of one size to a disk of a different size.

External floppy disk drive sizes

The floppy disk drives that are available are for use with the following disk sizes:

3.5 inch 720 kilobytes
3.5 inch 1.44 megabytes
5.25 inch 360 kilobytes
5.25 inch 1.2 megabytes

How to use the external floppy disk drive connector

Make sure the power to the computer is switched off.

Set DIP switch number 10 according to the type of floppy disk drive you intend to connect :

ON - PS/2 type

OFF - AT type

If you are using a drive which takes 3.5 inch floppy disks, select PS/2 type.

If you are using a drive which takes 5.25 inch floppy disks, select AT type.

The DIP switches are situated on the back panel of the computer.

Then connect the data cable from the external disk drive to the connector on the righthand panel of the computer.

Righthand Panel of Computer
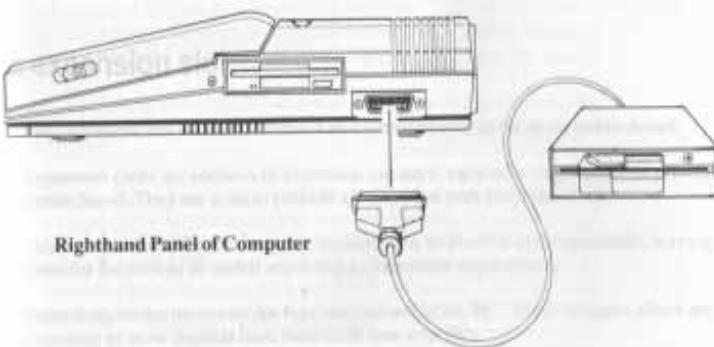
Once the cable has been connected, you can switch on the computer. You will then need to inform the system that the additional drive is present. Use the SETUP program to do this. To start the SETUP program, hold down the **[Ctrl]** and **[Alt]** keys and press the **[S]** key. SETUP will display a screen which lists your PC's features and the current settings for those features. Using the cursor keys to move from option to option, go to the one called "Diskette B", and select the floppy disk drive size you have connected. A full description of SETUP is given in Chapter 3.

11. The Expansion Slot and DIP Switches

11.1 The **expansion slot**

The expansion slot is used to connect an expansion card to the main motherboard.

Expansion cards are sections of electronic circuitry, each on a single piece of printed circuit board. They are used to provide a PC system with extra functions.

Industry standard PCs are designed, normally, to be flexible and expandable, leaving room for features to be added according to individual requirements.

Some features are necessary for fundamental use of the PC. Those features which are necessary or most popular have been built into your PC:

* a floppy disk controller

* a graphics controller (video adaptor)

* a parallel interface

* two serial interfaces(asynchronous communications adaptors)

* a hard disk interface

Your PC contains an expansion slot which allows the PC to be upgraded for more specialised requirements, for example, a modem expansion card could be added.

In addition, some built-in features can be disabled and replaced with one supplied on an expansion card. To disable the existing feature, you would have to adjust the appropriate DIP Switch setting. For example, if you wanted to replace the built-in graphics adaptor with another of your choice, supplied on an expansion card, you would have to adjust DIP Switch number 1, on the set of switches labelled "DIP Switch B" which is on the back panel of the computer. See Section 11.2 for more information.

Fitting an Expansion card

Both PC models have a reduced size expansion slot inside the system unit.

If you need to change any DIP switches when fitting an expansion card, you should change the switches first (see Section 11.2 below).

The position for the expansion card is beneath a cover on the back, lefthand corner of the unit. Firstly, raise the LCD screen, then turn the unit round so that you are facing the back panel of the unit.

Remove the two screws securing the small panel which is now on your right. Then slide the panel towards you and lift away from the unit.

Fit the expansion card into the slot, then replace the panel and the screws. There is a lip on the outer edge of the panel which fits inside the edge of the unit. To replace the panel, you must press on the outer edge of the panel to push the lip inside the edge of the unit, otherwise the panel will not fit back into place.

