

**COMPUTERIZATION FOR THE  
MAINTENANCE AND TROUBLE SHOOTING  
IN A PERSONAL COMPUTER (PC)**

**BY**

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**A PROJECT SUBMITTED TO THE  
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NIGERIA.**

**NOVEMBER 2004**

# CERTIFICATION

We hereby certify that we have supervised, read and approved this project work, which was found to be adequate in scope and quality for the partial fulfillment of the award of Postgraduate Diploma in Computer Science of Federal University of Technology, Minna.

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## DEDICATION

This project work is dedicated to my late mother, Madam ALICE O. DARAMOLA.

## ACKNOWLEDGEMENT

My profound gratitude goes to Almighty God for his infinite mercy and protection throughout the period of this work.

I gratefully acknowledge the assistance, guidance, and contribution of my able and competent Supervisor in person of Professor ADEGBOYE K. R.

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May almighty God bless each and every one of us – Amin.

**Daramola Kayode (November 2004)**

## ABSTRACT

The primary concern of this project is to provide overall guide with some possible solutions to common hardware problems, so that the Computer User can perform preventive maintenance to keep their computers in good working condition.

Trouble shooting chart menu is included for better trouble shooting and repairs. Also a rapid technique of trouble shooting and maintenance tutor program is developed for computer users.

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## CHAPTER ONE

### 1.0 GENERAL INTRODUCTION

#### 1.1 INTRODUCTION

The aim of this project is to help create awareness towards full understanding of the present or future personal computer (PC), so that it can be easily used and not feared. The project is designed to give an overview of what makes up a computer system and expert techniques (method) of diagnosing the faulty components and the various methods of repairs.

Computers are thought delicate because they are built from supposedly delicate electronic circuits, the same ones that their manufacturers warn about holding a metal part of the system unit in order to discharge the pulses of static electricity that can damage the circuits. We could see that computer literacy has become a necessity in today's world. There is virtually no aspect of human endeavor that has not been touched by the impact of computers. These hitherto presumed fragile-machines have become part of human lives such that it has become a necessity for any individual or organization that needs to process information accurately and with speed, Secretaries need computers for effective word processing, doctors need them for efficient patient's management, bankers use them to enhance and maintain current account and global banking services. Computers aid engineers, lawyers, librarians and every other professional in every fields of human endeavours.

## 1.2 COMPUTERS IN HISTORICAL PERSPECTIVE I

A computer is a programmable electronic device that can store, retrieve and process data. It is a device that is capable to accept data through any of the input devices, process the data, and produce the output through any of the output devices. This machine (or device) executes tasks on request, according to the way in which these tasks are described.

There are two major categories of computers, namely: Digital Computers and Analog computers

### 1.2.1 ANALOG COMPUTERS

Analog computers work by translating constantly changing physical conditions (such as temperature, pressure, or voltage) into corresponding mechanical or electrical quantities. They offer continuous solutions to the problems on which they are operating. For example, an automobile speedometer is a mechanical analog computer that measures the rotations per minute of the drive shaft and translates that measurement into a display of miles per hour.

### 1.2.2 DIGITAL COMPUTERS

A computer can recognize only two states in each of its millions of circuit switches - on or off or high voltage or low voltage.

By assigning binary numbers to these states ---1 for ON and 0 for OFF, for example and linking many switches together, a computer can represent any type of data from numbers to letters to musical notes. This process is called digitization.

### **1.3 THE GENERATIONS OF DIGITAL COMPUTERS**

Computers have been generally classified into a number of generations on basis of their technology.

#### **1.3.1 THE FIRST GENERATION**

The first general thought of an electronic computer was electronic numerical Integration and calculator (EWIAC). It was built in 1946 by Maunchy and Eckert at the University of Pennsylvania. The most popular model of the first generation computers was IBM 650 developed in 1994, which was capable of supporting both scientific and business applications.

#### **1.3.2 THE SECOND GENERATION**

This generation of computers evolved as a result of technological advances in electronic and solid state physics. The most popular model of this generation is the IBM 1401. Many important developments were made during this, period. This generation employed transistor, diodes and the printed orient board type at writing. The computers of this generation generate less heat, were more reliable and considerably reduced the physical size of the hard ware.

The second generation computers made great use of high-speed magnetic tape units for reading and writing data. There exist also technological advancement in data transmission and communication devices motivates real time and time sharing computer system. Data can be sent to and received from both local and remote data processing canthers.

### 1.3.3 THE THIRD GENERATION

The period 1964 was dominated by the third-generation of computers, the most popular model of this generation was the IBM 360. During this period, mini-computers, were developed. The important development of this generation includes the monolithic integrated circuitry and hybrid integrated circuitry was developed to replace the diodes and transistors characteristics of the second generation computers. Monolithic circuitry is concerned with the placing of element of a circuit (transistors, resistors and diodes) on a chip at a time.

### 1.3.4 THE FOURTH GENERATION

The fourth generation of computers took off in the 70's and exists till today.

The first affordable desktop computer designed specifically for personal use was called Altair 8800 and was sold by Micro Instrumentation Telemetry Systems in 1974. In 1977 Tandy Corporation became the first major electronics firm to produce a personal computer. They added a keyboard and CRT to their computer and offered a means of storing programs on a cassette recorder. Soon afterward, a small company named Apple Computer, founded by engineer Stephen Wozniak and entrepreneur Steven Jobs, began producing a superior computer.

IBM introduced its Personal Computer, or PC, in 1981. As a result of competition from the makers of clones (computers that worked exactly like an IBM-PC), the price of personal computers fell drastically. Today's personal computer is 400 times faster than ENIAC, 3,000 times lighter, and several million dollars cheaper.

In rapid succession computers have shrunk from tabletop to laptop and finally to palm size. With some personal computers, called pen-pads, people can even write directly on an etched-glass, liquid-crystal screen using a small electronic stylus, and words will appear on the screen in clean typescript.

The following are the important development of this generation:

- a. Large-scale integrated series
- b. User-friendly interfaces
- c. Faster memories and mass storage
- d. Improved soft-ware.

