USER MANUAL

1505 Reliance Way,
Fremont, CA 94539

Main Phone:	(510)623-1212
Main FAX:	(510)623-0818
Technical Support/Customer Service:	(800)786-8998
Technical Support/Customer Service FAX:	(510)651-0629
BBS:	(510)651-1606
WWW address:	www.acma.com
Technical Support email address:	tech-support@acma.com
Customer Service email address:	cust-service@acma.com.

VERSION 4.01
May 1998

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TABLE OF CONTENTS

i WELCOME TO ACMA COMPUTERS

Thank you for purchasing an ACMA computer system. We built your new system to your specifications using quality name-brand parts. Before leaving our factory, your computer was rigorously tested to ensure its reliability. Your new system is ready to go to work!

Rapidly changing technology means you will probably want to upgrade your computer at some point. Unlike some manufacturers, ACMA builds its computers to industry standard. Your computer may be upgraded when and if you feel the need. Additionally, ACMA maintains a comprehensive list of BIOS and driver updates for your system.

Please take the time to read this manual thoroughly, as it contains useful information on setting up your computer, upgrades, and troubleshooting. This manual is intended to provide you with all the basic information you need. Since ACMA builds each system to customer specifications, it is impossible to include all possible component-specific details in this manual. For this reason, your documentation package includes the original manufacturer's detailed component documentation for each component in your system.

When upgrading or troubleshooting your system, please refer to this manual first. If, after reading this manual, you need further information, please refer to the detailed component documentation.

Again, we at ACMA thank you for your purchase of an ACMA computer.

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ii CONVENTIONS

This manual uses several notational conventions to present information of special importance:

A Caution indicates potential personal injury, damage to your system, or loss of data and tells you how to avoid the problem.

Notes contain information on improving system performance or important things to keep in mind when performing a specific procedure.

Lists of items, points to consider, or procedures that do not need to be performed in a specific order appear in bullet format:

- Item 1
- Item 2

Procedures that must be followed in a specific order appear in numbered steps:

1. Perform this step first
2. Perform this step second

Specific keyboard keys are depicted in square brackets and are capitalized, for example: [ESC]. If more than one key should be pressed simultaneously, the notation will appear as [KEY1]+[KEY 2], for example [ALT]+[F4].

Buttons and knobs are depicted in round brackets and are capitalized and italicized, for example: {*RESET*}

Screen prompts are displayed in bold Courier font, for example:

C:\>

Start

Items you must type appear in standard Courier font, for example:

```
cd\letters\business\legal [ENTER]
```

1 GETTING STARTED

This chapter contains information needed to set up your computer for the first time. It includes information on planning your workspace, ergonomics, unpacking your new computer, and connecting all the components and peripherals.

COMPUTER WORKSPACE

There are many considerations when setting up a computer system. It is important that your computer be properly set up in order to protect your system and provide for your comfort. Some important questions to ask when designating a location for your new computer are:

- Do you have sufficient grounded power outlets nearby? (Please refer to the section "Electrical Outlets" below).
- Do you have a telephone outlet nearby (necessary if you purchased a modem)?
- Do you have sufficient workspace for your keyboard, mouse, and monitor?
- Is your workspace free of excess dust, static, heat, and moisture?
- Is your workspace ergonomic (refer to following section)?

We strongly recommend that you use a multi-outlet power strip with built-in surge protection. Voltage spikes caused by phenomena such as storms, transmission problems, and appliances can easily damage your computer.

The Ergonomic Workspace

Having an ergonomic workspace allows you to work comfortably for longer periods while reducing the likelihood or severity of strain, fatigue, or other detrimental effect. Here are some tips to help you set up an ergonomic workspace:

- Position your system so that the monitor and keyboard are directly in front of you. Contact your ACMA sales representative if you need to order items such as keyboard shelves and monitor stands to aid in proper placement of the keyboard and monitor.
- The monitor should be at a comfortable viewing distance, typically 20 to 24 inches.
- The monitor screen should be at (or slightly below) eye level when you are sitting in front of it.
- Adjust the monitor's brightness, contrast, color balance, and tilt as well as surrounding lamps and curtains to minimize reflections and glare on the screen. It is generally advisable to adjust the monitor's brightness as low as possible while still maintaining a clear view of the screen and its contents. You may also wish to purchase a glare guard. Please contact your ACMA sales representative.
- Your chair should provide good lumbar (lower back) support.
- Your forearms should be horizontal and your wrists in a comfortable neutral position while typing or using the mouse.
- There should be space to rest your hands on your desk while using the keyboard or mouse.
- Allow your upper arms to hang naturally at your sides.
- Sit erect, keeping your feet flat on the floor and your thighs level.
- Make sure your feet are supporting the weight of your legs and not the front edge of your seat. Adjust your seat and/or use a footrest to maintain proper posture.
- Vary your work activities or, if this is impossible, take frequent short breaks to stretch your arms and legs, focus on objects at varying distances, and relax.

Electrical Outlets

Your computer is a highly sophisticated and delicate electronic device. Many computers are needlessly damaged due to power fluctuations. Grounded outlets greatly reduce the possibility of personal injury and damage to your computer. They also allow surge suppressors to safely discharge voltage spikes and prevent damage to your computer. Not all three-pronged outlets are grounded, nor are all two-pronged outlets non-

grounded. If in doubt, you may purchase an outlet tester from a hardware store or electrical supply. Always connect your computer to a properly grounded outlet.

If the outlets in your chosen location are not grounded, either move your computer to a different location or have a qualified electrician ground your outlets.

Make sure that the wall outlet you select for your computer does not share the same circuit with any major appliance such as a refrigerator or washing machine. The drops in voltage caused by a major appliance powering on can lockup, reset, or even damage your computer. If in doubt, you may test the selected outlet before setting up your computer. Do this by plugging a lamp into the selected outlet, turning it on, and turning on the appliance(s) you think may share the same circuit. Next, shut off the breaker or remove the fuse that supplies power to the appliance(s). If the lamp remains lit, the wall outlet is on a separate circuit and may be used. If the lamp shuts off as well, consider moving your computer to a different location. Alternatively, you may contact a qualified electrician to transfer the wall outlet to a different circuit. Always call a qualified electrician to perform any electrical test or other work that you are not comfortable or qualified to do.

Do not connect your computer to any wall outlet that shares its circuit with a major appliance. The voltage sags caused by appliances such as a refrigerator powering on can lockup, reset, or even damage your system.

ACMA strongly recommends the use of a surge suppressor with all computers and computer components. Phenomena such as lightning and switching transformers at the utility can cause the normal 115-volt current in your wiring to spike, possibly as high as 4,000 volts or more. These extreme voltages can cause irreparable damage to your computer in a small fraction of a second. The consistent use of a quality surge suppressor that is plugged into a properly grounded electrical outlet that does not share the same circuit as any major appliance will ensure that your computer is unharmed by any fluctuations in the power supply.

UNPACKING YOUR SYSTEM

Clear enough floor space to allow you to unpack the shipping containers. Make sure the location you selected for your new computer is clean and ready for you to place the monitor, keyboard, mouse, case, speakers, printer, and other components. Be sure the electrical outlets you will plug your computer into are grounded and that you are using a surge suppressor.

Examine shipping containers for holes, smashed corners, dents, watermarks, or other damage that may have occurred during shipping. Notify ACMA immediately if any of these signs of damage are present.

Unpack each container and place all system components, cables, and manuals in a place where they may be easily inventoried. **Save the packing materials in case you need to ship your system at a later date.**

Verify each item you unpacked with the Packing List to ensure that you received all ordered items including cables, manuals, and diskettes. If there are any discrepancies, contact ACMA immediately.

Sample Checklist

The following items typically comprise a computer system. Since each ACMA computer is built to order, the components shipped with your specific system may vary.

- ❑ Power cord
- ❑ Keys (if applicable)
- ❑ Manuals
- ❑ Diskettes
- ❑ Telephone cord (if you purchased a modem)
- ❑ Speakers (if applicable)
- ❑ Software titles
- ❑ Mouse Pad

Do not install or attempt to connect to a wall outlet any device that appears damaged in any way. Personal injury or damage to your computer might result.

SETTING UP YOUR SYSTEM

Since ACMA computers are built-to-order, the layout and configuration of your system determines the locations of different connectors. Therefore, it is important that you pay particular attention to the labels above the different connectors when attaching the components. This information is also included in the "Read Me 1st" Setup Guide.

Please refer to Figures 1 (Keyboard Connector) and 2 (Sample Connection Layout) when connecting your components and peripherals. While the locations of these connectors may vary, the connectors themselves are universal, e.g. all serial ports are alike and so on.

To avoid damage, make sure your computer is completely powered off before connecting or disconnecting any electronic device (such as a peripheral).

Route all cables where no one will trip on them and where the cables will not be subject to abrasion or other damage. Frayed cables could cause damage to your computer and/or personal injury.

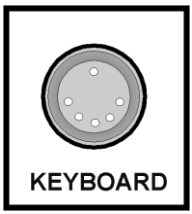

Figure 1: Keyboard Connector - AT form factor

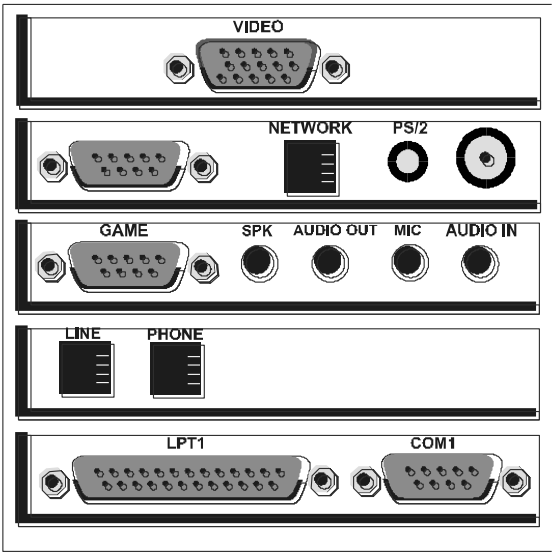

Figure 2A: Sample Connection Layout - AT form factor

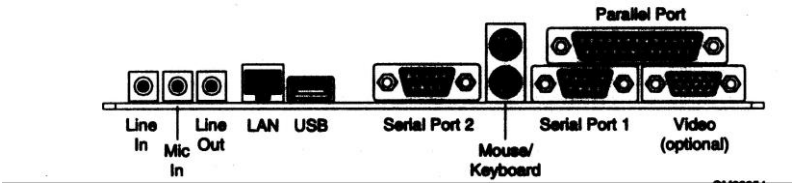

Figure 2B: Sample Connection Layout - ATX, Micro ATX, and NLX form factors

1. Locate all the connectors on the computer and each component and peripheral you are going to connect.
2. Place all components (case, keyboard, monitor, mouse, printer, etc.) in their approximate locations at the selected workspace.
3. Connect the keyboard cable to the connector marked KEYBOARD (see Figure 1). If your computer has a PS/2 keyboard, the keyboard connector will look like the connector in Figure 2B.
4. Connect the mouse cable to the 9-pin serial port marked COM1 or to the PS/2 connector (see Figures 2A and 2B).

5. Connect the VGA monitor cable to the 15-pin VIDEO port in the rear of the system (see Figures 2A and 2B).

6. Connect the accessories (see Figures 2A and 2B).

    - Speakers (SPK)
    - Microphone (MIC)
    - You may connect your computer to another audio component such as a receiver or tape deck using the AUDIO OUT (or LINE OUT) and AUDIO IN (or LINE IN) connections. Doing so requires that you purchase a stereo 1/8" earphone to RCA jack converter for both sound card connections (available at most electronic supply retailers).
    - Telephone cord for modem and telephone. Be sure to connect the cord from the wall jack to the jack labeled LINE (or TELCO), and the cord from the telephone (if any) to the jack labeled PHONE.
    - Joystick (usually marked GAME or JOYSTICK)
    - Printer (to LPT1)
    - Network (will vary according to the type of card - could be coax cable (BNC) or twisted pair (RJ-45))

7. Connect one end of the Monitor Power Cord to the Monitor and the other end to a surge-suppressor.

8. Connect one end of the System Power Cord to the System and the other end to a surge-suppressor. Make sure the power supply's voltage selector is set to 115V.

9. Turn on your computer and monitor using the {*POWER*} buttons on the front of the respective units.

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2 USING YOUR SYSTEM

This chapter contains useful information on using your new computer systems and its components, as well as some tips on how to achieve maximum performance from your new ACMA computer.

TURNING YOUR SYSTEM ON

Power buttons for most systems are located on the front of the computer case and always clearly marked.

TURNING YOUR SYSTEM OFF

Always use the following Shutdown Procedure to shut down your computer system:

Failure to follow the shutdown procedure as outlined below could cause loss of data and possible damage to system files required to boot the computer.

1. Save your work.
2. Make sure that any jobs such as printing, faxing, or file transfer have finished.
3. Exit (close) all open applications.
4. If you are using Windows 95®, Windows 98® or Windows NT 4.0®, click **Start** at the bottom left of your screen, then click **Shut Down**. Select **Shut Down** from the menu that appears and click **OK**. Wait until you see the words "It is now safe to shut off your computer".
5. Press the {*POWER*} button on the front of your computer.

Some newer computers require you to press and hold the POWER button for about four seconds to turn off the computer. In this case, pressing and releasing the POWER button quickly will cause the computer to go into "suspend" mode.

RESTARTING YOUR SYSTEM

There may be times when you may need to restart (reboot) the system without shutting it down, such as when you add certain software to your computer. If you wish to restart your computer, make sure you follow Steps 1-3 of the Shutdown Procedure (above) before restarting. There are four basic Restart Procedures. The one you use will depend on which situation best applies to you:

- If you are using Windows 95®, Windows 98®, or Windows NT 4.0®, click **Start** at the bottom left of your screen, then click **Shut Down**. Select **Restart** from the menu that appears and click **OK**. Your computer will reboot.
- Press [CTRL]+[ALT]+[DEL]. If you are in DOS, this will cause your computer to reboot. In Windows 95®, Windows 98®, or Windows NT 4.0®, this will cause a window with all open applications listed to appear with the options End Task, Shut Down, and Cancel listed. If this occurs, click Cancel and follow the method above to restart your Windows system.
- Press {*RESET*}. Only do this when in DOS and when Steps 1-3 of the Shutdown Procedure are complete. Pressing {*RESET*} within Windows may corrupt critical system boot files.
- Press {*POWER}*. Only do this after completing the entire Shutdown Procedure above and heeding all notes and warnings.

If your computer has locked up, the above procedures may not work to restart the system. If this happens, you will need to bypass the above procedures and instead use the Emergency Restart Procedure:

1. If you are using Windows 95® Windows 98®, or Windows NT 4.0®, try pressing [CTRL]+[ALT]+[DEL]. When the Task List appears, select any tasks shown as "Not Responding" and click **End Task**. This may shut down the affected application and avoid having to reset your system.
2. If you are using DOS, or if Step 1 does not work, press {*RESET*}. The computer will reboot. All unsaved data will be lost.

SHOULD YOU LEAVE YOUR COMPUTER ON?

System components heat up when the computer is on and cool back to room temperature when the computer is turned off. Hard drives spool up when you power on your computer and stop spinning when the computer is shut down. Over time, this process could eventually reduce the life of your computer or some of its components, especially if the computer is cycled on and off repeatedly during the day. Leaving the system on maintains a constant temperature, however mechanical components such as your hard drive(s) (which is/are always spinning when the computer is on) will have a shorter life, although the wear incurred by being left on is less than the wear of starting and stopping. You have three basic choices:

- Powering the system off after completing your work: This alternative is best if you use the computer infrequently, especially where the periods of use are short.
- Leaving the system on and only powering off at the end of the day: If you use your computer many times a day or for long periods, it is probably preferable to leave it on. Applications such as voicemail and faxing may require that the system be constantly powered up. Most office computers fall into this category and function normally. Some tips:
  - If your computer is not required to run applications such as fax or voicemail software after hours, you should power it down at the end of the day to conserve energy.
  - Enable the power management settings of your system and monitor to save energy (and save your monitor screen). This can be accessed through the Windows Control Panel (see Chapter 3 - Using Your Computer). Enabling power management and leaving your system on constantly might be your best alternative. Many computers also support spinning down the hard drives to save wear and energy.

- Make sure to use a screen saver or turn the monitor off when not in use. This prevents the possibility of 'burning' any screen images on the phosphors coating of the tube which could result in permanent shadows on the display.

❑ Never powering the system off: This approach is necessary for computers supporting 24-hour access to voicemail or faxing, or for network servers. However, systems should be reset at least once a week using the appropriate Restart Procedure, above, to reload a clean operating system, close unneeded files that were left open, and recover any memory held by processes that are no longer in use. You may want to research the impact (if any) of enabling your computer's power management features on your computer's required functionality. Again, the monitor may be turned off when not in use.