Expansion Slot

Expansion Card
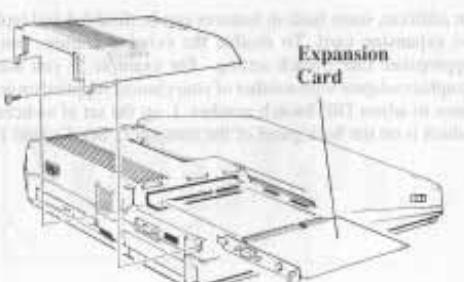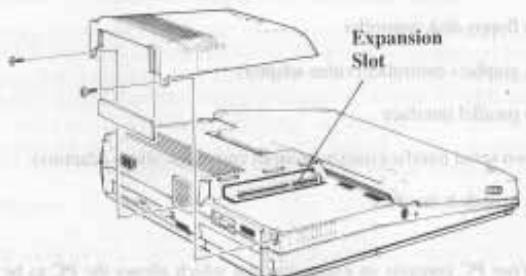
11.2 DIP switches for ALT286 and ALT386SX

Each model of PC has two sets of DIP switches - DIP Switch A and DIP Switch B. The DIP switches control the hardware settings of various features. Both sets of switches are on the back panel of the computer.
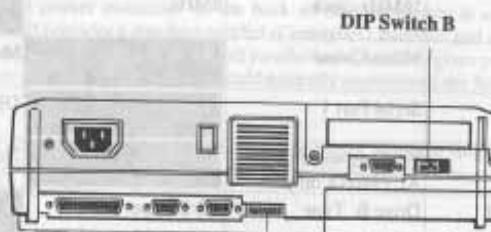
DIP Switch B

DIP Switch A

The back panel of the computer

The first set of switches, DIP switch A, controls the size of RAM by using combined switch settings, as follows:

DIP Switch A - numbers 1 to 3

	Switch 1	Switch 2	Switch 3
512K	OFF	ON	ON
1Mb	ON	OFF	ON
2Mb	OFF	ON	OFF
4Mb	ON	OFF	OFF

The default settings are shown highlighted in the above table.

Details of DIP switch A - numbers 4 to 10 are on the following page.

Switch Number	Function	Switch Setting	
		ON	OFF
4	Page Mode ALT386SX only	Page Mode	Normal
5	CPU wait	0 Wait ≤ 60ns DRAM	0.6/1 Wait >60nsDRAM
6	16MHz clock	8MHz	16MHz
7	Mono/Colour	Colour	Mono
8	Serial Port 1	Enable	Disable
9	Pipeline/Non-Pipeline - ALT386SX only	Pipeline	Non-Pipeline
10	Drive B: Type	PS/2 Type	AT Type

Note The external Drive B: Type must be set according to the supplied drive. Please refer to your dealer. 5.25 inch will usually be Type I and 3.5 inch will usually be Type II.

The default settings are shown highlighted in the above table. The default settings for switches 1, 2 and 3 are:

1 - ON
2 - OFF
3 - ON

DIP Switch B - numbers 1 and 2

There are two switches in this set: 1 and 2.

When both switches are in the ON position (down) the internal VGA adaptor is enabled; when in the OFF position, VGA is disabled.

Note that for some features, you must set the DIP switch and then use the SETUP program to inform the system of the hardware setting. See Chapter 3 for details of the SETUP program.

12. Parallel and Serial ports

12.1 The Parallel Port

The parallel printer connector on the back of the system unit is a 25-way D-type connector. It provides a standard parallel (Centronics) interface and so can be used to connect any printer that uses a standard parallel interface. This gives you a wide choice of printers and plotters, though we would naturally recommend the Amstrad DMP and LQ range.

If you or your dealer are not sure whether a printer or plotter is suitable, compare the pin-out and timing information given for the printer/plotter with the pin-out and timing information below.

In the following table, **C Pin** is the pin number on the Computer's parallel port, **P Pin** is the pin number on the Printer's connector and **R Pin** is the Return pin. The I/O indication shows the direction of the signal relative to the printer.