### 1.3.5 THE FIFTH GENERATION

The conventional computers are widely applied in routine business data processing and in mathematical – statistical calculations in science and engineering in the Japanese National Government has initiated a revolution towards the development of the new generation computers described as fifth generation. Is what they referred to as the artificial intelligence. The fifth generation computer is based on a new architecture, which support very large memory, high parallel processing and reasoning. Thus these generation can learn, associate, make references, take decision and otherwise behave in ways we have always considered the exclusive province of human reasoning.

### 1.4 OBJECTIVES

The aim and objectives of this project are to enable the computer users to be conversant with their computers and also be able to provide an overall trouble shooting/maintenance guide. With some possible solutions to common problems.



Hence the user can carry out practical maintenance work such as follows:

1. Familiarize themselves with the components inside the computer
2. Deals with computer equipment without fear
3. Perform daily maintenance routine
4. Carry out monthly, quarterly and annual maintenance routine
5. Check and locate faulty device
6. Upgrade the system memory
7. Install peripheral device like printer, monitor, mouse, disk drive, etc
8. Distinguish between hardware and software faults
9. To be able to detect virus on the system
10. Troubleshoot computer system to board level
11. To be able to troubleshoot and carry out minor repairs on printers e.g. Dot Matrix
12. To be able to replace fault and detect faulty cards e.g. power card.

#### **1.5 STATEMENT OF THE PROBLEM**

The problem of this study is to examine the present ways of maintaining and trouble shooting Gate Way 2000 PC and to proffer the more effective, easier, time conserving less labor method of troubleshooting operations.

#### **1.6 SOURCE OF DATA AND INFORMATION OF THE STUDY**

The data and information used in this study were obtained from textbooks, journals, hand books, handout, manual and notebooks.

Data and information were also collected from Electronic/Computer Scientist, users, and personal experience.

### **1.7 SIGNIFICANCE OF THE STUDY**

The researcher hopes that this study would:

- i. Contribute in no small measure in both theory and practical to the existing pool of knowledge about computer maintenance and troubleshooting
- ii. Reduce "trial and Error" method of maintaining and troubleshooting Gate Way PC.

### **1.8 NEED FOR THE STUDY**

- i. The need was as a result of the observation made on the present methods of carrying out repairs; maintaining and troubleshooting gate way pc.
- ii. Many a times technicians spent undue time in order to carry out repairs; while some cause more damage than how it was.
- iii. There should be proper logging of troubleshooting using the right peg for the right hole.

### **1.9 LIMITATION OF THE STUDY**

The work is focused on computer maintenance and troubleshooting operations. The study will not be good enough for a computer scientist that knows nothing about engineering basics.

The extent of this work can only serve as a guide to the likely problem(s). The write up can never be substitute for the many feature manual /circuit diagram of the computer.

#### 1.10 **EQUIPMENT/TOOLS NEEDED FOR TROUBLESHOOTING**

1-Complete tool box

1-Digital Multimeter

1-Bottle of Disk Cleaning Alcohol (Ethanol)

1-Packet of Lint-free dot or cotton swabs

1-Scratch floppy diskettes

1-Diagnostic Floppy diskettes preferably 3.25" type

1-Vacum Cleaner (Electric blower).

## CHAPTER TWO

### 2.0 SOME COMPUTER TERMS AND APPLICATIONS

#### 2.1 DEFINITIONS

**RAM** RAM (an acronym of Random Access Memory) refers to the types of memory devices whereby any location in memory can be found (located), on average, as quickly as any other location. Computer internal memories and disk memories are random access memories. A major characteristic of RAM is that the time it takes to write onto or read data from the memory location is the same. Also access to data is random instead of sequential. That is, to access a particular stored data, the exact memory location in which the data resides is read. The system does not have to start reading the first data and follow the search in sequence to access the required data.

**ROM** ROM (an acronym of Read-Only-Memory) is a special memory that can be read from but not written into. ROM is a type of computer memory, which contains computer instructions that do not need to be changed, such as the instructions for calculating arithmetic functions. The computer can read instructions out of ROM, but no data can be deleted from it or added to it. The switches of ROM chips are set when they are manufactured and are unchangeable. The patterns on these chips correspond to commands and programs that the computer needs in order to boot up, or ready itself for operation, and to carry out basic operations. Because Read-Only-Memory is

actually a combination of hardware (microchips) and software (programs), it is often referred to as firmware.

However, there are special kinds of ROM that can be programmed as well as some that can be erased. These are PROM (Programmable Read-Only-Memory) and EPROM (Erasable Programmable Read-Only-Memory).

**MICROPROCESSOR** A complex electronic chip, which is at the heart of a microcomputer providing the CPU of the system. Microprocessors are also used for control purposes on many machines and appliances, and domestic and industrial equipment.

A microprocessor unit is used to refer to the primary part of a microcomputer. It consists of an ALU, some main memory, usually for control, input/output interface devices, etc. Computer capability is usually defined by the microprocessor's capacity.

**MEMORY** Memory is divided into a large number of separate locations, each of which can hold a piece of data. Each memory location has an address that can be used to refer to it when data is stored in it or retrieved from it. We can visualize memory as a set of post office boxes, with the box numbers as the addresses used to designate particular locations.

**INPUT-OUTPUT (I/O)** Input is generally referred to as the data and instructions entered into a computer, perhaps via a keyboard or diskette. While Output is all information received from the system, perhaps as hard copy printout or as display on the screen.

**BOOTING** Is the term used normally to refer to putting the computer on, i.e. starting the computer. This enables the reading of computer programs into the computer, a technique known as bootstrap.

**BIT** (an acronym of Binary Digit), is the smallest unit of information that can be held on a computer. Bits are represented on computers by two-state devices. These devices are called two-state because they could only represent either 0 state or 1 state.

**BYTE** A byte is the unit of computer storage or data representation. It is the smallest group of bit, which can be addressed individually. A byte usually contains eight (8) bits. Each byte corresponds to one character of data (a **character** is a symbol in a set of symbols). The most common expression used to represent a computer's capacity, for instance is the **Kilobyte (KB)**, which is 1024 bytes.