If you leave your computer on all the time, you may wish to purchase one of many types of auxiliary cooling fans that fit inside your computer's case. Please contact your ACMA sales representative if you need to purchase additional fans.

GENERAL CONTROLS AND INDICATORS

It is important to understand the purpose of the different controls and indicators on your computer case. Note that some of these may not appear on your computer case.

Power Button and Indicator Light

Pressing {*POWER*} toggles the system on or off. Many newer computer systems support an option where the user can place the computer in Suspend mode. Suspend mode places the CPU and all peripherals into their lowest available power-consumption modes while preserving all open applications in a frozen state.

Computers equipped with this advanced option typically require the user to rapidly press and release {*POWER*} to place the system in Suspend mode. Shutting down the system requires pressing and holding {*POWER*} for about four seconds.

Please refer to the motherboard and operating system documentation included with your system for details on all power management options

supported by your computer. Always remember to follow the Shutdown Procedure before turning off your computer.

The Power Indicator Light will illuminate whenever the system is powered on.

Reset Button

Pressing the {*RESET*} button forces the computer to reboot (warm boot). {*RESET*} should only be used as described in the above listed Restart Procedures to avoid losing data and possible corruption of system boot files.

System Lock

The System Lock is a key lock that enables or disables keyboard operation. Systems that include this option will have their keys included with the accessories.

Hard Disk Access Indicator

The Hard Disk Access Indicator flashes every time a hard disk performs either a read or write operation.

KEYBOARD OPERATION

Your computer comes with either a 101-key Enhanced Keyboard or a 104-key model with special keys for Windows 95® or Windows 98®. The Enhanced Keyboard provides separate cursor keys and has twelve Function keys ([F1] through [F12]) along the top. Newer models, such as Microsoft's Natural Keyboard ®, provide extra keys for directly accessing Windows 95® and Windows 98® menus and functions.

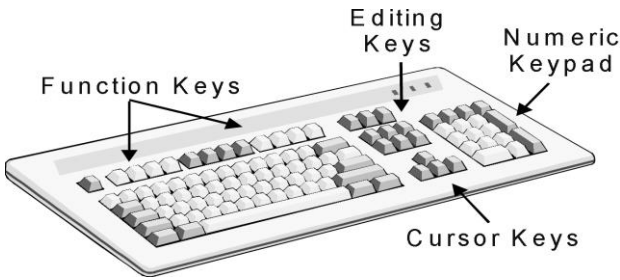
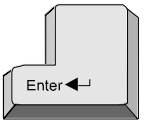
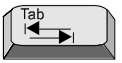
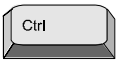
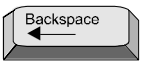
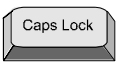


Figure 3: Keyboard layout

The alphanumeric keys on the 101-key Enhanced Keyboard are laid out in the standard QWERTY format. Basic keyboard functions are identical for most 101-key Enhanced Keyboards. If you purchased a Microsoft Natural Keyboard ® or other special type of keyboard with your system, please refer to the accompanying documentation for information on special keys and features.

Key Cap	Description
	The [ENTER] key is similar to the carriage return key on a typewriter. In DOS, pressing [ENTER] indicates that a command entry has been made.
	The [TAB] key is similar to the tab key on a typewriter. Its function varies between programs.
	The [CTRL] (Control) key is used in conjunction with other keys to perform certain control functions.
	The [ALT] (Alternate) key is used in a similar manner as the [CTRL] key.
	The [ESC] (Escape) key is used to send an escape code to a program or device. The general definition of the escape key is to interrupt current function.
	The [BACKSPACE] key is used to delete a single character to the left.
	The [NUM LOCK] key is toggles the number pad between acting as numeric keys or editing keys. When the keyboard Num Lock indicator is lit, the number pad is active.
	The [CAPS LOCK] key toggles the alpha characters to either all caps or lower case.

Number and punctuation keys are unaffected by the [CAPS LOCK] key. Alpha keys are all caps when the Caps Lock keyboard indicator is lit.

The [PAUSE/BREAK] key is used to pause or break operation of a program.

The [PRINT SCREEN] key sends the current screen contents to a printer.

The [SCROLL LOCK] key is not normally used with DOS. In some applications, it will change the text scroll up and down feature.

Editing Keys

There are six edit keys located between the main keypad and the numeric keypad. Various applications containing built-in edit functions (such as word processors) use these keys. The numeric keypad keys act as edit/cursor keys when [NUM LOCK] is turned off.

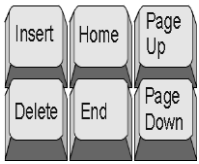


Figure 4: Editing Keys

Cursor Keys

The cursor keys are located below the edit keys and serve to move the cursor around the screen. Directional arrows on these four keys depict which way the cursor will move when a particular cursor key is pressed. An additional set of cursor movement keys can be found in the numeric keypad to the right of the cursor keys. Toggling [NUM LOCK] to OFF allows these keys to also be used as cursor keys.

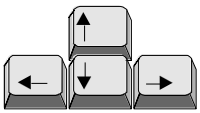


Figure 5: Cursor keys

Function Key Operation

The 12 function keys are programmable, and many DOS and Windows applications set them to perform various application-specific tasks. For example, pressing [F1] in a Windows application usually activates that application's Help functions. DOS defines certain function keys to aid command entry (for example, pressing [F3] at the DOS prompt causes the previously typed command to be re-displayed). Please refer to your DOS manual for specific function key activity. Many other applications such as word processors, database managers, and desktop publishers use function keys to speed entry of repetitive commands.

Figure 6: Function keys

Control-Alternate Key Sequences

The [CTRL]+[ALT] keys are used in combination with a third key to perform special system functions. For example, pressing [CTRL]+[ALT]+[DEL] will reboot the system (please refer to the sections "Turning Your System Off" and "Restarting Your System", above, for more detailed information about [CTRL]+[ALT]+[DEL]).

FLOPPY DRIVES

Virtually all computers come with a standard 3.5" floppy disk drive. Most 3.5" floppy disks store up to 1.44Mb of data, though some older diskettes only store 760Kb. You must take several precautions when using floppy disks to avoid losing stored data:

- Do not expose the floppy disk to extremes of heat, cold, sun, moisture, or dust.

- Keep your floppy disks away from magnetic fields (such as speakers or transformers).
- Never bend or twist your floppies.
- Do not open the metal door that shields the magnetic disk within the floppy assembly. You may damage it.
- Be sure to take any other environmental or security precaution you feel necessary to safeguard your floppies and their data.
- Remember: If your computer can read your data, so can anyone else's!

To access a floppy disk, insert it with the metal door facing towards the computer and the round metal spindle facing down. Slide it smoothly into the floppy drive slot until it clicks into place. To remove the disk, press the button on the floppy drive. Grasp the edge of the floppy and slide it smoothly out of the drive.

Data on floppies may be protected against accidental deletion or modification by finding the small sliding plastic tag on the underside of the floppy and pressing it down towards the middle of the diskette. This enables the Write Protect feature, which prevents any data from being added, modified, or deleted from the disk. Write-protected diskettes may be read and their data accessed. To remove Write Protect, slide the small plastic tab up towards the edge of the diskette.

Floppy diskettes also exist in 5.25" size. While obsolete, they may still be encountered in some situations. While highly unlikely, your ACMA computer may include a 5.25" floppy disk drive in addition to or (very rarely) instead of the aforementioned 3.5" unit. 5.25" floppies store 1.2Mb of data and require the same precautions as 3.5" diskettes. Older 5.25" floppy disks store as little as 180Kb of data.

CD-ROM DRIVES

Most systems include a CD-ROM drive as standard equipment. A CD-ROM disc provides up to 680 megabytes of non-volatile read-only storage, and thus is an ideal medium for many of today’s large applications. Most CD-ROM drives also have the ability to play standard audio CDs, and many of these have an earphone jack and volume control. This allows you to enjoy CD audio even if your computer does not have a sound card and/or speakers.

Note!

Unlike most stereo systems, plugging earphones into the CD-ROM will not disable any external speakers attached to your system. Please remember to either turn off any external speakers or turn their volume all the way down when listening to audio CDs via the CD-ROM earphone jack.

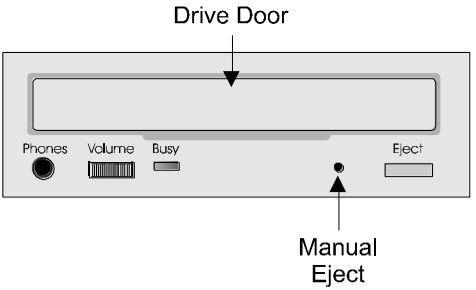


Figure 7: CD-ROM drive
(Your model may vary in appearance)

Basic Controls

Most CD-ROM drives are well labeled. Controls may vary slightly depending on your specific model.

- Headphone jack: Use this with headphones to listen to sounds coming from the CD-ROM only, such as an audio CD or a CD-ROM game you are playing. Note that you will not hear any sounds from your sound card through headphones connected to your CD-ROM drive.
- Volume: This controls the volume of the CD-ROM headphone jack only. Please refer to the above Note.
- Busy Indicator: This LED flashes when the CD-ROM drive is busy or being accessed.
- Eject Button: Press this button to open and close the CD-ROM door during normal operation
- Manual Eject: This functions as an 'Emergency Eject' mechanism when the Eject button is inoperable (such as when the system is turned off). Use this function as a last resort!

Loading a Disc

Most CD-ROMS use a simple tray to hold CDs. A few CD-ROMs use special CD caddies. Always be sure to grasp your CDs by their edges, to avoid getting fingerprints on the CD's data area.

Slot-equipped CD-ROM

The newest CD-ROMs dispense with trays and caddies. Instead of a door, these CD-ROMs have a slot running across the face of the unit. Simply insert your CD into the slot, writing-side up, and push gently. The drive will accept your CD. When the disk ejects, it will slide partway out of the drive. Grasp it by its edges, and slide it gently out of the slot.

Tray-equipped CD-ROM:

Use the following procedure to load a CD into a tray-equipped CD-ROM:

1. Press the EJECT button to open the CD-ROM tray.
2. Pick up the CD-ROM being careful to only touch the edges, and identify the side with writing on it.
3. Gently lay the CD-ROM in the tray with the writing side facing up.
4. Press the EJECT button to close the CD-ROM tray.

Caddy-equipped CD-ROM

1. Pick up the CD-ROM being careful to only touch the edges, and identify the side with writing on it.
2. Open the caddy. There are different types of caddies. Most have some type of plastic lid to lift up.
3. Gently lay the CD-ROM inside the caddy with the writing side facing up, and close the lid of the caddy.
4. Open the door of the CD-ROM drive. Caddy-equipped CD-ROMs typically have a handle for you to manually open the door.
5. Insert the caddy, ensuring that is properly oriented. Please refer to your caddy instructions.
6. Gently push the caddy until it is completely inserted into the drive.

Manually Ejecting a Compact Disc

Use this procedure only if the CD-ROM's Eject button fails to eject the CD. Use caution when performing this procedure.

1. Unplug your system.
2. Insert a small metal object (such as a straightened paper clip) into the small hole in the front of the CD-ROM drive. Push the paper clip gently yet firmly until the CD-ROM tray begins to open.
3. Gently and slowly pull out the CD-ROM tray until it is completely open. Remove the disc.

CD-R/CD-RW DRIVES

Standard CD-ROM drives only allow you to read the audio or coded data contained in the CD. Until recently, there was no way to add, edit, or delete the contents of a standard CD.

The advent of CD-R (CD-Recordable) technology brought the ability to 'burn' or record content onto CDs. This allowed individuals and business to create their own CD content, including but certainly not limited to backup archives, new products, or personalized audio compilations. Still, CD-R technology is limited in that content burned onto CDs cannot be edited or deleted.

CD-RW technology (CD-Rewriteable) allows you to use special CDs in the same way you might use a floppy disk, albeit with the far larger storage capacity that CDs offer. CD R/W technology enables you to add, edit, and delete information on CDs with the same ease as you perform the same functions on a hard or floppy disk. Unlike a hard or floppy disk, however, burned CD-RW data is non-volatile, meaning it is impervious to magnetic fields and other phenomena that can adversely impact data stored on floppy or hard disks.

Most CD-R and CD-RW drives closely resemble standard CD-ROM drives and use the same procedures outlined above for CD-ROM drives. If your ACMA computer includes a CD-R or CD-RW drive, please refer to the unit's documentation for complete information on using these new types of CD media.

DVD-ROM DRIVES

DVD is the latest revolution in compact disk technology. A DVD disk can hold up to 17 gigabytes of data, which is enough to contain a full feature-length movie, high fidelity six-track surround audio track, and the means to allow you to select among three different viewing formats. DVD-ROM drives function similarly to CD-ROM drives when loading and unloading discs and use the same procedures outlined above for CD-ROM drives. Also, DVD-ROM drives can read standard audio or data CDs. If your ACMA computer comes with a DVD-ROM drive, please refer to that unit's documentation for complete information on using your DVD capabilities.

OTHER MEDIA

Your ACMA computer may include other types of drives and storage media capabilities. These may include tape drives, which are typically used for backup storage due to their high capacity and slow speed. Alternatively, your computer might include removable hard drives, such as Iomega's Zip® or Jaz® drives. These combine high capacity with high speed, and are suited to such tasks as archiving data, working storage, games, or applications. Please refer to the documentation for any specific unit(s) included with your ACMA computer for complete details on using these drives.

VIDEO DISPLAY

Depending on the primary use(s) of your new computer, you may have ordered with more or less advanced graphics capabilities. There are two primary pieces of the computer's video/graphics system: The monitor, and the video card. Each of these components is discussed below:

The Monitor

All monitors include the following specifications:

- Overall Size: Monitors are rated by size, e.g. 14", 15", 17", etc. This figure is measured diagonally, e.g. from opposite corners.
- Viewable Area: Typically, the above number refers to the overall diagonal size of the monitor while the Viewable Area reflects the diagonal measurement of the screen itself: For example, most 15" monitors have a viewable area of between 13.2" and 13.9"

- Dot Pitch: Dot pitch refers to the distance between individual phosphors of the same color (color monitors use red, green, and blue phosphors) and is measure in fractions of a millimeter. For example, a monitor with .28 dot pitch contains red phosphors every .28 millimeters. The smaller the dot pitch, the closer the individual phosphors and the crisper the image you will see on your monitor. For example, a monitor with .25 dot pitch is sharper than one with .31, and so on.

- Refresh Rate: The faster the refresh rate, the more times the picture refreshes itself in a second. Higher refresh rates mean less flickering and thus reduced eyestrain. Note that the actual refresh rate depends on several variables, including your current resolution and the capabilities of your video card. The actual refresh rate will be the highest supported by your video card for each particular resolution. This figure is typically below your monitor's maximum performance capabilities.

- Maximum Resolution: Most monitors typically have a maximum resolution size of 1024x768 pixels, though many can achieve resolutions as high as 1600x1200 or greater. The higher the number, the finer and crisper the video output. Your actual screen resolution will be the lesser of the following:

  - Application resolution: Some applications run at resolutions as low as 640x480 or even less.

  - Monitor capabilities: If your video card's capabilities exceed those of your monitor, you will be limited to your monitor's maximum resolution.

  - Video card capabilities: If your monitor is capable of more resolution than your video card, you will be limited to the maximum resolution allowed by your video card. Please see the section "The Video Card", below.

Most monitors come with controls allowing you to set the brightness, contrast, horizontal size, vertical size, overall size, center point, color balance, and other parameters. Please refer to your monitor documentation for complete information on adjusting these controls. Also, please be sure to re-read the section "The Ergonomic Workspace" in Chapter One of this manual and follow the recommendations located

there, as monitors are large contributors to needless workplace fatigue and eyestrain.