C Pin	P Pin	R Pin	Signal name	I/O	Notes
1	1	19	STROBE	IN	The signal level is normally high; it is taken low to send data. The pulse width must be more than 0.5uS at the receiving terminal (ie your printer).
2	2	20	DATA 0 (LSB)	IN	8-bit data signal. Pin taken high corresponds to logical 1; pin taken low corresponds to logical 0.
3	3	21	DATA 1		
4	4	22	DATA 2		
5	5	23	DATA 3		
6	6	24	DATA 4		
7	7	25	DATA 5		
8	8	26	DATA 6		
9	9	27	DATA 7 (MSB)		
10	10	28	ACKNOWLEDGE	OUT	Pin taken low to indicate that your printer is ready to receive further data. Approximately 0.5uS pulse.

C	P	R	Signal name	I/O	Notes
11	11	29	BUSY	OUT	Pin taken high to indicate that your printer cannot receive data.
12	12	30	PE	OUT	Pin taken high to indicate that your printer is out of paper.
13	13	-	SELECT	OUT	Pin taken high to indicate ON-LINE, pin taken low to indicate OFF-LINE.
14	14	-	AUTOFEED	IN	Pin low means paper to be fed one line after printing.
-	15	-	NC		Not Connected.
-	16	-	0V		Logic GND.
-	17	-	CHASSIS GND		Printer chassis GND.
18	18	-	NC		Not Connected.
19	19	-	GND		Twisted-pair Return signal GND.
25	25	-	GND		Twisted-pair Return signal GND.
26	26	-	GND		Twisted-pair Return signal GND
:	:	:	:		:
30	30	-	GND		Twisted-pair Return signal GND
16	31	-	INIT	IN	Pin normally high; pin taken low to reset printer controller to its initial state and clear the printer buffer. Pulse width must be greater than 0.5uS at receiving terminal (ie your printer).
15	32	-	ERROR	OUT	Pin taken low to indicate printer out of paper, off-line or in an error state.
-	33	-	GND		Twisted-pair Return signal GND.
-	34	-	NC		Not Connected.
-	35	-	5V		Pulled up to +5V through a 4K7 resistance.
17	36	-	SLCT IN	IN	Data entry to printer only possible when pin low. Pin taken high to indicate printer OFF-LINE.

The standard, IBM PC to Centronics printer cable should work correctly. This is a cable has a 'male' 25-way D-type connector on one end that will fit into the 'female' 25-way D-type on the back of your PC system unit. The connector at the other end of the cable may vary but as a general rule it would normally have a 36-way "Amphenol" connector.

The 'male' end of the cable should be plugged into the parallel port on the system unit and the other end to the equivalent connector on the printer/plotter. If the 'male' plug on the end of the lead has slots for screws, use the screws supplied with the lead to attach it securely to the Parallel Port. Look at the printer/plotter's own manual to see how it recommends securing the lead to its connector.

If you attach a printer, find out from its manual which character set the printer uses. If it doesn't use the UK, 8-bit, ASCII character set, see if there is any switch on the printer that can change the character set used by the printer.

12.2 The Serial ports

ALT286 and ALT386SX are both fitted with two serial ports on the back panel of the computer. Each port is a 9 pin, D-type connector which provides a standard RS232 serial interface. This gives you a wide choice of modems, communications links and printers.

If you or your dealer are not sure whether a communications link or a printer is suitable, compare the pin-out given for the device with the pin-out details in the following table:

Pin	Description	Signal Name
1	Carrier Detect	DCD
2	Receive Data	RXD
3	Transmit Data	TXD
4	Data Terminal Ready	DTR
5	Signal Ground	GND
6	Data Set Ready	DSR
7	Request To Send	RTS
8	Clear To Send	CTS
9	Ring Indicator	RI

To make connections between the device and your PC, you will need a suitable cable.

The type of cable you need depends on what you want to connect to the Serial Port:

- To connect to a modem, or a desktop computer wired as a modem, you need a 'one-to-one' RS232 cable.