**MEGA BYTE** 1000 byte in terms of memory. Is a unit of computer memory which can be represented by  $1048576 (2 \times 10^{20})$  byte.

**DATA UNIT** Data Unit is a set of one or more characters treated as an whole

**FIELD** A field is a group of adjacent characters. It is a set of data positions treated as unit e.g. a name field etc. Each field can be referred to as a **Data Item**.

**RECORD** A record is a collection of related data item (fields). A group of related records is called a file.

**FILE** A file is generally a collection of information stored as records. Files are stored in memory devices such as a disk memory or tape memory. It is a group of related records, such as payroll files, student file, etc.

**DATA BASE** a database is imply a collection of data arranged in files used for more than one purpose. Thus, database files can be used for payroll as well as personnel systems, for instance. Each of the applications will make use of particular fields that are relevant to its processes.

**LOGIC BOMBS, VIRUSES, AND WORMS** In an effort to sabotage other people's computers, some computer users (sometimes called hackers) create software that can manipulate or destroy another computer's programs or data. One such program, called a logic bomb, consists of a set of instructions entered into a computer's software. When activated, it takes control of the computer's programs. A virus attaches itself to a program, often in the computer's operating system, and then copies itself onto other programs with which it comes in contact. Viruses can spread from one computer to another by way of exchanged disks or programs sent through telephone lines. Worms are self-contained programs that enter a computer and generate their own commands. Logic bombs, viruses, and worms, if undetected, may be powerful enough to cause a whole computer system to crash.

**DRIVE (DISK DRIVE)** A drive is a device that moves tape or disk past a read/write head. It is synonymous with a video head in that the movement caused by the device enables the system to read the magnetized content of the disk or tape, or to write onto the disk or tape.

Every drive has a unique name, which is used to identify it. The hard disk drive is usually referred to as C drive (C prompt – C:\>). Other drives are identified with letters A – Z according to the number of the drives available. DOS normally assigns these drive letters to the diskette drives and to the fixed disk in your computer.

To change from one drive to another, just type the name of the drive at the prompt with a colon (:). If for instance, you want to reference a file that is in a floppy disk, insert the disk in the 'a' drive and type a: at the C:\> and press the return key. This changes the prompt to A:\> signifying that you can now access any file in the diskette.

If an error message of this nature appeared

Not ready reading drive A

Abort, Retry, fail?

The drive door may not have been closed properly or the diskette not properly inserted, or that it is not formatted. If the error is due improper closure or insertion, correct the mistake and type r to Retry.

**DRIVERS** A driver device is usually an Operating System (O/S) module that controls specific input/output peripherals. Each of these peripherals usually comes with its driver, which is installed onto the computer to enable it to recognize and communicate with it. A mouse, for instance, will be unusable without a mouse driver installed. This is also applicable to CD ROM and printers (unless if an installed printer has the



same or similar properties with the one to be installed, in which case it will be simulated and used).

**ARITHMETIC/LOGIC UNIT (ALU)** The section of the central processing unit that performs arithmetic and logic operations.

**BINARY CODE** A coding system that uses two alternative elements – 0 or 1, TRUE or FALSE, voltage or no voltage – to represent numbers, characters, and symbols.

**CENTRAL PROCESSING UNIT (CPU)** The main part of a computer. Contains internal memory, a arithmetic/logic unit, and control circuitry and performs data-processing and timing and controlling functions.

**CONTROL UNIT** The part of the central processing unit that determines the sequence of computer activities, interprets instructions, and controls the way in which those instructions are carried out.

**DATA PROCESSING** The converting of raw data to machine-readable form and its subsequent processing (as storing, updating, combining, rearranging, or printing) by a computer.

**FLOPPY DISK** A thin flexible plastic disk that stores data in the form of magnetic patterns on its surface. Used primarily in microcomputers.

**FLOWCHART** A diagram that uses connecting lines and a set of conventional symbols to show the sequence of operations and the flow of data in a computer program.

**HARDWARE** The physical components of a computer system, such as the chips, disk drives, monitor, and other devices. Distinguished from software.

**INPUT** Data to be processed that is entered into the computer from a keyboard, disk drive, or other input device.

**INTERFACE** The hardware and software that enable a user to interact with a computer (called a user interface) or that enable two computer systems to interact.

**MEMORY** A storage area in which a computer saves data and from which it retrieves data.

**NETWORK** A system of computers, terminals, and *databases* connected by communications lines. Allows users of different types of computers to exchange data and to make use of special programs or of very large computers. Scopes range from local-area networks (LANs) to international networks.

**OPERATING SYSTEM** A linked series of programs that controls, assists, and supervises all other programs on a computer system and that allows dissimilar hardware systems to work together.

**OUTPUT** Data that has been processed by the computer and sent to a screen, printer, or other output device.

**PROGRAM** A step-by-step series of instructions directing the computer to carry out a sequence of actions in order to perform an operation or to solve a problem.

**SIMULATION** A computer representation of a real-life system or process that initiates the behavior of the real system under a variety of condition

**SOFTWARE** Instructions or programs used by a computer to do its work. Distinguished from hardware.

**TERMINAL** A device with a keyboard for inputting data to a computer and a display screen for receiving data from the computer.

**WORD PROCESSING** An automated means of creating and editing text. Uses computer programs that accept input (text) from a keyboard or from computer memory, enable the user to manipulate the text, and can send the original or revised text to a display screen or printer.

## 2.2 COMPUTERS AT WORK – APPLICATIONS

**COMMUNICATION** Computers make all modern communication possible. They operate telephone-switching systems, coordinate satellite launches and operations, help generate special effects for movies, and control the equipment in all phases of television and radio broadcasts. Local-area networks (LANs) link the computers in separate departments of business or universities, and larger networks, such as the Internet, permit modems –telecommunication devices that transmit data through telephone lines –to link individual computers to other computers anywhere in the work. Journalists and writers now use work processors to write books and articles, which they then submit to publishers on magnetic disks or through telephone lines. The data may then be sent directly to

computer-controlled typesetters, some of which actually design the layout of printed pages on computer screens.