The Video Card

The video card (also referred to as the graphics adapter or video adapter), in your system processes display information received from other system components, translates it into a form readable by the monitor, and transmits the information to the monitor. There is a huge variety of video cards available. When selecting a video card, you must be aware of numerous variables that affect video performance. Some important considerations are:

- Amount of RAM on the card: The more RAM a card has available, the higher resolution it can support, and the higher the possible color depth (number of colors that can be displayed simultaneously). Typically, most cards sacrifice resolution for color depth, e.g. they can display fewer colors at higher resolutions since both colors and resolution require some of the card's finite memory. Following is a table of the typical maximum resolution/color depth supported by most video cards:
  - 1Mb: 640x480x33,000 colors/1024x768x256 colors
  - 2Mb: 800x600x16 million colors/1152x864x33,000 colors
  - 4Mb: 1280x1024x16 million colors
  - 8Mb: 1920x1280x16 million colors
- Type of video RAM: Newer types of RAM access data far more rapidly than older types. Older types of RAM include DRAM and SRAM. Newer cards incorporate higher speed RAM such as SDRAM and WRAM.
- Video Chipset: Newer chipsets incorporate faster processing and more advanced functions such as full screen MPEG playback and 3D acceleration. Chipsets such as the S3 and the Voodoo line are currently used in higher end video cards.
- Card Bus Type: Computers use five primary types of buses, e.g. interfaces between the motherboard/chipset and expansion cards. Please refer to the section "Expansion Card Buses", in Chapter Three for further discussion.

UNIVERSAL SERIAL BUS (USB)

To date, many peripherals such as mice, printers, scanners, joysticks, and digital cameras required the user to shut down the computer, plug in the peripheral, and restart the computer in order to use the new peripheral. USB changes that; with USB, devices such as those listed above can be plugged in and unplugged at will, without restarting the computer. USB ports are standard on new ACMA computers, unless specifically ordered with motherboards that do not support USB. Please refer to the device-specific documentation for information on using devices with USB.

SMALL COMPUTER SYSTEMS INTERFACE (SCSI)

SCSI is a unique means of connecting up to seven peripherals to your computer via a single interface card. Thus, SCSI devices share the same interrupt request (IRQ), freeing up resources for further expansion. Please refer to Chapter 3 "Upgrading Your Computer" for more details on IRQs and system resources/expansion. SCSI is available in several versions such as SCSI, SCSI 2, Fast SCSI, Fast-Wide SCSI, Ultra-Wide SCSI, each version of SCSI offering greater speed and flexibility than its predecessor.

SCSI devices may be daisy chained, e.g. a cable running from the SCSI interface card might run to a printer, a second cable from the printer to a scanner, and so on.

Most available SCSI devices fall into the category of hard drives, CD-ROM drives, and scanners. SCSI is an ideal solution for users requiring large amounts of storage spanning numerous hard drives, CD-ROMs, such as network servers.

Your ACMA computer will have a SCSI adapter, if so ordered. If your computer did not come with a SCSI adapter and you opt to install one, you may do so by following the directions for adding expansion cards found in Chapter Three "Upgrading Your Computer"

NETWORK INTERFACE CARDS

A Network Interface Card (NIC) connects your computer to others. Networks can be as small as two computers sharing resources, or as large as thousands of computers sharing such resources as file servers, mainframes, and Internet access connections. Please refer to your

network interface card documentation, network software documentation (if any), network hardware documentation (if any), and your operating system manuals for complete details and instructions on all aspects of networking. Also, contact your System Administrator if you need help using the network.

Network Architecture

Networks may use third-party software such as Novell or Banyan to configure individual NICs as well as the network itself, or they may rely on Windows' built-in networking capabilities. A typical network connection allows a computer to use additional archival resources as if they were local (on your computer) drives. For example, your computer might have access to drives P,Q, and R, with those drives being network drives accessible by more than one user. Most networks also allow computers to share printers, modems, and other system resources.

There are two basic types of network architecture:

- Peer to Peer: Peer to peer networks are typically found on small networks such as in a home or small office. All computers on a peer-to-peer network share resources equally among them. For example, one computer might have a shared printer attached to it while the other computer has a shared modem for Internet connections. No computer is designated as the 'server' or 'client'.
- Client-Server: On a client-server network, one or more computers are designated as 'servers', while the rest of the computers on the network (usually the majority) are classified as 'clients'. All client computers share all server resources, depending on the physical wiring of the network and any access control/security protocols enacted on that network. Servers serve the needs of the client computers by acting as file or application repositories, running shared printers, or serving as a gateway to external resources such as the Internet.

Network Connections

Most network cards use one of three types of connections:

- Coax Cable: This resembles TV cable, and uses twist-lock connectors to secure the various components. Coax (BNC) networks link each computer together as links in a chain, hence the term 'backbone network'

- Twisted Pair: Twisted pair network wiring resembles oversized telephone cable. Individual network computers connect to the network via one or more hubs: Instead of running to the next computer, network cables from various networked computers are plugged into a switching and routing box (the hub). This type of network architecture is more complex that its BNC counterpart, however the increased speed and tighter security make twisted pair networks preferable in most modern businesses.

FAX/MODEMS

The fax/modem is your computer's gateway to the world. Many modern fax modems also have voice capability, allowing them to be used as telephones and fully featured voicemail systems when combined with software such as Symantec's WinFax. Other software, such as Symantec's PC-Anywhere, allows you to access your computer remotely and control it as though you were sitting in front of it. You may also remotely access networks, including the Internet.

Please refer to the Chapter One for instructions on connecting your modem. Your modem documentation and modem software contains complete information on using your modem's many capabilities.

OPERATING SYSTEM FUNDAMENTALS

This section is intended to provide you with some of the fundamental information you need to navigate the DOS, Windows 95®, Windows 98®, or Windows NT 4.0® operating systems. For complete information on using DOS and Windows, please refer to the specific documentation included with your ACMA computer.

Disk Organization

The very first floppy disks were extremely limited in their storage capacity. It was not unusual for users to have one disk for each separate application they used. For example, one disk might hold a word processor, another a spreadsheet, and so forth. Switching applications meant switching disks. While cumbersome, this system did keep applications and data highly organized.

The advent of higher capacity floppy and hard disk drives meant that users could store many applications and the data created within these

applications on the same disk. While faster and more efficient, this new capability also caused confusion due to several applications mixed with different data occupying the same space. The increasing number of files required by each application and the fact that many different types of data were created by the same applications (for example, memos and marketing documentation created by the same word processor) created the real possibility of hopeless confusion. This was the equivalent of tossing all one's papers in a filing cabinet without the use of labeled folders.

To prevent this, newer versions of DOS allowed users to create directories on their floppy and hard disks. Using the filing cabinet analogy, disk directories serve the purpose of file folders. Applications and data could now be organized into directories, for example WORDSTAR, DOS, BP, LETTERS, and MEMOS. Additionally, directories can be created within directories, for example DATA\LETTERS\BUSINESS\LEGAL, where LEGAL is a directory within BUSINESS, and so on.

The level of organization possible with this system is apparent: Using the above example, one would naturally expect to find one's business-related legal letters in the above directory.

Windows 95®, Windows 98®, and Windows NT 4.0® continue the file cabinet analogy by renaming directories as *folders*. Directories and folders are, of course, identical in form and function. This concept applies to all computers, from PCs to mainframes.

All disks have a root or home directory. All directories created on a drive are sub-directories of the root directory. The directory location of a given file is called the PATH.

ACMA Computers strongly recommends that you adopt a very organized directory system on all your hard drives and floppy disks. Keep your data separate from your applications. This will help prevent misplacing data, facilitate upgrades and changes to applications, simplify backup procedures, and guard against accidental data erasure.

Floppy drives are referred to as the A and B drives, hard drives, CD-ROMS, and other drive types as drives C and above. Most computers

have a single 3.5" floppy drive as their Drive A, and no B drive. Hard drives always start at C.

DOS Basics

On a DOS system, the computer will typically boot using the hard drive and will proceed through its startup files to the DOS prompt, which typically appears as follows:

C:\>

The above prompt means that you are currently on the C drive, in the root directory.

Use extreme caution when using these or any DOS commands. Unlike Windows, DOS has no safeguards against accidentally deleting, renaming, or moving critical system, application, or data files. Improper use of DOS commands can cause your system to not boot properly, application malfunctions, data loss, and can even corrupt your DOS and Windows operating systems! Always refer to your DOS documentation before attempting to use any DOS commands unless you are an experienced DOS user and very familiar with the command(s) you are using.

Changing Directories

To go to another directory, type `cd\<directory name>` and press [ENTER]. The DOS prompt will reflect your current drive and directory. For example:

C:\>`cd\wordstar [ENTER]`
C:\WORDSTAR>

You may skip directly to sub-directories within directories, go up one or more levels, or change drive/directories altogether. Examples:

C:\WORDSTAR>`cd \data\letters\business\legal [ENTER]`
C:\DATA\LETTERS\BUSINESS\LEGAL>`cd.. [ENTER]`
C:\DATA\LETTERS\BUSINESS>`cd\ [ENTER]`
C:\>`cd\dos [ENTER]`
C:\DOS>`cd\games`

```
C:\GAMES>a: [ENTER]
A:\>
```

DOS limits you to file/directory names of 8 characters or less. Note the use of the backslash (\) to delineate directories and subdirectories.

Creating directories

Most applications will create their own directories automatically when you install them. Still, you need to be able to create directories for your data and applications. That is done using the MD (Make Directory) command at the DOS prompt:

```
C:\> md data [ENTER]
```

This creates a directory called DATA within the C drive's root directory. You can also create subdirectories, for example:

```
C:\>md data\letters [ENTER]
```

creates the sub-directory LETTERS within the DATA directory.

Removing Directories

Removing directories is done in the exact way as creating directories, except that you use the RD (remove directory) command. Note that directories cannot be deleted unless they are empty, e.g. unless no files or sub-directories exist in the directory being deleted.

Deleting files

To delete a file, type in the path and file to be deleted, for example:

```
C:\>del \data\letters\business\legal\will.doc
[ENTER]
```

or

```
C:\DATA\LETTERS\BUSINESS\LEGAL\>del will.doc
[ENTER]
```

Copying files

Copying files from one path to another is simple, as shown in the following example:

```
C:\>a: [ENTER]
A:\>copy
c:\data\business\letters\legal\partner.doc
[ENTER]
1 file(s) copied
A:\>
```

or

```
C:\DATA\LETTERS\BUSINESS\LEGAL\>a: [ENTER]
A:\>copy c:partner.doc
1 file(s) copied
A:\>
```

Renaming files

Renaming files uses the REN command and has the format: REN <old filename> <new filename>. For example:

```
C:\DATA\LETTERS\BUSINESS\LEGAL\>ren lease.doc
newlease.doc [ENTER]
```

Checking The Contents Of A Directory

What files are in this directory, anyway? DOS answers that question by supplying the DIR (Directory) command. DIR can be used to check the contents of any valid directory or path. Examples:

```
C:\>dir wordstar [ENTER]
Volume in Drive C is APPS
Volume Serial Number is 1E2C-3A4B
Directory of  C:\WORDSTAR
WS.EXE            78,336      12-10-96
WORDSTAR.OVR       8,526      01-15-87
WSCHANGE.EXE      65,560      02-16-87
(etc.)
```

```
C:\>
```

or

```
C:\DATA\LETTERS\BUSINESS\LEGAL\>dir [enter]
Volume in Drive C is APPS
Volume Serial Number is 1E2C-3A4B
Directory of C:\DATA\LETTERS\BUSINESS\LEGAL
NEWLEASE.DOC      12,436      01-01-98
PARTNER.DOC       65,536      07-18-94
TRUST.DOC          4,240      03-26-97
C:\DATA\LETTERS\BUSINESS\LEGAL>
```

Additional DOS functionality

DOS includes many other powerful commands and functions. Additionally, the above listed commands contain many hidden features that allow you to customize their use. Refer to your DOS documentation for complete details.

Windows Basics

Windows 95®, Windows 98®, and Windows NT 4.0® are powerful, very easy to use operating systems. Windows 95® and Windows 98® are designed primarily for home or small business users who do not have the complex application support, networking, and security needs of larger operations, while Windows NT 4.0® provides an extremely stable and fault-tolerant system for high-end business use.

All modern versions of Windows share essentially the same graphical and intuitive user interface, however both operating systems operate differently due to their different design priorities. This section includes some fundamental details of the Windows user interface common to Windows 95®, Windows 98®, and Windows NT 4.0®. Please refer to the Windows documentation included with your ACMA computer for complete details about using Windows.

Here is a very brief overview of Windows:

Startup and Logging On

Most Windows computers automatically boot Windows on startup. You will see the Windows logo screen as the computer boots. This process

should take a minute or two depending on your computer's speed, RAM, and the number of device drivers, applications, and utilities that load when the system boots. Please refer to the section "Device Drivers" in Chapter Three for further discussion about device drivers, startup applications, and system resources.

When the computer finishes booting, you may see a box prompting you to input your user name and password. Windows NT 4.0® will also ask you to select the domain you are logging on to. Your System Administrator and/or supervisor will provide you with the appropriate entries for these fields, or you may input your self-assigned information. Enter the information (you may press [TAB] or use the mouse to select among the fields) and either press [ENTER] or click **OK**. The computer will log onto the network (if any) and shortly place you at the main Windows Desktop screen.

The Taskbar

At the bottom of the screen (typically), you will see the Windows Taskbar. The Start Button is on the left. On the right, the Taskbar displays the time and small icons depicting active applications and/or utilities. Open applications are displayed in the middle portion of the Taskbar.

To select any open application or utility, merely click its icon or box on the right or middle of the Taskbar. You may switch between active applications by simply clicking on the application you wish to use. For example, you might be working in Microsoft Word and have your e-mail and CD player applications running in the background. Click on the e-mail application's box on the Taskbar to check your messages. Click on the CD player's box to skip to the next song. Then, click on the MS Word box to return to the letter you are typing; simple as that.

The Start Button

The Start Button is the gateway to most Windows applications and utilities. Clicking **Start** opens a menu that allows to shut down your computer (see "Turning Your System Off" and "Restarting Your System" above), run applications, obtain help, modify system settings, open recently used files, quickly access your most frequently used data, and run programs. Please refer to your Windows documentation for further details about the Start Button and its many uses.

The Desktop

The Windows desktop is the backdrop for all your activity. You will note several icons (such as My Computer, Recycle Bin, and Network Neighborhood) on the desktop.

You may alter the appearance of your desktop, background displays, colors, resolution, color depth, and other display attributes by clicking the *right* mouse button and selecting Properties. Please refer to your Windows documentation for more information on customizing your desktop.

All current version of Windows allow you to click the right mouse button, thereby activating a list of frequently used commands. This list varies depending on the application in which you use the right-click feature. For example, to close an inactive application, you could right-click its box on the Taskbar and then click ***Close****.*

My Computer

Selecting My Computer opens a window containing graphical depictions of all drives on your computer and all network drives your computer is connected to. You will also see the Printers and Control Panel Folder. You may also see other folders such as the Dial Up Networking folder.

Selecting any drive's icon opens a window displaying the contents of that drive's root folder (remember that 'folders' and 'directories' are identical when discussing disk drives) and all folders contained therein. Clicking any sub-folders will, of course, open window(s) depicting the contents of the sub-folder(s) in question. You may open more than one drive, folder, or application at once. Note the functional similarity to the DOS CD and DIR commands. Following are some common functions and how to use My Computer to accomplish them:

- Moving files/folders: Open both the old and new file/folder locations. Within the old folder, select the file you wish to move by clicking on the file, holding the mouse button down, and dragging the file's icon into the window displaying the folder you wish to move the file to. Release the mouse button. This is the similar to using the DOS

COPY command followed by DELeting the file copy in the old location.

- Renaming Files/Folders: Open the folder containing the file/folder you wish to rename. Click once on the file's icon to select it. Wait a moment, then click on the file's/folder's name. You will see a cursor appear. Type in the new name and press [ENTER]. If you are renaming a file, be sure to type that file's three-character extension. This is similar to the DOS REN command.

- Copying Files/Folders: Use the same procedure as for moving files, above, but right-click and drag the file in question. When you release the button, select **`Copy Here`**. This is similar to the DOS COPY command.

- Deleting Files/Folders: Click on a file, and press [DEL]. Click **`Yes`** to confirm the file deletion. Deleting a folder deletes all sub-folders and all files in the deleted folder and sub-folder! This is the equivalent of the DOS DEL and DELTREE commands, except that Windows contains a safeguard in the form of the Recycle Bin (see below).

- Creating Shortcuts: Right-click on a file/folder/application and drag it to its new location (such as the Desktop). Release the mouse button and select **`Create Shortcut(s) Here`**. The icon will display a small check box and will rename itself "Shortcut to <filename>". You may click and drag this shortcut to move it anywhere you like, rename it, delete it, or copy it. Note that creating a shortcut is not the same as actually copying the file.

The Recycle Bin

Files deleted using DOS are gone unless you have recovery utilities to restore them. Windows, however, gives you a second chance. Double-click the Recycle Bin icon to open it and display all deleted files and folders. Right-click a deleted item, and then click **`Restore`** to return the file to its former location. Restoring folders also restores their sub-folders and all files contained therein.

Right-clicking the Recycle Bin icon and selecting **`Empty Recycle Bin`** empties the Recycle Bin. All files/folders in the Recycle Bin are lost permanently when you empty the Recycle Bin!