- To connect to a serial printer, a terminal, or a desktop computer wired as a terminal, you need a 'null modem' RS232 cable.
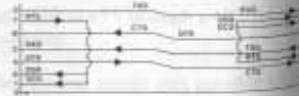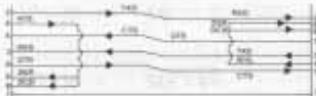
One way of checking whether a device is wired as a modem or as a terminal is to look at the type of connector on the device. Conventionally, devices wired as terminals have 'male' connectors and devices wired as modems have 'female' connectors. However, many manufacturers put 'female' connectors on both types of equipment for reasons of electrical safety, so the only sure way of telling is by finding out from the device's manual how Pin 2 is wired:

- If Pin 3 is used to **transmit** (ie Pin 3 is an output pin), then the device is wired as a terminal and you need a **null modem** cable.

- If Pin 3 is used to **receive** (ie Pin 3 is an input pin), then the device is wired as a modem and you need a **one-to-one** cable.

The cable you use should have a 'female' plug on one end to fit the 'male' connector on your PC. The type of plug it should have on the other end depends on whether the device being connected to the PC has a 'male' or 'female' connector. Your dealer should be able to help you here.

The 'female' end of this cable should be plugged into a Serial Port on the back of your PC and the other end into the equivalent connector on the device. If the 'female' plug on the PC end of the lead has screw holes, use the screws supplied with the lead to attach it securely to the Serial Port. Look at the device's own manual to see how it recommends securing the lead to its connector.

The next step is to set up the Serial Interface so that data is transmitted with the right characteristics and received data is correctly interpreted. Your device's manual should tell you what values you need to set.

If you plan to use the Serial Interface almost entirely to link your PC with a particular printer, terminal or modem it would be a good idea to include the necessary MODE commands (for details, see the description of the MODE command in Chapter 8, Part 2) in the AUTOEXEC.BAT file on your hard disk. These commands could be added easily, using the RPED editor described in Part 2.

If you add an expansion card providing a COM2 serial port that would conflict with the electronics of the built-in serial port, you can disable the built-in interface by adjusting a DIP switch. See Chapter 11 for details of where to find the switches and the settings you require.

Backing up data

Hard disks are designed to be extremely reliable and to have a long life, but like all mechanical devices, they can break down or be damaged by misuse or accident. There is also a possibility that the wrong command could be typed, and data lost. The hard disk can always be repaired or replaced if it goes wrong; what is potentially much more serious is the loss of data that might occur after such a mishap. Ten or twenty megabytes can easily represent years of work, irreplaceable financial records, or invaluable customer records.

This problem has existed ever since the start of computing. So, a process called 'backing up', or 'making a back up' has been evolved by professional computer users. A 'backup' is jargon for a copy made for safety's sake. Backups can be made of the entire hard disk every day (or even more often), or just a file or two every week or fortnight.

In general, backups are made by copying files from the hard disk onto floppy disks, as this does not need any extra equipment and is quite convenient. Often, however, backups are made with the help of additional tape-based hardware. If you have such equipment, follow the instructions supplied with them.

Backups can be quite time consuming, and you should weigh up the advantages of security against time taken to create the backups. For example, if you are writing a book using your PC, the loss and subsequent re-typing of a morning's work might be an acceptable risk. Anything more than a day's work lost would probably be unacceptable - in which case, you would want to make a backup daily (i.e. at the end of each day's work).

Every effort has been made to keep the process of making backups simple, but the task, nevertheless, demands a certain amount of discipline.

You will need a number of blank (i.e. formatted) floppy disks.

A hard disk can have the same capacity as hundreds of floppy disks, so at first sight, backing up a 40 megabyte hard disk onto floppy disks seems an awesome undertaking. Each floppy disk can take a couple of minutes to write, so backing up could take several hours.

Fortunately, this is often not the case. The MS-DOS BACKUP program, supplied with your PC, has various labour-saving options. You can just copy parts of the hard disk, or files that have been changed since the last back up. Also, you will not need to back up

any programs that originally came on floppy disks (as long as you keep them somewhere safe) because you can always re-install them. But you should keep backups of any information you generate.