**SCIENCE AND RESEARCH** Computers are used by scientists and researchers in many ways to collect, store, manipulate, and analyze data. Running simulations is one of the most important applications. Data representing a real-life system is entered into the computer, and the computer manipulates the data in order to show how the natural system is likely to behave under a variety of conditions. In this way scientists can test new theories and designs or can examine a problem that does not lend itself to direct experimentation. Computer-aided design, or CAD, programs enable engineers and architects to design three-dimensional models on a computer screen. Chemists may use computer simulation to design and test molecular models of new drugs. Some simulation programs can generate models of weather conditions to help meteorologists make predictions. Flight simulators are valuable training tools for pilots.

**INDUSTRY** Computers have opened a new era in manufacturing and consumer-product development. In the factory, computer-assisted manufacturing, or CAM, programs help people plan complex production schedules, keep track of inventories and accounts, run automated assembly lines, and control robots. Dedicated computers are routinely used in thousands of products ranging from calculators to airplanes.

**GOVERNMENT** Government agencies are the largest users of mainframes and supercomputers. In United State, for instance, the

Department of Defence uses computers for hundreds of tasks, including research, breaking codes, interpreting data from spy satellites, and targeting missiles. The Internal Revenue Service uses computers to keep track of tens of millions of tax return. Computers are also essential for taking the census, maintaining criminal records, and other tasks.

**EDUCATION** Computers have proved to be valuable educational tools. Computer-assisted instruction, or CAI, uses computerized lessons that range from simple drills and practice sessions to complex interactive tutorials. These programs have become essential teaching tools in medical schools and military training centers, where the topics are complex and the cost of human teachers is extremely high. Educational aids, such as some encyclopedias and other major reference works, are available to personal-computer users-either on magnetic disks or optical discs or through various telecommunication networks.

**ARTS AND ENTERTAINMENT** Video games are one of the most popular applications of personal computers. The constantly improving graphics and sound capabilities of personal computers have made them popular tools for artists and musicians. Personal computers can display millions of colors, can produce images far clearer than those of a television set, and can connect to various musical instruments and synthesizers. Painting and drawing programs enable artists to create realistic images and animated displays much more easily than they could with more traditional tools. "Morphing" programs allow photographers and filmmakers to transform photographic images into any size and shape

they can imagine. High-speed supercomputers can insert lifelike animated images into frames of a film so seamlessly that movie-goers cannot distinguish real actors from computer-generated images. Musicians can use computers to create multiple-voice compositions and to play back music with hundreds of variations. Speech processors even give a computer the ability to talk and sing.

**VIRTUAL REALITY** As personal computers became faster and more powerful in the late 1980s, software developers discovered that they were able to write programs as large and as sophisticated as those previously run only on mainframes. The massive million-dollar flight simulators on which military commercial pilots trained were the first real-world simulations to be moved to the personal computer.

Flight simulators are perfect example of programs that create a virtual reality, or a computer-generated "reality" in which the user does not merely watch but is able to actually participate. The user supplies input to the system by pushing buttons or moving a yoke or joystick, and the computer uses real-world data to determine the result of those actions. For example, if the user pulls back on the flight simulator's yoke, the computer translates the action according to built-in rules derived from the performance of a real airplane. The monitor will show exactly what an airplanes view screen would show as it begins to climb. If the user continues to climb without increasing the throttle, the "virtual plane" will stall (as would a real plane) and the "pilot" will lose control. Thus the

user's physical actions are immediately and realistically reflected on the computer's display. For all intents and purposes, the user is flying—that is, the “plane” obeys the same laws of nature, has the same mechanical capabilities, and responds to the same commands as a real airplane.

Many amusement parks now have rides and attractions that use virtual reality principles for creating exciting alternate realities for their audiences—for example, a simulated ride in a spaceship, complete with near collisions and enemy attacks. Acceleration and deceleration are simulated by pitching and moving seats, all computer-controlled and cleverly coordinated with stereo sound effects and wrap-around video displays.

## CHAPTER THREE

### 3.0 THE TROUBLESHOOTING METHODOLOGY

#### 3.1 EXPERT SYSTEM

Expert system is often regarded as representing sub class of Artificial Intelligence, and they often (wrongly) identified with fifth generation of computers.

Expert system has been working with varying degree of success for many years. However, as usual conventional systems relying on progress knowledge engineering, expert system are at the key development contributing to the fifth generation programs.

An expert system may be regarded as a means of recording and accessing human competence in a particular specialist field. The most robust interpretation suggests that an expert system is human like performance and can serve thereby as a replacement expert. It was in view of these that I resolved to adopt the expert system in troubleshooting, maintenance of PC to the beet of my knowledge. Hardware and software crashes can lead to frustration, hours of wasted effort or worse catastrophic accidents, and it is clearly time that the concept of expert system of troubleshooting and maintenance was carefully adopted as a vital tool in the project.

The majority of computer crashes are caused by fairly trivial events, such as a momentary loss of power or the accidental disconnection of a peripheral device: operator error can also be the cause accidentally pressing the wrong key can wipe



out all the data stored in memory or disk. Hard disks head crash when 20 MB of invaluable data programs just disappear into thin air are directly identifiable hardware faults.

Whatever, the cause, computer faults, both hardware and software, can have catastrophic results. Computer failures can cause loss of life, bankrupt companies and bring nations to brink of war.

When a fault is detected in the computer, by various techniques described in this project, the next stage is to determine the exact source of the fault. This is because a fault is not detected until some time after fault has occurred. This allows the fault to spread across much more of the system than is initially apparent.

Fault can be characterized by duration and extent.

1. A fault is referred to as LATENT when it occurs without producing errors during system operation.
2. TRANSIENT FAULTS are temporary conditions, usually the result of electromagnetic, temperature, humidity, incorrect operating, or other external disturbances. Transient fault typically disappear as soon as the external condition is eliminated.
3. An Intermittent Fault: Alternates between active and dormant state and is usually caused by poor design. Borderline operating conditions, for both transient and intermittent fault, errors may remain after the fault disappears.