Launching Applications

Use the following procedure to launch most Windows applications where is not a desktop shortcut to the program in question:

1. Click **`Start/Programs.`**
2. Select the folder containing the application you wish to run by moving the mouse pointer over it. That folder's contents will then be displayed.
3. Move the mouse to highlight the application you wish to launch, and double-click. The application will open.

Closing Applications/Files/Folders/Windows

To close an application, either press [ALT]+[F4], or click the small X in the top right-hand corner of the application's window. Be sure to save your work before closing the application! Some applications will ask that you confirm your choice to exit and may prompt you to save your open files before exiting. Do not count on this feature to preserve your work!

In most Windows applications, you will see another X in the upper right-hand corner of the window containing a file opened within that application. Clicking the X will close the file but will not exit the application. Be sure to save your work before closing files!

Resizing Windows

Any type of window (such as file, application, or folder) may be resized by placing the mouse pointer over an edge of the window to be resized, waiting for the mouse pointer to change to a double arrow, and dragging to increase or decrease the window's size. Doing this on a corner will allow you to expand or contract the window diagonally.

Clicking the small underlined box at the top right-hand corner of a window will Minimize that window. You will no longer see the application or file that you minimized, but the open file, application, or folder will remain open.

Clicking the box in between the Minimize and Close buttons toggles the window between Full Screen and Window (partial screen) modes.

SECURITY

There are several ways to add various levels of physical and access-control security to your system to protect it from unauthorized access. Physical security involves placing the computer in an inherently safe location, e.g. in a secured building for example.

Access-control security centers around the use of passwords and user levels to allow users only the level of system access they need to perform their jobs. Windows contains numerous security features such as passwords, user-level access control (users may access more or less of the system and/or network depending on their user level), shared-level control (users having the same user level may not be able to access each other's network areas, for example), and system/network monitoring to detect unauthorized use. Many software packages also allow you to set up passwords to prevent access to your data as used within that specific application.

Please refer to your Windows or application-specific documentation, System Administrator, security personnel, or supervisor as appropriate for complete information regarding security issues, your possible exposure, and security measures appropriate to your use of your computer. Below are brief descriptions of two of the most common types of password protection:

Power-On Password

Most systems can be set up to use a password that must be entered before the system will boot up. This is one of the best ways to prevent unauthorized access because the operating system and files cannot be accessed without the password.

Setting your computer up to use a power-on password requires you to enter your computer's BIOS Setup. Please refer to your motherboard manual for the exact names, locations, and uses of security features contained in your BIOS code. General instructions on running BIOS Setup are located at the end of Chapter Three.

Screen Saver Passwords

If you only have minimal security concerns (such as keeping the children in your family from playing on your system), a simple screen saver password might be sufficient protection. This can be activated from the

Display section of the Windows Control Panel (all versions). Please refer to your Windows documentation for more information. Remember: this method is not secure! Your files could still be accessed easily by (for example) rebooting your system and running in DOS mode.

3 UPGRADING YOUR COMPUTER

This chapter covers replacing and/or upgrading your computer's components such as the CPU, memory, drives, and expansion cards. One of your computer's most powerful features is its total expandability using easily installed industry standard components. There are a number of ways you can purchase components to upgrade your system. ACMA recommends you consult your sales representative before acquiring any additional components to prevent possible incompatibilities or difficulties.

Some computer systems feature integrated components, e.g. various functions built into the motherboard itself. These integrated components may include video, sound, and networking capabilities. NLX and Micro-ATX form factor computers will tend to have integrated components, whereas AT and ATX computers will tend to have these functions carried out using expansion cards. Please refer to your motherboard documentation before performing upgrades to determine if your system features integrated components and, if so, how to upgrade those capabilities. You may need to disable the on-board feature and add an expansion card to handle the new functionality.

Before touching any type of motherboard, memory module, or expansion card, touch a grounded metal object (such as your computer's case while it is plugged in to its properly grounded electrical outlet) to discharge any static electricity you may have built up.

UPGRADING: GENERAL CONSIDERATIONS

The rapid pace of advancement in computer technology means that you will probably decide to upgrade your computer at some point. Upgrades fall into one of two categories:

- Adding new functionality: If your computer is incapable of doing something you need it to do (such as acting as a voicemail system), then adding a voice capable modem and software will add this new functionality to your computer. Adding new functionality tends to

reduce the amount of system resources available to perform tasks in general since, for example, the voicemail software occupies active memory and consumes CPU cycles. This issue is discussed in detail further in this section.

- Enhancing existing functionality: Upgrades such as adding RAM, a faster CPU, etc. serve to enhance the computer's ability to perform its current tasks. Enhancing existing functionality tends to increase the system resources available for any given task.

Please refer to the device-specific sections of this chapter for further discussions on the potential impact of adding different upgrades to your computer.

System Resources

Like any other device, a computer has certain limitations in the number of concurrent tasks it can perform. Every component of your system has limits: Your hard drives can store a certain amount of data, your RAM can store a certain amount of active data, and your CPU can process a certain number of instructions per second. Each component in your computer has its own limitations.

One key limitation is your computer's base 640Kb of RAM. No matter how much RAM you have in your computer, your ability to run programs, utilities, etc. is directly impacted by the amount of free 'conventional' (base 640Kb) RAM you have available. All programs, device drivers, and utilities require at least a small part of the available 640Kb. Clearly, this limits your computer's ability to perform multiple concurrent tasks. This limitation can be somewhat overcome by the use of memory management software such as Quarterdeck's QEMM or Qualitas' 386Max, to name two. Also, the amount of total RAM in your computer does greatly affect system performance.

Device Drivers

Virtually every component in your computer requires a *driver*, e.g. special software that enables the CPU and operating system to recognize and control the component. Modems, sound cards, printers, monitors, hard drive controllers, motherboard components, and other components all need device drivers in order to function. Some of these drivers are added in the form of programs that activate the component and then

remain in memory. These are known as Terminate & Stay Resident (TSR) programs.

Software included with your upgrade components usually installs all required device drivers. Please refer to the upgrade component's documentation for complete instructions on configuring your new component.

DOS Device Drivers

Most DOS drivers are invoked when the computer processes the CONFIG.SYS and AUTOEXEC.BAT files, which are two of your computer's critical startup files. For example, a CD-ROM drive might have the following lines inserted in CONFIG.SYS and AUTOEXEC.BAT:

- CONFIG.SYS: **`DEVICE=C:\CDROM\CDROM.SYS /D:MSCD0005`**
- AUTOEXEC.BAT: **`MSCDEX /V /D:MSCD005 /L:F`**

Windows Device D rivers

Windows will recognize components activated by DOS device drivers. Alternatively, Windows installs drivers for each component. These drivers may be located either on the Windows disks/CD or on media supplied by the component manufacturer. Each component you purchase will come with complete instructions for installing the component and configuring it to run under Windows.

Plug And Play

Many modern components are Plug and Play compatible. While older components such as modems required you to physically set such parameters as IRQ, base memory address, and DMA channel, Plug and Play allows for simple installation and configuration of all types of components. To use Plug and Play features, you must have both a Plug and Play component and a Plug and Play aware operating system such as Windows 95® or Windows 98®.

A typical Plug and Play component installation consists of powering down the computer, attaching the new component, and turning the computer back on. Windows will detect the new hardware, assign settings to it, and prompt you for either the Windows media and/or the

software that came with your component. Directions on setting up each component are found in the documentation accompanying the component you are installing.

Windows NT® Considerations

If your computer runs under Windows NT®, you must consider several things before upgrading your computer:

- No Plug and Play support: Windows NT® requires you to manually set the configuration of all components. Many components have jumpers that allow this, but some Plug and Play components cannot be physically adjusted.
- Limited hardware support: Windows NT® comes with a 'compatibility list' of supported systems, components, and peripherals. Refer to this list before purchasing any upgrade components. Alternatively, many components come with Windows NT® drivers. Be sure to check that your proposed upgrade will run under Windows NT® before purchasing your component. Your ACMA sales representative can help you with this.

REMOVING THE COVER

Before performing any upgrades, you must remove the computer's cover. To do so:

1. Turn off the power to your computer.
2. Disconnect the power cable.
3. Disconnect the peripheral cables (video, printer, mouse, and keyboard).
4. Use only the proper hand tools (screwdrivers) to prevent damage to your system.
5. Remove the retaining screws on the rear panel.
6. Facing the rear of the system. Hold on to the sides of the cover with both hands, and slide the cover towards you. You may need to tilt the cover up slightly to finish removing it. Set the cover and screws aside until you are done adding the new components.

7. When you are finished with your upgrade, replace the cover by following these steps in reverse order.

You must run BIOS Setup and/or the Windows hardware installation utility after most changes to your system's configuration. Please refer to the section in this chapter appropriate to the type of upgrade you are performing for further guidance.

UPGRADING THE CPU

Upgrading the Central Processing Unit (CPU) in your computer is one of the easiest ways to possibly increase its performance. Furthermore, CPU upgrades are normally quite straightforward. Most motherboards support CPUs of varying speeds. There are two basic methods of upgrading the CPU, depending on whether your CPU connects to the motherboard via a ZIF socket or slot. The method that applies to your computer depends on the type of processor in your computer. Please refer to the appropriate section below. After performing the CPU upgrade, be sure to follow the directions found in your motherboard documentation..

CPU Upgrade Considerations

Obviously, faster CPUs process instructions more rapidly than slower CPUs. Many people think that a faster CPU will increase system performance by the same overall percentage as the increase in CPU speed. This is not the case. Adding a CPU that is 50% faster than your current CPU will probably not increase your computer's performance by nearly 50%. Still, upgrading your CPU can greatly benefit your system depending on your circumstances. Before upgrading your CPU, consider the following items:

- Hard drives are the computer's slowest means of accessing most data: Except for floppies and some CD-ROMS, hard drives, which typically have access times of 11 milliseconds or more, are much slower than memory, which has access times of 70 nanoseconds to as little as 10 nanoseconds. Much of a computer's time is spent waiting for the hard drive to retrieve data. Upgrading your hard drive to a faster model is a sure way to vastly increase system performance. A hard drive that is 20% faster than another hard drive will cause a system performance increase of nearly 20% and perhaps more.

Please refer to the section "Upgrading Hard Drives" later in this chapter for further considerations regarding hard drive upgrades.

- Adding RAM can dramatically increase your system's performance: For example, a computer running Windows 95® that has 32Mb RAM will run many times faster than the same computer with only 8Mb or 16Mb RAM. In fact, all current versions of Windows benefit from up to 64Mb RAM and more depending on how you use the computer. Please refer to the section "Adding RAM" later in this chapter for further discussion regarding memory upgrades.
- If your computer spends significant time processing data where the hard drive remains unused, increasing the CPU speed is probably the best idea: Programs such as 3D graphics rendering programs require immense computations in order to render images, but do not require that data be obtained from the hard drive. In situations like these, upgrading your CPU might be the best way to boost system performance.
- Will your motherboard support your proposed upgrade? Most motherboards support a range of CPU types and speeds. Be sure to refer to your motherboard documentation to ensure CPU compatibility before commencing the upgrade.

Upgrade Procedure: x86, Pentium, Pentium Pro, AMD, and Cyrix CPUs (ZIF socket)

The Intel x86, Pentium, and Pentium Pro CPUs, along with AMD and Cyrix CPUs, use a Zero Insertion Force (ZIF) socket on the motherboard to hold the CPU. Upgrading these CPUs is a simple procedure.

Observe the static electricity precautions. Take care when manipulating the CPUs so as not to bend or break the CPU pins or ZIF lever.

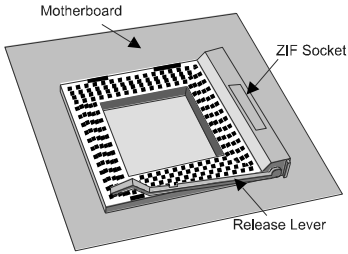


Figure 8: ZIF Socket

Before beginning, double-check your motherboard's documentation to ensure that your motherboard supports your proposed upgrade. Be sure to read the entire manual, especially where it mentions motherboard jumper settings. The procedure below assumes that you have already successfully removed your computer's cover. Note that come newer heatsink/fan combinations attach directly to the ZIF socket. These must be removed prior to removing the CPU.

1. Locate the CPU on the motherboard.
2. If necessary, clear any wiring or other component blocking access to the CPU. Read the section below on "Adding Expansion Cards" if you need to temporarily remove any of your computer's expansion cards to access the CPU.
3. Disconnect the heat-sink/fan combination from the computer's power supply. Trace the wires back to their plastic connector and carefully pull the connectors apart.
4. Look for a retaining clip or other device that might restrict the movement of the ZIF socket lever and remove it.
5. Slowly lift the lever on the side of the ZIF socket until it is vertical. The CPU should now gently lift out of the socket.
6. Lift the CPU and heat-sink/fan combination straight up and out of the ZIF socket.
7. Install the heat-sink/fan on the new CPU.

8. Place the new CPU on the ZIF socket. The pins on some CPUs are configured so that they will only install one way. Be sure that you orient the new CPU correctly in the ZIF socket to avoid damaging it.
9. While pressing down gently on the CPU, close the lever on the ZIF socket slowly. This should lock the CPU into place.
10. Change the jumpers on the motherboard (if necessary - Refer to your motherboard documentation).
11. Replace the cover, reconnect all cables, and start your system.

Upgrading Pentium II CPUs (Slot 1)

Unlike its predecessors, the Pentium II CPU uses a cartridge containing the CPU/heat sink-fan/cache RAM combination. Therefore, you cannot upgrade a Pentium/Pentium Pro/AMD/Cyrix CPU to a Pentium II unless you also upgrade the motherboard. This cartridge slides into a retention module that secures the cartridge to the motherboard.

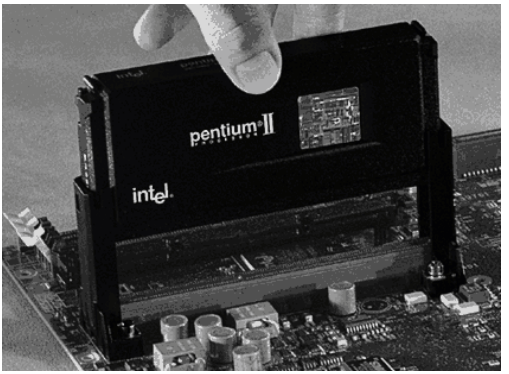


Figure 9: Pentium II CPU

Use the following procedure to upgrade a Pentium II CPU:

1. There is a sliding clip running along the top of the CPU cartridge that retains the cartridge in place. Slide it sideways until it comes off, and set it aside.
2. Locate the latches on the sides of the CPU cartridge near the top. Move the latches out to release the cartridge.

3. Grasp the cartridge firmly and slide it straight out of the retaining assembly. Set the old CPU cartridge aside.
4. Slide the new CPU straight into the slot until it contacts the motherboard, then push gently yet firmly until the cartridge presses into place in the slot.
5. Secure the latches on the sides of the CPU.
6. Slide the clip back into place along the top edge of the CPU cartridge.
7. Change the jumpers on the motherboard (if necessary - Refer to your motherboard documentation).
8. Replace the cover, reconnect all cables, and start the system.

Upgrading Celeron CPUs (Slot 2)

Intel's Celeron line of processors shares the same upgrade procedure as the Pentium II. Please refer to the section "Upgrading Pentium II CPUs", immediately above.

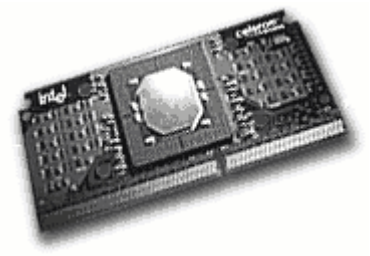


Figure 10: Celeron CPU

Note that, unlike the Pentium II, the Celeron's components are exposed. Be sure to grasp the CPU card only at the edges and to follow static electricity precautions.

UPGRADING SYSTEM MEMORY

Adding RAM can provide your computer the greatest overall performance increase, especially on computers running Windows. Both current versions of Windows benefit greatly from additional RAM. For example, a computer with 32Mb RAM will run dramatically faster than an identical computer with 16Mb RAM or less. In fact, Windows runs best when the computer has 64Mb RAM or more. This does not

necessarily mean that all computers need 64Mb RAM: Many home computers run perfectly well with 16Mb or 32Mb RAM since they typically perform less demanding tasks than business systems.

Increased RAM means that your computer can run more applications simultaneously, and that those applications will run faster. The reason for the increase in speed is primarily because Windows uses virtual memory, e.g. Windows sets aside space on the hard drive to use to emulate RAM. More physical RAM means that Windows will reduce its reliance on the much slower virtual memory, resulting in faster system performance.