Exactly of what, and how frequently, you make backups is therefore up to you. A popular method is to have five disks, one for each working day, onto which that day's work is backed up. Then at the end of the week, everything important is copied onto a master set of floppy disks, and the day by day floppies can be re-used. It is a good idea to have at least two sets of master disks in use as backups, and to alternate between them (i.e. backup onto one set one week, and onto the other the next).

This way, if you have a power cut or accident whilst you are making the backup, and both the hard disk and the floppy are ruined, you can always go back to your last backup. This would not be possible if you had just used one set, as you would have just lost your last backup by copying over it!

On a daily basis, this scheme would require the /M option of the MS-DOS BACKUP command, and on a weekly basis, use the /D option. See Part 2, chapter 8, for full details of the BACKUP command.

Whatever scheme you choose, it is important to make backing-up a regular activity.

Transporting the PC

Whenever you move your PC, take the following precautions:

- Do not move the unit from a cold environment (e.g. the boot of a car) into a warm environment and attempt to use it immediately - wait until the unit has reached room temperature.

- Take special care when transporting and handling the computer (which contains the hard disk drive) - it is very sensitive to vibration and will almost certainly be damaged if you drop it.

Protecting the LCD display

The LCD panel consists of two thin plates with polarizers which are easily damaged. Handle the display gently to prevent damage.

If the computer is dropped or suffers intense shock, it will be damaged.

Do not operate or store the computer in direct sunlight, high temperatures or high levels of humidity.

Charging the Battery

The battery can be charged at two speeds: "Quick", when the computer is not being used. This takes about two hours. When the computer is being used, the battery can be on a much slower charge, "Trickle charge".

- **Charging the battery quickly while the computer is not being used:**

Start with the power to the computer switched off.

Connect the mains AC lead into the power connector on the back panel of the unit, then plug into the mains power supply and switch on the AC power.

The battery will quick-charge, automatically. The middle LED light will light up, coloured orange.

If you are using the computer and you decide you want to charge the battery, switch off the computer for at least 5 seconds, then plug in the AC lead.

- **Charging the battery slowly while the computer is being used**

Alternatively, if you want to use the computer but also need to charge the battery, you can do so: start with the computer switched off. Insert the AC lead into the power connector on the back panel of the computer. Connect the mains plug to the power supply, then turn on the computer. The battery will then be on "Trickle" charge. While charging slowly, the middle LED light turns green.

Cleaning the LCD screen

When cleaning the display surface, wipe gently, using a soft cloth, for example, gauze and one of the recommended solvents, listed below:

- Isopropyl alcohol

- Ethyl alcohol

- Trichlorotrifloroethane

DO NOT wipe the display surface with dry or hard materials that will damage the polarized surface.

DO NOT use the following :

- Water

- Ketone

- Aromatics

14. Troubleshooting - hardware

14.1 Video system checks

For full information about the built-in display adaptor, LCD screen monitor connections, Display DIP switch and VGA utilities, see Chapter 6.

1. If an external CRT monitor is used, check that it is properly connected to the system, and that it has the correct pinout configuration. Also, check that none of the pins is bent on the monitor cable connector.

2. Check that all switch settings match your system's configuration.

3. If you are using a multi-frequency monitor with a TTL/analogue switch, check that it is set to analogue.

4. If your system has a second (co-resident) video adaptor card (whether it is connected to a monitor or not), check to see whether you are using an invalid configuration. If you still encounter problems, remove the co-resident card and re-try. Co-resident cards cannot be EGA or VGA boards.

5. If no text output is displayed on the screen, make sure that the brightness and contrast controls have not been accidentally misadjusted.

6. If you are using a multi-frequency monitor and the display is rolling or appears to lose synchronisation, see if adjusting the horizontal and vertical controls corrects the problem.

7. If you switch on the system and an error message is displayed which concerns the way the video system is set up, re-run the system's SETUP program and select either VGA or EGA, if possible.