### 3.2 TROUBLESHOOTING AND REPAIR

When your computer system fails to operate the way it should, it can be hard to know where to start and what to do. There are so many complex interacting elements in the system that a subtle error in the set up information, for example, can cause all sorts mysterious faults. A bad keyboard can cause the system to appear to freeze or to wild. A bad RAM chip can cause a system to fail to boot, or to periodically crash.

Troubleshooting a faulty system is a methodical process in which you track down and eliminate possible causes at a problem until it disappears. There are no quick solutions or shortcuts, except the experience to know where to start looking and thus save yourself wasted time. This section of the project is meant to be an introduction to fundamentals of troubleshooting a computer system.

### 3.3 PROBLEM DEFINITION

Before you can start chasing down a problem, you have to know what it is, exactly what it is, and some of its likely causes as viz:

#### EFFECTS

When your system behaves unexpectedly, you should immediately exit important program you are running and make certain your data are safe. Never perform the testing described in this project work with important irreplaceable files.

If the problem is critical (it causes the system to lock up at boot) or prevent you

From using the machine in any fashion, make careful note of when the fault occurs, and what seems to be causing it to occur (boot, first key pressed, first attempt to read from a disk, etc.)

If the problem seems to be transient, try to determine the exact sequences of events that cause it.

### **PHYSICAL CONSIDERATION**

Software testing can be done without disturbing the computer's hardware and physical setup. If the troubleshooting or repairs both indicate that you will have to deal extensively with the hardware, you should consider at the start whether you want to move the computer to a location where it will be more accessible.

Fixing a loose video cable can and should be done with the computer in its usual place.

Testing and repair involving the internal hardware and expansion cards should probably be done with the computer spread out, as it was when you first powered it up.

### **HANDLING CONSIDERATION**

Handling computer under repair is much like that of handling is being assembled. When removing expansion cards and Ics, you should observe the anti static precautions. When connecting or disconnecting cables or any place of hardware,

the system power should be off never pull a board, change jumper or switch setting, or switch cables with the power on.

When working with systems that contain hard disk drives, you need to be more gently than when you first installed the drive. An initialized hard drive can even more prove to damage than a new one, since it contains data that can be lost. This is especially true if the system fault prevents you from packing the hard disk drive's head. If the hard disk drive is not a self packing type and your system failed in use, preventing you from running a head packing utility, handle the system unit with extreme care.

Since you will probably have to power the system up and down several times during hardware troubleshooting, be certain that pack the heads each time. Always allow the hard disk a minute or two to spin down to a halt before moving or bumping the case.

### 3.4 TOOLS

Many troubleshooting and repair operations can be accomplished without tools, the tool set needed to assemble the computer should be sufficient, but the complete set listed in this project work is recommended as repair often involves steps more complicated than those of assembly.

More advanced tools such as a soldering pencil, logic probe, multimeter, oscilloscope, cable tester, etc. are not required for board level testing and repair the scope of this project work.

### 3.5 SOFTWARE TOOLS

Software diagnostic tools can be very useful reference manual, which accompanies some system when bought, has a number of diagnostic routines that can help you pinpoint problems.

There are also many other routines programs, and software tools available in the public domain and shareware market, which can be obtained from local bulletin boards, computer user groups, and online information services sometimes a small specialized testing routine can save us hours of labour.

Commercial diagnostic programs are also indispensable to anyone who does a lot of computer troubleshooting and repair. A software tool that is certainly needed for troubleshooting at no cost is a RAW.

### SYSTEM BOOT DISK

A Raw boot disk should be a floppy disk with the operating boot files, but no configuration files for DOS, AUTO EXEC, BAT and CONFIG.System.

To simplify some steps of software troubleshooting copy of all the drives and utilities normally used when a system booted. A text editor such as EDLIN, COM, which comes with most versions of DOS, should be included, so that one can create and modify configuration files as necessary.

### 3.6 HARDWARE TROUBLESHOOTING

Hardware troubleshooting and repair is much like that of software although it is more involved because of the system disassembly required. Again, it is probably

easier to proceed with hardware trouble shooting if the computer system is moved to a test bench like area.

### **LIMITED TROUBLESHOOTING**

If one is certain that a particular problem lies with a specific expansion card or other device, one can begin by inspecting that device. Check all of its connections and its installation, if everything appears normal cables correctly attached, and seated in expansion slot, all jumpers firmly in place, then remove the device for closer inspection. Check the placement of all jumpers and the position of all dip switches on the card. Check the entire one after the other. Don't assume or overlook anything.

Remove and reinstall any attached enables, looking for bad connector pins, a bad attachment of the cable or signs that the cable may have been damaged, e.g. any IC's or other devices are installed in socket, check to see that they are firmly and correctly seated in the sockets.

When the card and devices conditions are verified, reinstall it and carefully reconnect it as necessary. Power up the system to see if the problem has been cured. If it has not been cured, then certainly the problem lies in that devices that component will have to be repaired or more likely replaced.

## EXTENDED TROUBLESHOOTING

If a problem to a single component cannot be pinpointed or if a problem that appeared to be the fault of a single device turned out to be one has to troubleshoot the entire. If this becomes necessary it's best to take the wide angle approach discussed here, rather than try to troubleshoot sections of the system individually.

Take the system and strip it down to bare essentials. If possible, the only expansion devices in the system unit should be a video card and a floppy drive controller. The only devices attached to the system should be a keyboard and monitor. If the system does not function properly in this configuration, the fault lies with whatever hardware is installed.

Motherboard, RAM floppy controller, keyboard or video adapter. Without substitute parts to swap into the system (e.g. a temporary replacement for the floppy controller or video card), it can be hard to trace the problem further.

If the stripped system works correctly, reinstall the removed component one at a time until the malfunction occurs. If more than one optional device is installed at that point, try removing some of the earlier installed ones to see if the problem disappears again. This process should lead to the deflection of the faulty component or problem-causing device.

The most common problem, assuming that none of the device was actually faulty, is an improperly shared system resource, such as a DMA channel or interrupts request (TRQ) line.

Shared hardware port addresses also occasionally occur, especially with multiple parallel ports and EMS (Expanded Memory) cards. No shared hardware port addresses or signal lines is permitted.