ACMA computers may contain a variety of motherboards depending on several variables including any specific customer requests. Many motherboards have different requirements for memory sizes, types, and quantities. Please refer to your motherboard documentation for complete information on memory requirements and the location of memory banks.

There are several important considerations when upgrading RAM:

- Type of memory module required: Most x86, Pentium, AMD, and Cyrix-based computers use 72-pin SIMM modules which must be installed in pairs, e.g. two identical modules must be inserted into one bank. Some of these computers also support 168-pin DIMM modules, and still others only accept DIMM modules. Pentium II based computers typically use 168-pin DIMM modules.
- Type of RAM required: There are several different types of RAM available, including Fast Page (usually 70ns or 60ns), Extended Data Out (EDO - 60ns), and SDRAM (10ns). Pentium based computers and their AMD/Cyrix counterparts can typically use either Fast Page or EDO memory, although EDO is highly recommended. Pentium II based computers typically require SDRAM, and require that the DIMM modules be equipped with EEPROM chips. Consult your motherboard documentation and your ACMA sales representative to determine the best choice for your system.
- Availability of RAM banks: If your motherboard has a free RAM bank available, you may obviously use that to expand the amount of RAM. If, however, all memory banks are filled, you will need to remove some RAM prior to adding new SIMM/DIMM modules.

Installing Memory Modules

This section elaborates on the types of memory available and provides instructions on adding RAM to your computer. Replacing memory modules is a relatively easy task, yet use caution when working with RAM to avoid damaging the delicate modules and motherboard connectors. All memory modules are designed to fit in the socket one way: It is impossible to install a module backwards. Small holes are present on both ends of each memory module; use these to snap the memory module into the socket.

Do not attempt to force memory modules into or out of the sockets! Be especially careful not to damage the retaining clips that hold the memory modules in place, since they are soldered on the motherboard and not replaceable. Also, always take precautions against static electricity, as outlined at the beginning of this chapter.

72 Pin SIMMs

As stated above, most Pentium/AMD/Cyrix based systems use 72-pin SIMMs. Motherboard designs vary: most require two SIMMs per bank, and a very few accept one SIMM per bank (making upgrades easier). Motherboards using two SIMMs per bank require that both SIMMs in a given bank be identical. 72-pin SIMMs are available in various combinations of the following:

- **Capacity**: 512KB, 1MB, 2MB, 4MB, 8MB, 16MB, 32MB
- **Speeds**: 60 and 70ns
- **Parity**: 36 bit SIMMs include 4 parity bits
- **Non-Parity**: 32 bit SIMMs
- **Fast Page Mode or EDO (Extended Data Out) SIMM**
- **Error Checking & Correcting (ECC)**

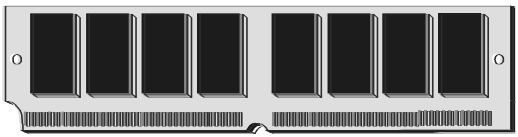


Figure 10: 72 Pin SIMM

Use Steps 5-8 of the following procedure to insert a 72-pin SIMM into your motherboard's memory bank if you do not first need to remove old RAM. If you do need to remove old RAM to accommodate the new, follow the entire procedure:

1. Touch a grounded metal object to discharge any static electricity.
2. Find the metal or plastic clips holding the memory module in place.
3. Using both thumbs, gently slide the clips away from the memory module, and pull the memory module forward.
4. Gently lift the memory module out of the socket.
5. Insert the new memory module firmly at a 45-degree angle in the socket (see Figure 11).
6. Gently push the memory module down and rotate upwards towards the retaining arms of the socket.
7. The memory module should gently snap into place. Do not attempt to force the modules into the sockets, as this will damage the sockets and the modules.
8. Replace the cover on your computer, reconnect all cables, and start the system. Verify that the computer recognizes the correct amount of RAM. You may need to run BIOS setup to do this; consult your motherboard documentation.

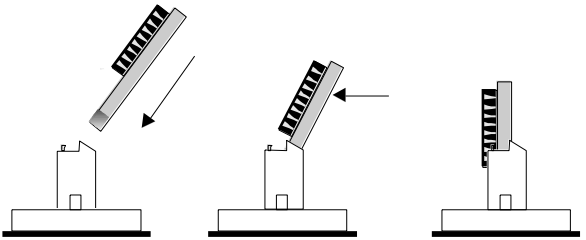


Figure 11: SIMM installation

168 Pin DIMMs

DIMM modules are available in various variations of the parameters listed below:

- **Capacity**: 8MB, 16MB, 32MB, 64MB, 128MB, 256MB

- **Speeds**: 10, 15, 40, 50, 60, and 70ns
- **Parity**
- **Non-Parity**
- **Fast Page Mode or EDO (Extended Data Out) DIMM**
- **Error Checking & Correcting (ECC)**

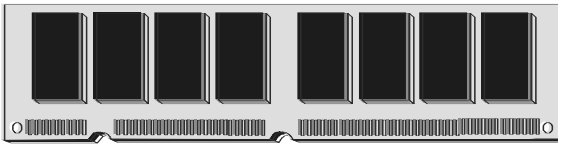


Figure 12: 168 Pin DIMM

Use Steps 3-4 of the following procedure to insert a 72-pin SIMM into your motherboard's memory bank if you do not first need to remove old RAM. If you do need to remove old RAM to accommodate the new, follow the entire procedure:

1. Touch a grounded metal object to discharge any static electricity.
2. Open the retaining clips at the ends of the DIMM socket, Grasp the DIMM firmly, and lift it straight up and clear of the socket.
3. Insert the new memory module firmly by aligning it with the socket and pressing firmly straight down. Be sure that the DIMM module is properly oriented.
4. Ensure that the retaining clips at the ends of the DIMM socket close to retain the module in place.
5. Replace the cover on your computer, reconnect all cables, and start the system. Verify that the computer recognizes the correct amount of RAM. You may need to run BIOS setup to do this; consult your motherboard documentation.

ADDING OTHER DRIVES

There are two basic types of drives:

- Drives requiring external accessibility such as a floppy, CD-ROM, tape back-up, or any type of drive requiring you to insert media.

- Drives that do not require external accessibility such as hard drives, which do not require any user intervention

Installing drive hardware is very simple and virtually identical for all drives. Device driver and support application installation can vary widely. This section provides an overview of drive installation procedures. The following diagram depicts a typical drive installation.

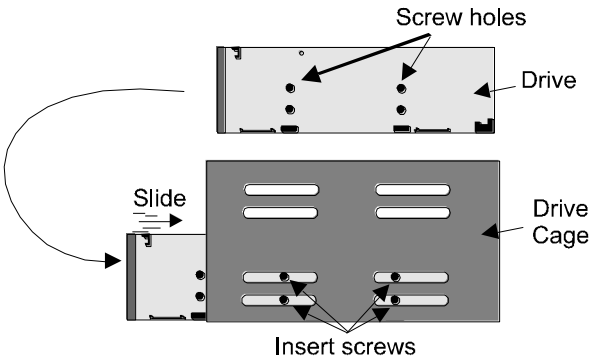


Figure 13: Installing a drive (side view)

Installing a Floppy Drive

Your ACMA computer includes at least one floppy drive. It is very uncommon for modern computers to have more than one floppy disk drive. Use the following procedure to install a new floppy drive:

1. Remove your computer's cover and determine the best location for the drive you are installing. There may be a hard drive located behind the bezel (or cover) of a drive bay. Always open your computer before committing to any upgrade to ensure there is room to add your new component.
2. Remove the bezel from the front panel covering the slot you intend to use. These typically snap into place.
3. Install the rails or mounting brackets (if necessary) onto the drive, slide the drive into the drive bay, and attach four mounting screws (see figure 13). Most drive cages have slots for the mounting screws,

allowing you to precisely position your new drive flush with the front of the case.

When installing a 3.5" drive in a 5.25" drive bay, you may need to purchase an adapter kit to provide you with a front bezel adapter and proper mounting brackets. This kit is available at most computer stores.

4. Attach one of the power cables from the power supply to the keyed connector on the drive. Some 3.5" floppy drives use a smaller connector than most hard drives and CD-ROMS. Most computer cases already have suitable power cables available. If your does not, you may purchase an adapter from your ACMA sales representative.

If you do not have an available power cable, you can purchase a "splitter" that connects to one of the cables being used and provides you with a free power lead. Please contact your ACMA sales representative.

5. Find the floppy ribbon cable, distinguishable by twisted wires between the two drive connectors. Attaching the middle connector to your drive causes the system to designate the drive as Drive B. Attaching the end connector to your drive causes the system to designate your new drive as Drive A. Note the location of Pin 1 on the drive's connector, and attach the ribbon cable to the drive. The colored wire on the cable should be on the same side as Pin 1 on the connectors of both the drives and the motherboard. See Figure 14.

Figure 14: Floppy Drive Cable

6. Replace the system cover, reconnect all cables, and turn your system on.

7. Enter BIOS Setup. Refer to your motherboard documentation for details on entering and using SETUP. Follow the directions in your motherboard documentation for adjusting your computer's CMOS to reflect the new drive.

8. Save your changes and restart the system. Windows may install some additional software if necessary. If you are prompted to do so, insert your Windows disk/CD-ROM to allow Windows to copy the needed drivers onto your hard drive.

To remove a floppy drive, perform the previous instructions in reverse order.

Installing a Hard Disk Drive

Most ACMA systems ship with IDE hard drives, although ACMA will include SCSI drives if you order your computer to be so equipped. Since IDE hard drives comprise the vast majority of drives currently in use, this manual will provide instructions on upgrading IDE hard drives only. Please refer to your SCSI controller documentation and your hard drive documentation if you adding a SCSI drive.

Installing a second hard disk drive is very similar as adding a second floppy drive. Two IDE hard drives may share the same controller. This is accomplished by connecting two hard drives to different connectors on the same cable. Note that IDE cables are virtually identical to floppy cables, except that IDE cables lack the twisted wires between drive connectors. Pin 1 is designated by a colored stripe on the cable (see Figure 15).

Figure 15: IDE cable

Please read the hard drive manufacturer's instructions and your motherboard manual before attempting to install a hard drive. Also, make a backup copy of your current hard drive's contents before you begin.

IDE hard drives have jumpers that must be properly configured before installing the drive. While the layout and configuration of jumpers varies, many IDE hard drives use the jumper layout depicted in Figure 16.

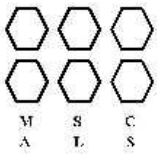


Figure 16: Hard drive jumpers (typical)

In the above example, MA = Master, SL = Slave, and CS = Cable Select. Placing a jumper across the pins labeled MA causes the system to designate that drive as the master drive, and so forth. Use of the CS position is not recommended. Typically, the Master drive is connected to the end of the cable, the Slave to the middle connector. Again, consult your hard drive and motherboard documentation for details on upgrading your hard drive(s).

Use the following procedure to install an IDE hard drive. There is additional discussion about setting up hard drive following this procedure:

1. Make all necessary changes (jumpers and/or switches) to the drive as outlined above. Typically, this will involve setting the jumpers on your old hard drive to MA, and those on the new drive to SL.
2. Install the rails or mounting brackets (if necessary) onto the drive, slide the drive into the internal drive bay, and attach the mounting screws (see Figure 13).
3. Attach the power cable to the connector on the drive.
4. Connect the hard drive cable to the appropriate connector. This will be either the existing IDE cable or a new cable that will connect to the motherboard's secondary IDE controller. Alternatively, your computer may use a controller card plugged into the board's ISA or PCI expansion bus. Pay close attention to the position of Pin 1 on both the drive and the cable. Pin 1 is designated by a colored stripe on the cable (see Figure 15). On the drive, Pin 1 is usually on the side of the connector closest to the power connector. Check your hard drive documentation.
5. Replace the system cover and reconnect all cables. Turn your computer on.
6. Enter BIOS Setup. Refer to your motherboard documentation for details on entering and using SETUP. Follow the directions in your

motherboard documentation for adjusting your computer's CMOS to reflect the new hard drive. Most new motherboards will auto-detect your new drive. Some motherboards will even detect IDE drives 'on the fly, e.g. it is not necessary to go into SETUP. Again, refer to your motherboard documentation.

7. Save your changes and restart the system. Windows may install some additional software if necessary. If you are prompted to do so, insert your Windows disk/CD-ROM to allow Windows to copy the needed drivers onto your hard drive.

8. Run the DOS "FDISK" command to create an active DOS partition. FDISK also allows you to create partitions, e.g. to segment one physical hard drive into two or more 'logical' drives. For example, a primary hard drive divided into three partitions will have the drive letters C, D, and E assigned to it. There are some exceptions to this. Please refer to your MSDOS documentation for complete details on using FDISK.

9. Use the DOS "FORMAT" command to high level format the drive. If you intend the new hard drive or drive partition being formatted to serve as the main (bootable) drive, you will need to use the /s switch when FORMATting a hard drive, e.g. `format c: /s [ENTER]`. Otherwise, use the regular format command, e.g. `format c: [ENTER]`. You will be asked to confirm your choice. When the drive is formatted, you will be prompted to enter a volume label. This is optional.

Improper use of the FDISK and FORMAT commands can permanently erase data! Read your DOS documentation before attempting to use these commands or any other that could result in lost data.

Many hard drives ship with 'optimization' software. We typically recommend that you not use these applications, as they may cause problems with your operating system and since these applications, in some cases, cannot be deleted from the hard drive once installed.

10. To remove the hard drive, follow the above procedure in reverse order.

Hard Drive Fundamentals

All IDE hard disks are low-level formatted by the manufacturer. In some cases, they ship already bootable. Please refer to the manufacturer's manual before installing and configuring your hard drive.

Formatting a hard drive separates the storage media into numbered clusters. A useful analogy is to think of the hard drive as a box divided into many compartments, with each cluster representing one compartment. The larger the hard drive, the bigger the box. The number of compartments, however, remains fairly constant. It is obvious that larger hard drives will have larger sized clusters. Each cluster can only hold one file, since the list of file locations allows only one entry per cluster. Large files may occupy several clusters. Small files waste space, since they may occupy only a small fraction of the cluster.

A typical hard drive has 65,536 clusters. A 2Gb drive will therefore have clusters that are 32,768 bytes in size (32768x65,536). Small files such as AUTOEXEC.BAT (typically a few hundred bytes) therefore waste large amounts of drive space. This wastage is termed 'slack space'. MSDOS and older versions of Windows 95® are limited to hard drives of 2Gb or less. Larger hard drives require partitioning into logical drives of less than 2Gb each in order to be recognized by these older operating systems. This method of formatting hard drives is called FAT or FAT16.

Newer versions of Windows 95® (commonly called Windows 95 OSR2®), Windows 98®, and Windows NT 3.51 and 4.0® support updated hard drive formats that allow up to 4,000,000 clusters on a hard drive. The box that once held 65,536 compartments can now hold 4,000,000. A typical hard drive formatted using the newer systems has clusters of only 4,096 bytes, dramatic savings over the old 32,768 bytes. Drives of up to 2Tb (terabytes) may be formatted using the new systems. These systems are called FAT32 (Windows 95 OSR2® and Windows 98®), and NTFS (Windows NT 3.51 and 4.0®). If you use one of these newer operating systems and are asked if you wish to enable 'large drive support' when running FDISK, select **Yes**.

If you are upgrading from an older operating system to one that supports FAT32 or NTFS, you can use a utility (CVT.EXE) available on the World Wide Web at http://www.dentalaw.com/freestuff/cvt.zip to convert your existing hard drive partition. Download the file and use a utility such as WinZip to extract CVT.EXE from CVT.ZIP. Restart your computer in MS-DOS mode, change to the directory where CVT.EXE is located, and type `CVT <drive> [ENTER]`, where `<drive>` is the letter of the drive you wish to convert, for example `CVT C: [ENTER]`. This will convert your FAT16 drive to a FAT32 drive while preserving all data on the drive. Still, it is always a good idea to make backups of your data before performing any hard drive operations.

Please refer to the section "Operating System Fundamentals" in Chapter Two for a discussion about disk drive directories, their functions, and the need to ensure that your directory system remains organized. Again, disk drive directories are the equivalent of filing cabinets.

ACMA Computers strongly recommends that you adopt a very organized directory system on all your hard drives and floppy disks. Keep your data separate from your applications. This will help prevent misplacing data, facilitate upgrades and changes to applications, simplify backup procedures, and guard against accidental data erasure.