8. Many programs, especially games, prompt the user for the type of monitor (e.g. color (RGB), monochrome, composite color, and so on) for best results. When using the LCD screen, you could look at both colour and monochrome and choose the one you prefer.

14.2 Hardware Messages

Three kinds of messages are listed below, in alphabetical order:

* Error Messages - suggest how to correct the problem

* Information Messages - to advise you but indicate that no action is necessary

* Run-Time Messages - are displayed if an error occurs after the startup procedure is complete.

* **Base Memory size = 64K**

    Used in reporting base memory for Extended Features.

* **Decreasing available memory**

    This message immediately follows any memory error message, and informs you that the memory chips are failing.

* **Diskette configuration error**

    The specified configuration is not supported.
    Change the configuration.

* **Diskette drive reset failed**

    The diskette adaptor has failed.

* **Diskette drive 1 seek failure**

    The B: drive failed or is missing.
    Check the B: drive

* **Diskette drive 0 seek failure**

    The A: drive has either failed or is missing.
    Check the A: drive.

* **Diskette read failure - strike F1 to retry**

    The diskette is either not formatted or defective.
    Replace the diskette with a bootable diskette and retry.

* **Display adaptor failed; using alternate**

    The color/monochrome switch is set wrong
    Change the switch to the correct setting.

    The primary video adaptor failed.
    Check the primary video adaptor.

* **Error found; disk X: Failed initialisation**

    POST reports hard disk configuration information is incorrect.
    Re-run SETUP and enter correct hard disk information.

* **Errors found; Incorrect configuration information memory size miscompare**

    POST reports the size of base or expansion memory does not agree with configuration information.

    Re-run SETUP and enter correct memory size.

* **Extended Memory size = 00000K**

    Used in reporting extended memory size for Extended Features.

* **Gate A20 failure**

    Protected mode cannot be enabled.
    Check the system board.

- **Hard disk configuration error**

  The specified configuration is not supported.
  Correct the fixed disk configuration.

- **Hard disk failure**

  Bad disk.
  Re-boot the system. If that doesn't work, attempt to boot the system from floppy di...

- **Hard disk read failure - strike F1 to retry boot**

  The hard disk is defective.
  Re-boot the system. If that doesn't work, attempt to boot the system from floppy di...

- **FDD controller failure**

  Disk and diskette controller failed.
  Check the system board

- **FDD A is not installed**

  Cannot find diskette controller for diskette drive A
  Check the system board

- **FDD B is not installed**

  Cannot find diskette controller for diskette drive B.
  Either install or replace the controller card.

- **Invalid configuration infrmation - please run SETUP program**

  * Memory size is incorrect.
  * Display adaptor is configured incorrectly.
  * Wrong number of diskette drives.

  Run the SETUP utility.

- **I/O card parity interrupt at *address*. Type (S)hut off NMI (R)eboot, other keys to continue**

  (Run-time message) The peripheral card has failed.

  Type (S)hut off NMI.
  Note: This will only temporarily allow you to continue. You must replace the peripheral card.

- **Keyboard clock line failure**

  Either the keyboard or the keyboard cable connection is defective.
  Make sure the keyboard cable and keyboard are connected properly.

- **Keyboard controller failure**

  The keyboard controller firmware has failed.
  Check the keyboard controller.

- **Keyboard stuck key failure**

  A key(s) is jammed.
  Try pressing the key(s) again.

- **Last boot incomplete**

  Incorrect configuration of Intel 82335 chip set.
  Reconfigure Intel 82335.

- **Memory address line failure at *hex-value*, read *hex-value*, expecting *hex-value***

  Circuitry associated with the memory chips has failed.
  Check the circuitry.

- **Memory data line failure at *hex-value*, read *hex-value*, expecting *hex-value***

  One of the memory chips or associated circuitry has failed.
  Replace the memory chips.

- **Memory high address line failure at *hex-value*, read *hex-value*, expecting *hex-value***

  Circuitry associated with the memory chips has failed.
  Check the circuitry.