Once the fault is narrowed down to one or two devices, check their configuration to see if they are perhaps sharing a system resource or are otherwise improperly configured. If everything appears to be correct, one of the components is most likely faulty. The best way to test hardware is in a working computer system.

### 3.7 REPAIR

Repairing computer systems consist mostly of replacing faulty in their entirety. During repair with a soldering iron at the level of board's integrated circuits, resistor, and other components requires skill and experience. It is often simpler and more cost effective to replace an entire expansion card than try repairing it, even if the fault is detected.

There are a few items that can be repaired with minimum skill. Cables are one example. If a cable developed a broken conductor inside one of the connector shells, a few minutes work with a soldering iron can save the replacement cost of the cable.



START THE TROUBLESHOOTING PROCESS HERE FOLLOW THE CHART ANSWER THE FOLLOWING QUESTIONS

COMPUTER

THE COMPUTER HAVE VIDEO?

FAN BLOWING?

ADJUST THE VIDEO CARD  
POSSIBLE SOLUTION

IS THE VIDEO QUALITY OKAY?

THE SYSTEM ROM CONTAINS A SET OF ERROR CODES TO HELP WITH TROUBLESHOOTING WE RECEIVE THEM AS BEEPS, MESSAGES OR NUMBER CODES.

ARE THERE BURNT PARTS?

REPLACE THE BURNT PARTS

CHECK MOTHERBOARD AND THE P.S.U

MOST PCs USES A SERIES OF BEEPS TO SIGNAL A PROBLEM. AMI BEEPS USES ONE OR TWO BEEPS.

IS THE COMPUTER BEeping ONCE OR TWICE?

DUES THE COMPUTER HAVE AMI BIOS?

PROBLEM SOLVED

DUES COMPUTER BOOT?

DUES AN ERROR SHON?

FIND THE ERROR MESSAGE AND FIX THE PROBLEM

CHECK THE HARD DISK

DUES THE COMPUTER HAVE HARD DISK?

GO TO THE FORM DISK SECTION

THE BEEP CODES COVER MOST ERROR.

CHECK ERROR CODES

PROBLEM SOLVED

However, if the cable has molded on connectors or the break is somewhere along its length, no repair is possible.

Nearly all computers component and product have warranties. If a product fail within the warranty period, one should contact the seller or manufacturer about repair or replacement of the defective part.

### 3.8 TROUBLESHOOTING CHART

Troubleshooting is much easier if you have a guide to the possible problems and related symptoms that a malfunctioning system can display.

This project is intended to provide an overall troubleshooting guide with some possible solutions to common problems, both in CHART FORM AND COMPUTER PROGRAMS known as TUTOR programs on how to troubleshoot. Which will go a long way to help computer user perform preventive maintenance on their system to save cost. In some cases, the fault is self-explanatory. In others, the problem is simply narrowed to a particular area of the system, and you will have to use the various information provided in this project work to computer the troubleshooting.

### 3.9 SYSTEM

The following problems with overall system may be encountered.

#### **SYSTEM DOES NOT POWER UP**

- System unit not plugged in
- Power cord loose or broken

- Wall socket faulty, or circuit breaker open
- Short circuit in computer system causing power supply shutdown
- Power supply faulty

#### **SYSTEM DOES NOT BOOT**

- Non-bootable diskette in drive A
- Hard disk drive not initialized
- System file on hard disk drive missing or damaged
- Faulty Cmos setup information, and/or incorrect motherboard didswitch setting
- Faulty RAM device
- Loose disk drive control, data, or power cable
- Power supply loaded pass voltage limit
- Expansion card loose in slot.

#### **SYSTEM FREEZES, CRASHES, OR REBOOTS SPONTANEOUSLY**

- Faulty RAM device
- Loose motherboard power connector
- Expansion card loose in slot
- Conflicting hardware assignments
- Incorrect or conflicting software configuration
- Memory – resident program and driver conflicts

#### **KEYBOARD DOES NOT RESPOND**

Keyboard not firmly plugged into motherboard port

- TX-style keyboard used with wrong motherboard

- Switchable keyboard set to wrong type (CTIAT) for motherboard
- Keyboard lock switch in locked position
- Keyboard lock switch wiring loose on motherboard, or connector reversed

#### **NOISE FROM SYSTEM UNIT**

- Normal power supply noise (fanhum, air movement)
- Normal hard disk drive noise (hum or slight whine while running).
- Faulty hard disk drive (loud or repeated chatter or thump, loud whine)
- Faulty cooling fan (loud hum, chatter overheating smells)

#### **NO SOUND FROM SPEAKER**

- Speaker connection to motherboard loose
- Speaker or wiring faulty
- Programs not making use of speaker

#### **REAL-TIME CLOCK/CALENDAR MALFUNCTIONS**

- No real-time clock/calendar installed
- Clock battery weak, dead or missing
- Clock/Calendar not set properly (correctly)
- Real-time, time and not retired and used to set DOS system clock.

### **3.10 VIDEO**

The following problems commonly occur with

#### **NO VIDEO DISPLAY**

- Monitor not plugged in, or not turned on
- Video cable not connected to video adaptor, or connection to adaptor or monitor loose.
- Video cable faulty
- Incorrect monitor type for video adaptor in use
- Motherboard color/mono select dipswitch set incorrectly
- Incorrect video type specified in set up
- Video adaptor incorrectly configured
- Incorrect video mode selected
- Software incorrectly configured
- Monitor incorrectly configured (applies monthly to multiscan and VGA monitors)
- Monitor brightness or contrast turned down
- Software screen-blanking utility in operation

#### **FAULTY VIDEO DISPLAY**

- Incorrect video mode selected
- Video adaptor incorrectly configured
- Monitor vertical and horizontal hold and controls misadjusted
- Monitor brightness and/or contrast control misadjusted
- Software incorrectly configured
- Insufficient video RAM (VGA, older EGA only)
- Motherboard master oscillator trimmed (older CGA systems only)

### 3.11 DISK DRIVE

Hard and floppy disk drive can display the following problems

#### WRITE FAILURE

- No disk on diskette drive
- Diskette not firmly seated in drive (3.5inch drives) or drive door close (5.25inch drive)
- Disk not formatted to drive only not initialized
- Diskette writes protected
- Diskette drive write-protect sensor blocked or faulty
- Hard disk partition flagged read only.