Replacing Your Hard Drive

The above hard drive upgrade procedure assumes that you are adding an additional hard drive to your computer and that you are not planning to remove the hard drive containing your operating system and applications. If you wish to move the contents of your existing hard drive to a new drive and then retire your existing drive, you will need to use the following procedure:

1. Follow the hard drive upgrade procedure outlined above. Make sure your new hard drive is set as the Slave (SL) drive.
2. Use a program such as DriveCopy to transfer the contents of your existing hard drive to the new one. DriveCopy will make an exact duplicate of your old hard drive. Partitions on the old hard drive will be copied to the new hard drive and retain their proportions. For

example, copying a 2Gb drive that has a 500Mb partition to a 3Gb drive will result in the 3Gb drive having a 750Mb partition. Refer to the program documentation for complete information on using your chosen drive copying software.

3. Remove your old hard drive according to the above procedure.
4. Remove your new hard drive according to the above procedure.
5. Install your new hard drive in your computer using the above procedure. Make sure you set the jumpers to Master (MA) and that you do NOT run FDISK or FORMAT.

Backing Up Your Work

Modern computers and data storage media are extremely reliable, and the chances of component failure are minimal. Still, the possibility of data loss is a very real one. Voltage fluctuations, brownouts, blackouts, component failure, system lockup, and human error can cause data loss. Of these, human error is the single largest cause of accidental data loss. It is virtually certain that you will experience a loss of data at some point in your computing history. If you take proper precautions, data loss should be no more than a minor inconvenience. Without the proper precautions, data loss can be catastrophic, sometimes irreparably so. Protect your data - Make frequent backups!

There are many products available to ensure the preservation of your data such as removable disk drives, tape drive, CD-R and CD-RW drives, and automated backup software. Your ACMA sales representative can help you choose the right option to fit your needs.

Installing a CD-ROM Drive

1. Remove your computer's cover and determine the best location for the drive you are installing. There may be a hard drive located behind the bezel (or cover) of a drive bay. Always open your computer before committing to any upgrade to ensure there is room to add your new component.
2. Remove the bezel from the front panel covering the slot you intend to use. These typically snap into place.
3. Configure the jumpers on your CD-ROM drive. Most CD-ROM drives have the same jumper configuration as IDE hard drives (see

Figure 16). If the CD-ROM drive is the only drive attached to a particular controller, its jumpers should normally be set to a 'neutral' position or to MA (Master). The jumpers should be set to SL (Slave) if the CD-ROM is being attached to the same controller as a drive designated Master. Please refer to your CD-ROM documentation for complete information on properly configuring your CD-ROM jumpers.

4. Install the rails or mounting brackets (if necessary) onto the drive, slide the drive into the drive bay, and attach four mounting screws (see figure 13). Most drive cages have slots for the mounting screws, allowing you to precisely position your new drive flush with the front of the case.

5. Attach one of the power cables from the power supply to the keyed connector on the drive.

If you do not have an available power cable, you can purchase a "splitter" that connects to one of the cables being used and provides you with a free power lead. This item can be found in most computer stores.

6. Depending on the type of interface on the CD-ROM drive (IDE, SCSI, or proprietary), connect the cable to the CD-ROM drive and the appropriate controller. This might be your computer's secondary IDE adapter, a SCSI adapter, or a sound card equipped with an IDE or SCSI controller. Pay close attention to the position of Pin 1 on both the drive and the cable. Pin 1 is designated by a colored stripe on the cable (see Figure 15). Some CD-ROM cables do not include a middle connector for a second device; these cables are functionally identical to IDE hard drive cables.

When installing an IDE CD-ROM in a system with IDE controllers integrated into the motherboard, connect the CD-ROM to the secondary IDE controller to avoid adversely affecting your hard drive's performance

7. Attach the audio cable included with your CD-ROM to the audio connector on the CD-ROM. Connect the other end to the CD audio input on your sound card. Please refer to your CD-ROM and sound

card documentation for more information on connecting CD-ROM audio cables.

8. Replace the system cover, reconnect all cables, and turn your computer on.

9. Install the necessary DOS and/or Windows software drivers and/or change the CMOS settings as required by the CD-ROM you are installing. Refer to your CD-ROM documentation.

ADDING EXPANSION CARDS

Many expansion cards are available to expand your computer's functionality. Most computer users will purchase additional expansion cards, either to replace older cards in their systems or to add new functionality to their computers. Always remember to ground yourself before working with any of your computer's components to avoid damage caused by static electricity.

Expansion Card Buses

Computers use five primary types of buses, e.g. interfaces between the motherboard/chipset and expansion cards:

- ISA: The oldest of the bus types, ISA remains in use by the majority of expansion cards available today. The ISA bus runs at 8Mhz with an 8-bit data path, which is suitable for cards such as modems, sound cards, and TV tuner cards. Video cards, network interface cards, and SCSI adapters benefit from the use of other, higher speed buses.

- EISA: EISA expands on the classic ISA architecture. This bus uses a 16-bit data path and operates at 14Mhz. Most older video cards and many modern sound cards use the EISA bus.

- VLB: This bus runs at 33Mhz with a 32-bit data path. This bus type is primarily found in 486-based computers, although some Pentium-based systems incorporate VLB slots on the motherboard. VLB video cards are much faster than their ISA/EISA counterparts. There are few (if any) VLB cards available today.

- PCI: The standard for Pentium computers (and some high-end 486 systems), the PCI bus operates at speeds of 50,60,66,75,83, or even 100Mhz depending on the CPU speed and chipset capabilities. Most

modern network interface cards, SCSI adapters, video cards, etc. use the PCI bus architecture, which features a 32 or 64-bit data path.

- AGP: AGP is the latest revolution in bus architecture. AGP runs at the same speed as the PCI bus, however the AGP slot's direct connection to the Pentium II CPU and its MMX ® extensions combined with its 128-bit data path make the AGP port as much as 200% faster than an otherwise identical PCI video card.

Types of Expansion Cards

Expansion cards are available for practically any purpose imaginable. Some examples of expansion cards are:

- VGA display cards
- SCSI controllers
- I/O cards (serial and parallel ports)
- Internal fax/modem cards
- Sound Cards
- Network Interface Cards

Some peripheral devices come with their own expansion cards. Examples include:

- Scanners
- CD-ROM drives
- Tape Back up drives
- PCMCIA drives

The basic procedure for installing expansion cards is the same regardless of the exact expansion card being installed. Most cards, however, have unique methods of installing device drivers and applications that use the card. Consult the card's accompanying documentation for information.

Since Windows 95 and Windows 98® support Plug and Play, much of the need for users to configure expansion card settings such as IRQs, I/O port addresses, and DMA channels is eliminated. Still, you should be familiar with the significance of these settings, especially when installing

non Plug and Play components, or when using a non Plug and Play operating system such as DOS. Please refer to "Configuring Expansion Cards" later in this section for further details about expansion card settings.

Installing Expansion Cards

Before purchasing an expansion card, make sure that your motherboard or riser board (see below) has an empty expansion slot of the correct type (ISA or PCI) to take the new card. Obviously, this is not a consideration in cases where you are replacing an existing card with a newer model.

Form Factors

Most desktop computers conform to the AT, ATX, Micro ATX, or NLX form factor. A form factor specifies such details the size and shape of the motherboard and the location of expansion slots, ports, etc.

AT form-factor computers are primarily distinguished by the fact that the serial and parallel ports are attached to one or more expansion slot covers (see Figure 17) in the rear of the computer case. They connect to the motherboard via ribbon cables similar in appearance to floppy or IDE cables. A consideration when adding expansion cards to an AT form factor computer is whether there are enough expansion slots in the rear of the computer to accommodate your proposed upgrade.

ATX and Micro ATX form-factor computers have all ports (serial, parallel, USB, keyboard, mouse) integrated directly onto the motherboard. This generally makes adding expansion cards easier, since there can never a situation where the motherboard has sufficient expansion slots, but there are no slots available on the case due to ports.

The NLX form factor is similar to ATX in that all ports are integrated directly onto the motherboard. The NLX form factor is designed such that the computer occupies a minimum of space on a desk. Thus, expansion cards do not plug directly into the motherboard; a riser card containing expansion slots plugs into the motherboard, and all expansion cards plug into the riser card. Otherwise, installing expansion cards in NLX computers is identical to installing cards in AT/ATC computers.

Micro ATX and NLX form factor computers may have certain functions (video, sound, and networking) integrated on to the motherboard. If you

have an NLX or Micro-ATX computer, refer to your motherboard documentation for information on which functions are integrated onto the motherboard and how to upgrade that functionality prior to adding expansion cards.

Configuring Expansion Cards

Always refer to your expansion card documentation when installing an expansion card. This documentation details how to set the card's configuration (if necessary). This section provides a brief explanation of expansion card and system settings.

Hardware Interrupts

Many computer components including most expansion cards use hardware interrupt request lines (IRQs). Upon receiving an interrupt request, the CPU drops what it is doing and attends to the interrupt.

Motherboards have two 8524 interrupt processing chips. Old motherboards only had one 8524 chip. When expanding technology rendered 8 interrupts insufficient, the second 8524 was added to bring the total number of interrupt request lines to 15 (the second or 'cascade' 8524 uses an interrupt on the primary 8524). IRQ processing is hierarchical, e.g. each interrupt is assigned a different priority. IRQs of higher priority take precedence over lower-priority interrupts. Priority assignments are as follows: 0,1,2, 9, 10, 11, 12, 13, 14, 15, 3, 4, 5, 6, 7, and 8.

Pressing a key on the keyboard causes IRQ1 to tell the microprocessor to stop what it is doing and process the keystroke. When the task is complete, the processor resumes working on the previous task.

The following table displays standard interrupt assignments. Note that these may vary depending on your computer's configuration. PCI cards have the ability to share IRQs. Most graphics cards do not require interrupts.

Interrupt Number	Function/Assignment
NMI (Non-Maskable Interrupt)	Reports Parity, Microprocessor, or Adapter card errors
0	System Timer
1	Keyboard

Interrupt Number	Function/Assignment
2	Cascade IRQ (VGA and NIC)
3	COM2 (Serial Port 2) or COM4. If COM2 or COM4 are not present, then IRQ 3 is available
4	COM1 (Serial Port 1) or COM3. If neither COM1 nor COM4 are present, IRQ 4 is available.
5	LPT2 (Parallel Port 2). If LPT2 is not installed, this IRQ is available. LPT1 sometimes is assigned to IRQ 5.
6	Floppy Disk Interface
7	LPT1 (Parallel Port 1). LPT1 may sometimes be assigned IRQ 5.
8	Real Time Clock
9	Cascade from IRQ 2
10	Available
11	Available
12	Available
13	Coprocessor
14	Primary IDE Disk Interface
15	Secondary IDE Disk Interface - If not installed or not enabled, IRQ 15 is available

I/O Port Addresses

The CPU uses Input / Output (I/O) port addresses much like telephone numbers, making calls to other devices. The numbering system for I/O port addresses looks like a memory map, however it is merely a method to access external devices.

Any part of the computer's circuitry that the CPU requires access to is assigned an I/O port number. I/O port numbers cannot be shared. There are 65,536 ports ranging from 0000h to FFFFh. The chart below identifies some of the devices that have pre-assigned I/O port numbers. Your computer's configuration may vary.

Base I/O Address	Device
000-0FF	DMA and IRQ Register, programmable interval timer
1F0-1F8	Fixed Disk

Base I/O Address	Device
200-207	Game I/O
278-27F	LPT2 (Parallel Port 2)
2E8-2EF	COM4 (Serial Port 4)
2F8-2FF	COM2 (Serial Port 2)
300-31F	NIC (Network Interface Card)
360-36B	PC Network Address
378-37F	LPT1 (Parallel Port 1)
380-3F8	SDLC, Bisynchronous
3A0-3AF	Bisynchronous (primary)
3B0-3BF	Mono display & printer adapter
3C0-3CF	EGA/VGA
3D0-3DF	CGA/MCGA
3E8-3EF	COM3 (Serial port 3)
3F0-3F7	Floppy Diskette Controller
3F8-3FF	COM1 (Serial port 1)

DMA Channels

Some devices use Direct Memory Access (DMA) channels read or write directly to memory, bypassing the CPU in order to achieve high-speed data transfer. DMA channels cannot be used by more than one operating device at a time. There are eight DMA channels numbered 0 through 7. DMA 4 cascades channels 0 through 3 to the CPU. Channels 0 through 3 handle 8-bit data transfers, while channels 5 through 7 handle 16-bit data transfers. DMA channel assignments are typically as follows:

DMA Channel	Use
(Low order DMA 8-bit)	
0	Reserved
1	Reserved
2	Hard Disk
3	Reserved
4	Cascade for 0-3
(High Order DMA 16-bit)	
5	Reserved
6	Reserved
7	Reserved

Expansion Card Installation Procedure

The following procedure is the same for all expansion cards. Still, it is always a good idea to consult the documentation that comes with your expansion card.

1. Disconnect all cables, then remove the case cover.
2. Make all necessary configuration changes to the board (setting the jumpers and/or switches). Again, consult your documentation.
3. Remove the screw holding the expansion slot cover located in the rear of the system.

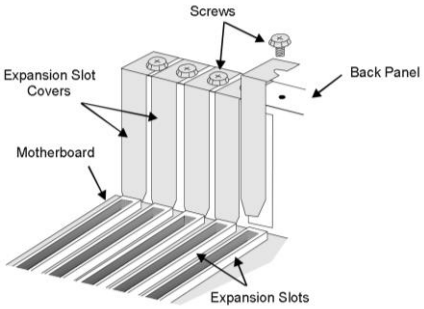


Figure 17: Expansion Slot Cover

4. Guide the board into the expansion slot, and press gently yet firmly to make sure the card's edge connector seats in the expansion socket. Secure the board to the system unit using the screw you took out when removing the expansion slot.

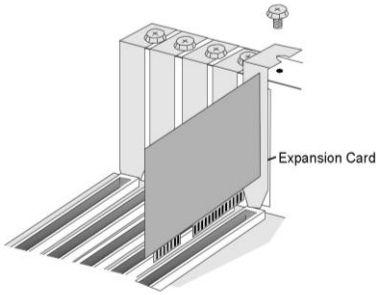


Figure 18: Installing Expansion Card

5. Replace the computer's cover, reconnect the cables, and turn on your computer.
6. Follow the directions in your card's documentation to set up all necessary device drivers, supporting software, and utilities.

ADDING USB COMPONENTS

The new Universal Serial Bus (USB) protocol is truly revolutionary. USB devices plug directly into USB ports, and may be plugged and unplugged at will, even when the computer is running.

USB devices are Plug and Play compatible: Merely plug in your USB device, install the drivers per the directions included with the device, and begin enjoying the added functionality immediately with little or no configuration process and no need to reboot your computer. Once the drivers are installed, you can plug and unplug your USB devices at will.

Many devices are either available for USB or will be shortly. The list includes digital cameras, printers, joysticks, scanners, and others.

UPGRADING SOFTWARE

Upgrading software is usually a simple procedure. Follow the directions in your software documentation to upgrade software. The one major consideration when upgrading software is the new version's impact on your computer's resources. Most newer versions of software titles require greater percentages of system resources in order to run. Further, many

newer software titles require more advanced hardware components than their predecessors. You should always weigh the total impact of software upgrades before proceeding with the upgrade.

UPGRADING YOUR OPERATING SYSTEM

The decision to upgrade your operating system should not be made lightly. Each operating system is designed for specific purposes and thus has distinct advantages and disadvantages for any given situation. Further, operating systems vary greatly in their hardware requirements. Be aware that listed minimum requirements are truly minimum; while the operating system will run on minimally equipped machines, system performance will not be optimal.

Please refer to your Microsoft documentation for more information on upgrading your operating system.

BIOS SETUP

It is impossible to describe how to use BIOS Setup in detail, since most BIOSs have different features and user interfaces. This section provides a brief overview of using BIOS Setup and some of the features common to most BIOS Setup formats.

Entering Setup

While the computer is running its initial checks, press the appropriate key to enter SETUP. Most computers require you to press [DEL], however many use [F1]. Some systems even use key combinations such as [CTRL]+[ALT]+[S]. Please refer to your motherboard's documentation for complete details on entering and using SETUP.