- **Memory double word logic failure at *hex-value*, read *hex-value*, expecting *hex-value***

  Memory chip circuitry failed.
  Replace the memory chip.

- **Memory odd/even logic failure at *hex-value*, read *hex-value*, expecting *hex-value***

  Circuitry associated with the memory chips has failed.
  Check the circuitry.

- **Memory parity failure at *hex-value*, read *hex-value*, expecting *hex-value***

  One of the parity memory chips has failed.

- **Memory parity interrupt at *address*. Type (S)hut off NMI, (R)eboot, other keys to continue**

  (Run-time message) A memory chip(s) has failed.
  Type (S)hut off NMI
  Note: This will only temporarily allow you to continue. You must replace the memory chip(s).

- **Memory test terminated by keystroke**
  This message indicates that you have pressed the Spacebar while the memory tests were running. This stops the memory tests.

- **Memory write/read failure at *hex-value*, read *hex-value*, expecting *hex-value***

  One of the memory chips has failed.
  Try replacing the memory chips.

- **No boot device available - strike F1 to retry boot**

  Either diskette drive A:, the hard disk, or the diskette itself is defective.
  Retry boot. If that doesn't work, replace the diskette or the hard disk.

- **No boot sector on hard disk - strike F1 to retry boot**

  The C: drive is not formatted or is not bootable.
  Format the C: drive, make it bootable.

- ***nnn*K Base Memory**

  The amount of base memory that tested successfully

- ***nnn*K Expanded Memory**

  The amount of expanded memory that tested successfully.

- ***nnn*K Extended Memory**

  The amount of extended memory that tested successfully.

- ***nnn*K Extra Memory**

  The amount of extra memory that tested successfully.

- ***nnn*K Standard Memory**

  The amount of standard memory that tested successfully.

- **Not a boot diskette - strike F1 to retry boot**

  The diskette in drive A: is not formatted as a bootable diskette.
  Replace the diskette with a bootable diskette and retry boot.

- **No timer tick interrupt**

  The timer chip has failed.
  Check the timer chip on the system board.

- ***Hex-value* optional ROM bad checksum= *hex-value***

  The peripheral card contains a defective ROM.
  Replace the peripheral card.

- **Shutdown failure**

  The keyboard controler or its associated logic has failed.
  Check the keyboard controller.

- **Strike the F1 key to continue**

  This message indicates that an error was found during POST. Pressing the [F1] key
  allows the system to attempt to boot.

- **Time-of-day clock stopped**

  The CMOS Time-of-day clock chip has failed.
  Run the SETUP utility.

- **Time-of-day not set - please run SETUP program**

  Clock not set.
  Run the SETUP utility.

- **Timer chip counter 2 failed**

  Chip failed.
  Check the timer chip system board.

- **Timer or interrupt controller bad**

  Either the timer chip or the interrupt controller is defective.
  Check the timer chip or the interrupt controller on the system board.

- **Unexpected HW interrupt Interrupt at *address*. Type (R)eboot, other keys
  to continue**

  (Run-time message) This could be any hardware-related problem.
  Note: Not displayed if the extended interrupt handler is not enabled.
  Check the hardware

- **Unexpected interrupt in protected mode**

  The non-maskable interrupt (NMI) port can't be disabled.
  Check the system board, particulary the logic associated with the non-maskable
  interrupt.

- **Unexpected SW Interrupt Interrupt at *address*. Type (R)eboot, other keys
  to continue**

  (Run-time message)
  There is an error(s) in the software program.
  Note: Not displayed if the extended interrupt handler is not enabled.

  Try turning the machine off and then on again. If that doesn't work, check the program.

- **Unexpected type 02 interrupt at *address*. Type (S)hut off NMI, (R)eboot,
  other keys to continue**

  (Run-time message)
  There is an error(s) in the software program.
  Note: Not displayed if the extended interrupt handler is not enabled.

  Try turning the machine off and then on again. If that doesn't work, check the program.