#### READ FAILURE

- No disk on diskette drive
- Diskette not firmly seated on diskette drives or drive door not closed
- Disk not formatted or (hard drive only) not initialized

#### DISKET FAILS TO RECOGNIZE NEW DISK

- Change disk jumper on diskette drive incorrectly set
- Diskette cable loose or faulty.

### 3.12 PERIPHERALS

The following problems with peripherals devices may be encountered.

#### SERIAL PORT NOT FUNCTIONING

- Expansion card incorrectly configured
- Software incorrectly configured
- Serial port not initialized (use MODE command)
- Incorrect parameters (band rate, stop bits, parity) specified
- VART and or drivers Ices installed (secondary ports only)
- Serial cable incorrectly wired
- Cable connections loose
- Serial device (printer, plotter, mouse) incorrectly configured.

### 3.13 FEASIBILITY STUDY

Feasibility study is concerned with preliminary investigation and it is upon to determine whether the proposed project is feasible or not feasible. The objectives of the analyst is to clarify and understand the scope of the project which are list in chapter one, starting from the statement of the problem through the end of that chapter.

### 3.14 OPERATION OF THE EXISTING SYSTEM

This is concerned with the ways and manners by which computer are being repair/troubleshoot. The following methods are the most common ways to troubleshoot computer as at the time designing this project work.

Trial and error method

Sets comparison method

Personal idea method

Group/Team work method

Impromptu repair method

#### **TRIAL AND ERROR METHOD**

This has to do with removing, testing and replacing any or all components the computer scientist/engineer feels or assume is likely to be the problem source, until he is tired or the fault is detected. This method may take hours, day, weeks or even months depending on the nature of problem and luck/chance of success on the part of the engineer.

#### **SET COMPARISON METHOD**

Require that there have to be good working computer system of the same MAKE MODEL and equal circuit board. The engineer will thereby be comparing the values of the measure components of the two systems until the fault is detected. This is a good method and required good professional skill so as not to damage the other working system.



### **PERSONAL EXPERIENCE/IDEA METHOD**

Professional engineer with a lot of practical experience, having good record keeping on repaired system will use this experience to troubleshoot/repair another system with similar problem.

### **GROUP/TEAM WORK METHOD**

Sometimes in an organization having skill personal, with their wealth of different experience do jointly repair complicated problems. Since it is believed that two heads are better than one, irrelevant parts on the circuit board will not be disturbed.

### **IMPROMPT REPAIR METHOD**

This is mostly on a partial contact component when a faulty system start working fine soon as the printed wiring board is touched, shapes, tampered with or disturbed without knowing the particular fault area. Therefore, no real working is done on the system.

### **PROBLEM WITH THE EXISTING SYSTEM**

After going through the existing method of diagnosing and troubleshooting of computer system, the problem identified with the system/methods are:

Damage to the printed board

Undue delayed in repairs

Mallfunctioning of system

Laborious and boredom in repair

Lack of uniformity of repair

Cumbersome or congestion of workshop

Deception repair

1. **Damage to the printed Circuit (Wiring) Board**

Due to continuing removing and replacing of components as a result of try an error method of repair damages are usually done to the printed circuit board.

2. **Undue delay in Repair**

It is common for engineers to delay jobs especially when the fault has not been detected.

They can keep a job for days; weeks, months and even year only to be promising the customer endlessly and at the end, the job may not be done. Meanwhile, it could be a very simple problem, having his proposed troubleshooting kit at hand.

3. **Malfunctioning of System**

At times, the repaired system using the aforementioned methods may be malfunctioning after sometime, if not properly diagnosis and cleared.

4. **Laborious and Boredom in Repair**

Engineers may spend the whole day without success trying to clear a fault; some of them sweat and are restless.

## CHAPTER FOUR

### 4.0 MAINTAINING YOUR SYSTEM: PREVENTIVE MAINTENANCE

#### 4.1 DEVELOPING A PREVENTIVE MAINTENANCE PROGRAMME

Developing a preventive maintenance is important to everyone who uses or manages personal computer systems. Two types of preventive maintenance procedures exist – active and passive.

Active preventive maintenance includes steps you apply to a system that promote a longer, trouble-free life. This type of preventive maintenance primarily involves periodic cleaning of the system and its components. This section describes several active preventive maintenance procedures, including cleaning and lubricating all major components, reseating chips and connectors, and reformatting hard disk.

Passive preventive maintenance includes steps you can take to protect a system from the environment, such as using power-protection device; ensuring a clean, temperature controlled environment; and preventing excessive vibration. In other words, passive preventive maintenance means treating your system well. This section also describes passive preventive maintenance procedures.

#### 4.2 ACTIVE PREVENTIVE MAINTENANCE PROCEDURES

How often you should implement active preventive maintenance procedures depends on the system's environment and the quality of the system's components. If your system is in a dirty environment, such as a shop floor or a gas station

service area, you might need to clean your system every three months or less. For normal office environment, cleaning a system every one to two years is usually fine. However, if you open your system after one year and find dust bunnies inside, you should probably shorten the cleaning interval.

Another active preventive maintenance technique discussed in this section is reformatting hard disks. Low-level reformatting restores the track and sector marks to their proper location and forces you to back up and restore all data on the drive. Not all drives require this procedure, but if you are using drives with a stepper-motor head actuator, periodic reformatting is highly recommended. Most drives with voice-coil head actuator run indefinitely without reformatting due to their track following service mechanisms that prevent temperature induced mistracking.

Other hard disk preventing maintenance procedures include making periodic backups of critical areas such as Boot Sectors, File Allocation Tables, and Directory structures on the disk.