Some Typical BIOS Features

The SETUP program is a menu driven program used to define your system's configuration:

- System date and time: Allows you to set the system clock. This can also be set using your operating system.
- Memory size: Most motherboards auto-detect system RAM. Still, it is a good idea to check that your computer's BIOS recognizes the correct amount of memory

- IDE Detect: Most modern motherboards automatically detect IDE devices connected to their on-board IDE controllers without user intervention. Some require you to enter BIOS Setup and run the IDE Detect routine in order to detect IDE devices. Older motherboards may require you to manually input your drive(s)' parameters.
- Floppy Disk: Most motherboards require you to manually input the type of floppy drive(s) in your system.
- Cache RAM: Allows you to enable or disable the external memory cache. Enabling the cache increases system performance in most situations.
- Shadow RAM: Enabling shadow RAM causes data to be moved from slower ROM to faster system RAM, increasing system performance.
- Peripheral Setup: This feature allows you to customize the settings of your motherboard's on-board peripherals such as ports, graphics, and sound (some motherboards have built-in sound and graphics capabilities).
- Boot Options: You may opt to boot your computer from a floppy, hard drive, or CD-ROM in most cases. Some motherboards even allow you to boot via a network interface card (NIC).
- Virus Protection: Some motherboards warn you whenever a program attempts to write data to a hard drive's boot sector. This feature can be toggled on and off
- Power Management: Most motherboards include power management capabilities that allow your computer to reduce its energy consumption and wear on internal components during periods of inactivity. The level of power savings can be set, and a number of options defined as to which activity will return the computer to full power.
- Security: Most BIOS includes provisions for password access control. This type of password is extremely secure, since it is invoked prior to starting your computer's operating system.
- CPU/Memory Configuration: Most motherboards allow you to set advanced features such as memory wait states and clock cycles.

There are several instances where you will need to run SETUP, including:

- When you install a new motherboard
- Whenever you make certain types of changes to your system configuration such as adding drives, changing the CPU, adding or removing RAM, and adding or changing certain components. Adding components such as expansion cards typically does not require you to run SETUP.
- If the battery backup fails or is disconnected

GETTING THE MOST FROM YOUR COMPUTER

Many people simply use their computers without giving much thought to the impact their activities might have on the computer's performance. Like an automobile, a computer gets progressively farther out of tune with use. You can do many things to tune your computer and obtain maximum performance. A well-tuned computer will run significantly faster than an identical computer that is not optimally tuned.

Tuning a computer is neither a one-time task nor a task that only needs doing on an intermittent basis. Keeping your computer thoroughly tuned is an ongoing process requiring conscious thought and effort. Still, the few extra seconds invested in maintaining your computer will assuredly pay off in increased performance and reliability.

Some important things you can do to keep your computer tuned are:

- Resist the urge to load programs that run in the background: There is a wide assortment of programs that run 'behind the scenes'. These programs do everything from monitor your computer for viruses to allowing you to write 'sticky notes' on your computer's screen. It is not our intention to discourage you from using any of these programs. Simply be aware that these programs consume system resources, and load them judiciously. Programs such as Symantec's Norton Utilities provide, in our opinion, some very valuable services and are well worth the resources they use.
- Keep your drives in order: A well-organized hard drive directory system goes a long way to helping you reduce wasteful clutter on your drives, thus freeing space for more important applications and data.

- Defragment your hard drives: Hard drives store files by placing pieces of them in random clusters and keeping a list of which clusters store each file on the drive. Using the box and cubbyhole analogy, the hard drive places some of the file in a cubbyhole, notes the file and location on a master list, places the next piece, and so on. It is obvious that retrieving the file is a cumbersome affair since the hard drive must consult the master list, find the first piece of a needed file, consult the list again, and repeat this procedure for each piece of each accessed file. Defragmenting a hard drive takes all the pieces of a file and places them in consecutive clusters. This can greatly improve hard drive performance. Since hard drives are among the slowest parts of your computer, improvements in hard drive performance improve your system's overall performance.

- Do not open more applications than necessary: Each open application occupies system RAM leaving less room for other applications to run. In Windows systems, this means that Windows will increasingly resort to using the hard drive as virtual (emulated) memory. Hard drives are extremely slow compared to fast system RAM.

- Delete old files and applications: Just because you no longer use an application does not mean it no longer impacts system performance. Many Windows applications alter the Windows startup files and may allocate resources for themselves even when they are not running. Deleting these unused applications cleans up your Windows startup files, saves hard drive space, and may leave you with more system resources available for work that is more valuable.

- Periodically run a system maintenance program: Programs such as Symantec's Norton Utilities will monitor your system for hard drive errors, drive fragmentation, CPU utilization, damaged system file entries, and will also monitor many other important items.

- Avoid the use of needless 'enhancements': Animated cursors, animated icons, sounds, trailing mouse pointers, etc. all consume resources. If your system has plenty of available resources and you wish to add these items, feel free to do so. If your system is taxed even without these items, it is best not to use them.

- Make regular backups of system files, applications, and especially data: you might, for example, inadvertently install some software that negatively affects your system and is impossible to completely

uninstall. You might make a mistake in some critical operating system settings that will take hours to repair. Making periodic backups of all system files and applications and updating these backups before adding any software or modifying any operating system settings will have you back up and running in very little time. The extreme importance of keeping current backups of all data needs no further elaboration.

- Periodically run benchmarking software: Keep track of the various performance figures listed by the benchmarking program. If one or more of these figures begins to decline, you should be able to quickly track down the cause of the performance degradation and repair it.

The above list may not be all-inclusive, depending on how you use your computer. The benefits of performing the above items range far beyond merely keeping your system tuned: paying close attention to your computer and its performance might alert you to serious problems before they have a chance to cause data loss or hardware failure. Again, keeping your computer tuned requires an ongoing investment of your time. Your computer represents a significant capital investment. The small amount of time spent maintaining your system will more than pay for itself. Guaranteed.

4 TROUBLESHOOTING

Your computer system is designed to provide you with trouble-free operation. This section provides you with basic troubleshooting assistance in the unlikely event that something goes wrong with your computer..

Most malfunctions are usually caused by incorrectly setting up or configuring your system during hardware or operating system upgrades. Loose mechanical connections such as loose cards, cables, or components are frequent troublemakers. These can occur during upgrades, repairs, or simply by moving the computer from one location to another. You can probably correct most problems quite easily.

Should a hardware failure occur, you will most likely need to have the machine serviced by a professional technician or return it to ACMA (or the reseller from whom you purchased the system) for repair.

The following list covers some of the steps you should take if your machine does not operate as you expect. If the recommended steps do not solve the problem, please call ACMA Technical Support.

BASIC TROUBLESHOOTING PROCEDURES

To identify a problem, one must first be familiar with normal system operation. Pay attention to your computer when it boots, and memorize its normal displays, indicator lights, noises, and messages. A normal boot up consists of the hard disk drive(s) beginning to spin, the monitor displaying the amount of system RAM (you may hear a ticking noise during the RAM verification), the floppy drive being accessed (the indicator light comes on briefly), and a single audio beep signifying successful conclusion of the Power On Self Test (POST). The computer then attempts to load the operating system from the floppy drive, hard drive, or the network drive, depending on your BIOS settings.

Incompatible or conflicting device drivers (that probably run perfectly when the other conflicting driver(s) is/are not present) are another frequent cause of problems. Isolating this problem requires identifying the offending driver(s) by removing all drivers then re-installing them one

at a time until you duplicate the problem. Then, if possible, re-configure the drive to work with the rest of the system.

Intermittent problems are much harder to isolate. If drivers do not appear to be the problem, check your CMOS BIOS Setup configuration. If you find nothing apparently wrong with your settings, choosing **`load BIOS Defaults`** in BIOS Setup so you can rule out the BIOS settings.

Troubleshooting is a process of elimination. If you have just performed a hardware or software upgrade, undo the upgrade to see if the problem goes away. If it does, the problem is with your upgrade. If not, first check any system components that could have been affected by the upgrade such as nearby expansion cards, cables, or jumpers. If the problem persists, or if you have not performed any recent hardware or software changes, please refer to the appropriate section of this chapter for further guidance.

The following is a list of commonly asked questions and possible fixes. Whenever possible, perform the suggested isolation tasks in the order given.

SYSTEM AND HARD DRIVE

System will not boot - Power LED is OFF.

Most likely cause: no supplied power.

1. Verify that the power supply fan is spinning. (If so, go to step 4)
2. Make sure that your power cable is properly connected at both ends. If not, plug it in securely.
3. Verify that the surge protector strip or wall outlet is on and is providing power. Plug in a lamp and turn it on to test your wall outlet. If the lamp does not light, check the wall circuit's fuse or breaker.
4. Check that the voltage selector switch is set for the right voltage (115V for the United States and Canada, 230V for Europe). Switch the setting if necessary.
5. Remove the cover and check that the power supply is connected to the motherboard securely.

6. Check the power supply fuse or breaker (if so equipped).

System will not boot - Power LED is ON.

Most likely cause: bad component or card. Record and verify any beep codes during this process.

1. Touch the computer case to discharge static electricity, then unplug your computer, and remove the case. Reseat all cards and reconnect all cables.
2. Discharge static again, and press in all chips on the system boards that seat in sockets.
3. Check for a bad card or component by removing one card at a time and rebooting after each card is removed. Leave the video and hard drive controller for last.

System will not boot from the hard disk.

Most likely cause: corrupted boot files.

1. Does the hard drive(s) spool up when powering on the system? Listen for the rising whine characteristic of the hard drive coming up to speed. If you are certain that the drive(s) is/are not spinning, skip to Step 7.
2. Run BIOS Setup, and verify that the hard disk drive setting(s) is/are defined correctly. Refer to your motherboard's documentation for instructions on running BIOS Setup.
3. Does the Hard Disk Access LED flash when attempting to read or write to the drive? If not, skip to Step 6.
4. Boot using your MS-DOS® Setup Disk or Windows Startup disk, as appropriate, and type `C: [ENTER]` at the DOS prompt. If you are unable to access the hard drive, skip to Step 6. If you can access the hard drive, type `A:SYS C: [ENTER]` to copy the MS-DOS® boot files to the hard drive. Remove the floppy and restart your computer.
5. Run the CHKDSK or SCANDISK utilities on your DOS system or Windows Startup disk to check for and repair possible hard drive errors. Scan your system for computer viruses.
6. If you receive the message **`Invalid Drive`**, run FDISK from your MS-DOS® Setup Disk or Windows Startup Disk to verify that

the hard drive has a valid active partition. Refer to your DOS or Windows documentation for instructions on using the FDISK utility. If you have an active partition, try typing `FDISK /mbr [ENTER]` at the DOS prompt to rebuild the Master Boot Record.

7. Remove the system's cover and check the hard disk ribbon cable to ensure it is properly connected. Check the hard drive's power cable.

System boots up but runs unstably

Most likely cause: bad component or card.

1. Run BIOS Setup program and disable the L2 (external) cache. If this solves the problem, your L2 cache is bad. If it is contained in a removable module, replace the L2 cache module. If it is soldered on the motherboard, the whole motherboard needs to be replaced. Note that this procedure does not apply to Pentium II/Celeron systems.
2. If the problem persists, reseat the SIMMs and/or DIMMs. Replace them if you have extra memory modules available.
3. If the problem persists, verify the possibility of a bad card by removing cards one at a time. Leave the video and drive controllers for last.

DISPLAY

System appears to be booting - Monitor is blank.

Most likely cause: Monitor does not have power or is turned off.

1. Make sure that your monitor is turned on (LED is lit).
2. Make sure that your power cable is properly connected at both ends.
3. Adjust your monitor's brightness and contrast controls.
4. Ensure that the video cable is properly connected to the video port at the back of the computer.
5. Verify that the video card's switch/jumper settings are set for the proper monitor type (if your video card is so equipped). Note that this step requires unplugging the computer and removing the case.
6. Remove the cover and ensure all cards, cables, and components are properly seated or connected.

Display is on but flickering or garbled - All resolutions

Most likely cause: bad connection.

1. Ensure that your power cable is properly connected at both ends.
2. Adjust your monitor's controls.
3. Check that the video cable is properly connected to the video port at the back of the computer.
4. Check the pins inside the monitor cable's connector to see if any of them are bent and/or broken.
5. With the computer and monitor on, wiggle the monitor cable. If the display changes, there is a flaw in the monitor cable. Call for service.
6. Verify that the video card's switch/jumper settings are set for the proper monitor type (if your video card is so equipped). Note that this step requires unplugging the computer and removing the case.
7. Remove the cover and make sure all the cards are seated securely on the motherboard.

Display is on but flickering or garbled - Some resolutions

Most likely cause: incorrect video driver or monitor type.

1. Ensure that you have the correct video driver installed. Refer to your video card documentation for instructions on verifying the driver and obtaining the latest version from the manufacturer.
2. Make sure that the correct monitor type is selected. Contact the monitor's manufacturer if the monitor type is not included in the operating system or in the video card driver library.

FLOPPY DRIVE

System will not read floppy disks.

Most likely cause: bad floppy disks or loose cables.

1. Ensure you are using the proper type of diskette, and that you are orienting the diskette properly when inserting it in the drive.
2. Has the disk been formatted? If not, you will get see the message **`General failure reading drive A: (A)bort, (R)etry, (F)ail`**. Press `F [ENTER]`.
3. Does the Floppy Access LED illuminate when trying to read or write to a diskette? If not, skip to Step 5. If the Floppy Access LED is constantly illuminated, then the data cable is improperly attached.
4. Run BIOS Setup to verify that the drive is defined correctly. Refer to your motherboard documentation for instructions on running BIOS Setup.
5. Remove the cover and check the floppy ribbon cable for proper connection to the controller card and floppy disk drive. Check the power connection to the floppy drive.

CD-ROM DRIVE

The CD-ROM does not work.

Most likely cause: CD-ROM drivers are not loaded or are conflicting with other drivers.

1. Verify that the CD-ROM was not inserted upside down and that it is not an audio CD disc.
2. Verify that the CD-ROM has a clean surface, and try another data CD-ROM that you know works properly.
3. In Windows, open **`My Computer`** to check that Windows recognizes the CD-ROM. If your drive does not appear, skip to Step 5.
4. Remove any recently installed any hardware or software to see if the new installation is causing a conflict.
5. Verify that the device drivers are properly installed. Consult your CD-ROM and adapter (or sound card) documentation for installation directions.
6. Check that the I/O address and IRQ specified in the device driver line in CONFIG.SYS matches the actual port that the CD-ROM is

connected to. Refer to your CD-ROM documentation for instructions.

7. Check that the correct version of MSCDEX.EXE is installed. MS-DOS® 6.0, for example, requires MSCDEX.EXE version 2.2 or later. Always use the MS-DOS version of MSCDEX.EXE that is located in the DOS directory. Remember that some CD-ROM drivers use an interface driver with a different name.

8. Verify that the Master/Slave jumper on the CD-ROM is properly configured. Note that this step requires powering down your computer and opening the case.

9. Check your CD-ROM adapter for interrupt and I/O address settings. Avoid any interrupt and I/O address conflicts with other peripheral cards.

AUDIO

No sound when playing .WAV or .MID files.

Most likely cause: Improperly connected speakers or improperly configured software driver.

1. Check your speakers to ensure they are plugged into the correct output jack on your sound card. Amplified speakers should be connected to the LINE OUT jack and non-amplified speakers to the SPEAKER jack.

2. Check to see if your speakers require batteries or an AC adapter to supply power to them. Some amplified speakers have a switch on the back to toggle between amplified and non-amplified modes.

3. Check the volume control on your speakers to ensure the volume is high enough.

4. Check your speakers by hooking them to another computer or your CD-ROM drive headphone output jack and playing an audio CD.

5. If you have Windows 95® or Windows 98®, check both the "System" and "Multimedia" sections of the Control Panel to ensure that you have the proper settings for your sound card (consult you sound card/audio subsystem manual and your Windows

documentation). Check your software to verify that the volume settings are not turned off.

6. If you have Windows 3.1 or 3.11, check to see if .WAV files can be played under the SOUND icon in the Windows Control Panel. If the names of the sound files are grayed out (not selectable), re-install the sound card software.

No sound when playing audio CDs.

Most likely cause: software driver not loaded.

1. Check your speakers to ensure they are plugged into the correct output jack on your sound card. Amplified speakers should be connected to the LINE OUT jack and non-amplified speakers to the SPEAKER jack.
2. Check your speakers by hooking them to another computer or by playing a .WAV file in Windows.
3. Check your software to verify the volume settings are not turned off.
4. If you have Windows 95 or Windows 98®, check both the "System" and "Multimedia" sections of the Control Panel to assure you have the proper settings for your sound card. Consult your sound card/audio subsystem and Windows documentation for further instructions.
5. If you have Windows 3.1 or 3.11, check the "Drivers" section of Control Panel to verify you have loaded the MCI Audio CD driver. If not, install it by clicking the **Add** button and choosing it from the list.
6. Make sure you are not installing the audio CD upside-down. The side with writing on it should be facing up when it is inserted.
7. Remove the system cover and verify you have a small audio cable connecting your CD-ROM and sound system. This cable is different than the large flat ribbon cable that connecting your CD-ROM to the controller. Refer to your CD-ROM documentation and to Chapter Three, above, for more information.

KEYBOARD

System does not recognize the keyboard.

Most likely cause: improper keyboard connection, or keyboard locked.

1. Verify that the keyboard cable is properly installed.
2. If you have a Key Lock on your computer case, make sure it is in the OFF position.
3. If your keyboard has a selector switch (typically on the underside of the keyboard), check that it is set to the AT position.
4. Try another keyboard (if possible) to isolate the problem.

MOUSE

The mouse cursor does not move or moves erratically.

Most likely cause: loose mouse cable or mouse driver is not loaded.

1. Ensure the mouse cable is securely connected to the mouse port or COM port. If you have a loose connection, re-seat the cable. Serial mice should function properly at this point; you will need to reboot your computer if you have a PS/2 mouse.
2. Make sure the correct DOS and Windows drivers are correctly installed. Refer to your mouse documentation for further instructions..
3. Run the test program that comes with the mouse (if any).
4. Make sure driver configuration matches your mouse installation, e.g. that the mouse is connected to the port referenced by the driver (usually COM1).
5. Remove the mouse ball and clean it and the rollers. Use a cotton swab moistened with rubbing alcohol to clean your mouse rollers. Do not use water.
6. Try the mouse on the second serial port or another computer to see if it is defective.

A mouse will only work in a DOS application that supports a mouse. The DOS mouse driver must be installed before the application for the mouse to work.

NETWORK INTERFACE CARD

The system does not detect the network interface card.

Most likely cause: improperly configured card.

1. Verify correct network card functionality by using the test utility that came with your network interface card or any other procedure as detailed in your network card documentation.
2. For Plug and Play operation, make sure that the card is set to Plug and Play mode. If your card does not have jumpers, use the utility program that came with your network interface card to configure it. Refer to your documentation for further details.
3. If your card is not Plug and Play, ensure sure that the resource settings such as IRQ and I/O address do not conflict with other system devices. Use the Windows device manager and/or your network card configuration utility. Refer to your Windows and network card documentation for instructions.

System detects card but is inaccessible to the network.

Most likely cause: bad network connection, improperly configured network protocol, or defective network card

1. Make sure that the network cable is properly connected. Coax (BNC) cables require terminators at both ends of the cable. If your system uses twisted pair (RJ-45) cable, make sure that the hub is powered on and that the connected ports are operational. Switch ports and cables to isolate possible defective ports/cables. Refer to your network hub documentation for further information.
2. Make sure that your network protocols are configured according to the network requirements. Refer to your Windows documentation, network card documentation, and hub documentation for further information, or contact your System Administrator.

3. Check the LED next to the network connector on the card. If it is not indicating network activity by blinking, the network card or hub may be defective.

PRINTER

System reports a print error.

Most likely cause: Improperly connected printer cable or printer problem

1. Verify that the printer cable is securely connected at both ends.
2. Make sure printer is powered on and switched to ONLINE.
3. Exit to an MS-DOS prompt (or restart your computer in MS-DOS mode if using Windows) and type the following: `[CTRL]+[P]`. Type a few words, and press [ENTER]. The printer should print what you just typed. If not, replace the printer cable and/or the printer and repeat this step to isolate a defective cable or printer. Press `[CTRL]+[P]` again to toggle MS-DOS print mode OFF.
4. If the printer works using the above test, the problem is probably an incorrect or corrupted printer driver. Re-install the printer driver if necessary. Refer to your printer documentation for further information.

FAX/MODEM

System does not recognize the fax/modem

Most likely cause: improperly configured fax/modem.

1. For Plug and Play operation, make sure that the modem is set to Plug and Play mode. If your modem does not have jumpers, use the utility program that came with your modem to configure it. Refer to your documentation for further details.
2. If your modem is not Plug and Play, ensure that the resource settings such as IRQ and I/O address do not conflict with other system devices. Use the Windows Device Manager to check and adjust your settings. You may also need to adjust your modem jumpers. Refer to your Windows and modem documentation for instructions.

System recognizes fax/modem but cannot dial-out

Most likely cause: incorrect fax/modem driver or bad fax/modem.

1. Make sure the telephone line is functioning properly, that the telephone line is plugged into modem's LINE (or TELCO) jack, and that the line is not in use by another party.
2. Make sure that the correct fax/modem drivers are installed. Obtain the latest version of this driver from the manufacturer if possible. Refer to your modem documentation for details.
3. In Windows, open the Control Panel and select **`Modem/Diagnostic`**. Select the modem's COM port, then click **`More Info`**. Make sure that Windows reports the correct modem information. Refer to your modem and Windows documentation for further information.
4. Try dialing out using a DOS communications program.
5. If all these tests fail, the fax/modem may be defective.

System dials out but does not connect at maximum speed

Most likely cause: incorrect speed setting or poor quality telephone line.

1. Ensure that the fax/modem is set to run at optimum speed. Most fax/modems will automatically slow down if optimum speed fails to establish a connection. Telephone line quality may drastically limit connection speed to well below the fax/modem's capabilities.
2. Try dialing multiple times at different times of the day and to different destinations to see if the connection speed remains the same or if it improves.
3. If the fax/modem sometimes connects at maximum speed, the low connection speeds could be due to limitations on the receiving side of the call or intermittent variations of line quality.
4. If you cannot achieve maximum connection speed using the above, try the fax/modem using a different line.
5. If these tests fail, the fax/modem may be defective.

POST ERRORS

This discusses BIOS initialization messages and probable causes. Note that listed possible causes for a message reflect probabilities only. Always have a qualified service technician troubleshoot your system if you cannot diagnose the problem.

Your computer's BIOS performs the Power On Self Test each time the system is turned on. First, the BIOS initializes and tests major system parts and checks for any external BIOS residing on the I/O bus (such as a SCSI controller). If the POST encounters any errors, the computer will emit a coded series of beeps or, if the error is encountered after initializing the video card, BIOS will display the error message on the monitor. Once the POST is successfully completed, the system boots.

Beep Codes

Most motherboards use the following beep codes to signify errors. Please refer to your motherboard documentation for a complete list of beep codes and their significance.

Number of Beeps	Explanation
1	Defective motherboard memory refresh circuitry - Replace the motherboard.
2	Parity error in base 64Kb RAM - If you just installed RAM or changed the physical RAM configuration, refer to Chapter Three and verify you followed the memory installation procedure correctly. You may have installed the wrong type of RAM. If not, you probably have a defective SIMM or DIMM and must replace it.
3	Base 64Kb RAM memory failure - If you just installed RAM or changed the physical RAM configuration, refer to Chapter Three and verify you followed the memory installation procedure correctly. You might have inserted RAM in the wrong bank, not used two identical SIMMs in the same memory bank, or not installed the SIMM or DIMM fully into its slot. If not, you probably have a defective RAM module.
4	Timer not operational - Either the base 64Kb RAM

Number of Beeps	Explanation
	failed (Read the above entries for 2 and 3 beeps and reboot), or you have defective motherboard circuitry. After testing the RAM, if the problem persists, replace your motherboard.
5	Processor error - Your CPU generated an error. If you just upgraded your CPU, check to ensure the motherboard jumpers are properly set. Check to ensure the CPU is correctly oriented in its socket/slot, and is firmly pressed into place. If the above checks are satisfactory, you probably have a defective CPU
6	8042/gate A20 failure - Your keyboard might be bad. Connect another keyboard and reboot. If the error persists, your keyboard controller chip is probably bad. Replace the motherboard.
7	Processor Exception Interrupt Error - The processor returned an exception error. Refer to your motherboard's documentation for instructions on how to clear the CMOS. You will have to re-set your BIOS Setup values as your old values may be lost. If this does not work, you may have a corrupted BIOS or defective CPU.
8	Display memory read/write error - If you just upgraded your video card or removed and reinserted it in the case for any reason, double-check that it is properly installed. Refer to the directions in Chapter Three. Check your video cable connection, as sometimes systems generate this error when the monitor cable is loose/unplugged. If this fails, you probably have a defective video card.
9	ROM checksum error- The ROM values do not match the CMOS checksum. Refer to your motherboard's documentation for instructions on clearing the CMOS. Clear the CMOS and reboot. If this fails, you may have a defective motherboard.
10	CMOS shutdown register read/write error - The CMOS shutdown register failed. Refer to your motherboard's documentation for instructions on

Number of Beeps	Explanation
	clearing the CMOS, clear it, and reboot. If this fails, you may have a defective motherboard.
11	Cache error/external cache bad - If you recently upgraded your cache RAM, check to make sure it is correctly oriented and firmly seated. Also check to ensure your motherboard jumpers are properly set. If this fails, replace your cache RAM.

POST and Boot Messages

Once BIOS successfully initializes the video card, your system displays POST and boot messages while BIOS completes initializing. There are two kinds of POST messages:

- Error messages: failure in hardware or firmware.
- Informational messages: require no action. These provide valuable information.

Following is a list of POST messages and explanations. Note that different motherboards may display different messages or that messages may have slightly different meanings than those listed here. Always refer to your motherboard documentation for an explanation of error messages.

Error Messages	Explanation
8042 Gate - A20 Error	The keyboard's A20 controller is not working. Call for service, or replace your motherboard.
Address Line Short!	Motherboard access decoding circuitry error. Replace the motherboard.
CH-2 Timer Error	Most systems have two timers. This message indicates an error in timer #2. Call for service.
CMOS Battery State Low	CMOS RAM uses a battery for power. Replace the CMOS battery. Refer to your motherboard documentation for instructions.
CMOS Checksum Failure	CMOS saves a checksum value whenever settings are changed in BIOS Setup. Clearing the CMOS will cause this error, as will a dead

Error Messages	Explanation
	CMOS battery or a defective CMOS. Reset your CMOS settings and reboot. If that fails, replace the CMOS battery, following the directions found in your motherboard documentation. Call a service technician if these suggestions do not solve the error.
CMOS System Options Not Set	CMOS RAM values are either corrupted or non-existent. Run BIOS Setup and reboot. If that does not solve the problem, replace the CMOS battery following the directions located in your motherboard documentation. If that fails, call for service.
CMOS Display Type Mismatch	The video adapter type value in CMOS does not match the type detected by BIOS. Run BIOS Setup.
CMOS Memory Size Mismatch	The amount of system RAM is different than the value stored in CMOS. Run BIOS setup. You may have incorrectly installed SIMMs or DIMMs.
CMOS Time and Date Not Set	Run BIOS Setup to set the system date and time.
Invalid System Disk	The diskette in Drive A does not contain a valid copy of the operating system files. Replace the floppy with a valid system diskette, and follow the directions on the screen.
Diskette Boot Failure	The diskette in drive A is corrupt and cannot be used to boot the system. Replace the faulty diskette with another system diskette and follow the directions on the screen.
Display Switch Not Proper	Some systems require setting a switch on the motherboard to 'color' or 'monochrome'. Turn off the system, change the switch setting, and reboot.
DMA Error	DMA controller error. Call for service or

Error Messages	Explanation
	replace the motherboard.
DMA #1 Error	Master DMA channel error. Call for service
DMA #2 Error	Slave DMA channel error. Call for service.
FDD Controller Failure	BIOS cannot communicate with the floppy drive controller. Check to ensure all floppy drives are properly connected and that the gray ribbon cable is properly oriented. Refer to Chapter Three. If this fails, you may have a bad data cable, floppy drive, or a defective motherboard. Call for service.
HDD Controller Failure	BIOS cannot communicate with the hard drive controller. Check to ensure all hard drives are properly connected and that the gray ribbon cable(s) is/are properly oriented. Refer to Chapter Three. If this fails, you may have a bad data cable, hard drive, or a defective motherboard. Call for service.
INTR #1 Error	Interrupt channel 1 failed POST. Call for service.
INTR #2 Error	Interrupt channel 2 failed POST. Call for service.
Invalid Boot Diskette	BIOS can read the floppy in Drive A but cannot boot the system. Use another floppy diskette with system files on it.
Keyboard is Locked … Unlock It	The Keyboard Lock is engaged. Unlock the keyboard and continue booting the system.
Keyboard Error	There is a timing error with the keyboard. Set the BIOS Setup keyboard option to `Not Installed` and reboot the system to avoid this messages. If problems persist, replace your keyboard. Note that one or more keys being pressed during POST might also cause this problem.

Error Messages	Explanation
KB/Interface Error	There is a keyboard connector error. Turn your system off, check your keyboard connection, and reboot. If that does not solve the problem, you probably have a defective keyboard. Replace and reboot.
Off Board Parity Error	Parity error in expansion card memory. This message appears in the format `OFFBOARD PARITY ERROR ADDR= XXXX XXXX` where 'xxxx' is the hex address of the memory error. This may be caused by a defective expansion card or improperly installed expansion card memory. Refer to your expansion card documentation for further information.
On Board Parity Error	Parity error in motherboard memory. This appears is in the format `ONBOARD PARITY ERROR = XXXX XXXX` where xxxx is the hex address of the memory error. Check to ensure your RAM conforms to the requirements set forth in Chapter Three of this manual and your motherboard documentation.
Static Device Resource Conflict	One or more expansion cards are in conflict with other resources. This is usually a result of improperly setting the expansion card's configuration when installing the card in your computer. Refer to your expansion card documentation for further guidance.
Parity Error ????	A parity error occurred at an unknown address. Reboot. If the problem persists, call for service or double-check any recently installed upgrades.

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5 NOTICES

FCC CLASS B STATEMENT

This equipment has been tested and found to comply with the limits for a Class B digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. There is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception (which can be determined by turning the equipment off and on) the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult an experienced radio/TV technician for help

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

To meet FCC requirements, shielded cable and power cords are required to connect this computer to a monitor or other Class B certified device

CUSTOMER SUPPORT INFORMATION

ACMA is dedicate to providing our customers with the utmost in customer support. Please do not hesitate to contact us at one of the following numbers or on-line if you have any questions or concerns about your ACMA computer.

Customer Service (800) 786 - 8998

Our Customer Service Department Staff is trained to provide prompt courteous assistance for most of your non-technical, post sales questions or problems. Please have invoice, work order, or serial number available so we can handle your call promptly.

Technical Support: (800) 786 - 8998

If you have technical questions or need assistance in identifying or solving a problem, the Technical Support Engineers at ACMA can provide you with the assistance needed to isolate the problem or provide you with technical information you require.

International Callers: (510) 623 - 1212

For all callers outside the USA

Customer Support FAX: (510) 651- 0629

Both Customer Service and Technical Support can be contacted using this fax number. Communicating by fax can be very convenient for International callers. It can also benefit individuals and corporations who require written information.

Technical BBS: (510) 651 - 1606

Our Technical Service Department maintains a free electronic bulletin board service with 24 hour a day access; 8 data bits, no parity, 1 stop bit at 1200 to 14,400 baud. It is a convenient way to get hold of information and drivers needed to operate at the most current level.

World-Wide Web Site: http://www.acma.com

Both Technical Support and Customer Service can be reached from our web site or emailed at tech-support@acma.com or cust-service@acma.com.

Technical Service Hours

ACMA provides toll-free technical support for the life of your system. Our support line operates Monday through Friday from 8:00 a.m. to 5:30 p.m. PT (Pacific Time). ACMA Technical Support will be available 24 hours a day, 7 days a week beginning June 1st, 1998. Most problems can be diagnosed over the phone. However, questions about peripherals may be best handled by contacting the manufacturer first.

RETURNING EQUIPMENT FOR REPAIR

If you purchased your system from a reseller and not directly from ACMA, please contact your reseller for instructions on service and repair.

If our Technical Support Engineers are unable to resolve your problem over the phone or on-site, you will need to forward your equipment to the factory for service. Refer to the limited warranty for date of coverage and items covered. Please follow these instructions when returning equipment for service:

1. Call ACMA Customer Service for a Return Materials Authorization (RMA) Number. Provide the invoice number, serial number, and reason for return.
2. An RMA number will be issued once the serial and invoice numbers are supplied. RMA numbers are valid for 30 days.
3. Pack and ship your computer or other warranted product to ACMA or the Authorized Repair Center specified, remembering to:
   a. Pack items in original shipping containers. Only include accessories if requested.
   b. Mark the RMA number clearly on the outside of each container.
   c. Ship the items, freight prepaid and insured.
5. The original purchaser shall bear all responsibility for shipping charges and risk of loss or damage during transit to ACMA. All claim procedures required due to damage incurred during return shipping to ACMA are the responsibility of the sender.
6. Repaired or replacement merchandise will be returned to you at ACMA's expense.

Include a detailed description of the problem and any method used to duplicate the problem. Also provide details regarding any conversations about the problem you have had with Technical Support personnel.

Whenever possible, back up your hard disk before returning your system. Our technicians may need to reformat the hard disk to verify that it is functioning properly. This process erases any files on the disk.