#### 4.3 **CLEANING A SYSTEM**

One of the most important operations in a good preventive maintenance program is regular and thorough cleaning of the system. Dust buildup on the internal components can lead to several problems. One is that the dust acts as a thermal insulator, which prevents proper system cooling. Excessive heat shortens the life

of system components and adds to the thermal stress problem caused by wider temperature changes between power-on and power-off states. Additionally, the dust may contain conductive elements that can cause partial short circuits in a system. Other elements in dust and dirt can accelerate corrosion of electrical contacts and cause improper connections. In all, the removal of any layer of dust and debris from within a computer system benefits that system in the long run.

All PC-compatible systems use a forced-air cooling system that allows for even cooling inside the system. A fan is mounted in, on, or near the power supply and pushes air outside. This setup depressurizes the interior of the system relative to the outside air. The lower pressure inside the system causes outside air to be drawn into openings in the system chassis and cover. This draw-through, or depressurization, is the most efficient cooling system that can be designed without an air filter. Air filters typically are not used with depressurization systems because there is not an easy way to limit air intake to a single port that can be covered by a filter.

Some industrial computers use a forced-air system that uses the fan to pressurize, rather than to depressurize, the case. This system forces air to exhaust from any holes in the chassis and case or cover. The key to the pressurization system is that all air intake for the system is at a single location – the fan. The air flowing into the system, therefore, can be filtered by simply integrating a filter assembly into the fan housing. The filter must be cleaned or changed periodically. Because the

interior of the case is pressurized relative to the outside air, airborne contaminants are not drawn into the system even though it may not be sealed. Any air entering the system must pass through the fan and filter housing, which removes the contaminant. Pressurization cooling systems are used primarily in the industrial computer models designed for extremely harsh environments.

Most systems you have contact with are depressurization systems. Mounting any sort of air filter on these types of systems is impossible because air enters the system from too many sources. With any cooling system in which incoming air is not filtered, dust and other chemical matter in the environment is drawn in and builds up inside the computer. This buildup can cause severe problems if left unchecked.

One problem that can develop is overheating. The buildup of dust acts as a heat insulator, which prevents the system from cooling properly. Some of the components in a modern PC can generate an enormous amount of heat that must be dissipated for the component to function. The dust also might contain chemicals that conduct electricity. These chemicals can cause minor current shorts and create electrical signal paths where none should exist. The chemicals also cause rapid corrosion of cable connectors, socket-installed components, and areas where boards plug into slots. All can cause intermittent system problems and erratic operation.

Floppy disk drives are particularly vulnerable to the effects of dirt and dust. Floppy drives are a large "hole" within the system through which air continuously flows. Therefore, they accumulate a large amount of dust and chemical buildup within a short time. Hard disk drives do not present quite the same problem. Because the head disk assembly (HAD) in a hard disk is a sealed unit with a single barometric vent, no dust or dirt can enter without passing through the barometric vent filter. This filter ensures that contaminating dust or particles cannot enter the interior of the HAD. Thus, cleaning a hard disk requires simply blowing the dust and dirt off from outside the drive. No internal cleaning is required.

#### 4.4 DISSEMBLY AND CLEANING TOOLS

To properly clean the system and all the boards inside requires certain supplies and tools. In addition to the tools required to disassemble the unit, you should have these items:

- \*Contact Cleaning Solution
- \*Canned air
- \*A small brush
- \*Lint-free foam cleaning swabs
- \*Antistatic wrist-grounding strap

You also might want to acquire these optional items:

- \*Foam tape
- \*Low-volatile room-temperature vulcanizing (RTV) sealer

- \*Silicone type lubricant

- \*Computer vacuum cleaner

These simple cleaning tools and chemical solutions will allow you to perform most common preventive maintenance tasks.

**Chemicals:** You can use several different types of cleaning solutions with computers and electronic assemblies. Most fall into the following categories:

- \*Standard cleaner

- \*Contact cleaner/Lubricants

- \*Dusters

Many specific chemicals are used in cleaning and dusting solutions, but five types are of particular interest. The EPA has classified ozone-damaging chemicals into two classes – Class I and Class II. Chemicals that fall into these two classes have their usage regulated. Other chemicals are non-regulated. Class I chemicals include:

- \*Chlorofluorocarbons (CFCs)

- \*Chlorinated solvents

Class I chemicals can only be sold for use in professional service and not to consumers. A law that went into effect on May 15, 1993, requires that the containers for Class I chemicals be labeled with a warning that the product “Contains substances that harm public health and the environment by destroying ozone in the atmosphere.” Additionally, electronics manufacturers and other



industries must also apply a similar warning label to any products that use Class I chemicals in the production process. This means that any circuit board or computer that is manufactured with CFFc will have this label!

Class II chemical include hydrochlorofluorocarbons (HCFCs). These are not as strictly regulated as Class I chemical because they have a lower ozone depletion potential. Many cleaning solutions have switched to HCFCs because they do not require the restrictive labeling required by Class I chemicals and are not as harmful. Most HCFCs have only one tenth the ozone damaging potential of CFCs.

Other nonregulated chemicals include Volatile Organic Compounds (VOCs) and Hydrofluorocarbons (HFCs). These chemicals do not damage the ozone layer but actually contribute to ozone production, which, unfortunately, appears in the form of smog or ground level pollution. Pure isopropyl alcohol is an example of a VOC that is commonly used in electronic part and contact cleaning. HFCs are used as a replacement for CFCs because the HFCs do not damage the ozone layer.

#### 4.5 STANDARD CLEANERS

Standard cleaning solutions are available in a variety of types and configurations. You can use pure isopropyl alcohol, acetone, Freon, trichloroethane, or a variety of other chemicals. Most board manufacturers and service shops are now leaning to the alcohol, acetone, or other chemicals that do not cause ozone depletion and

That comply with government regulations and environmental safety. You should be sure that your cleaning solution is designed to clean computers or electronic assemblies. In most cases this means that the solution should be chemically pure and free from contaminants or other unwanted substances. You should not, for example, use drugstore rubbing alcohol for cleaning electronic parts or contacts because it is not pure and could contain water or perfumes. The material must be moisture-free and residue-free. The solutions should be in liquid form, not a spray. Sprays can be wasteful and you almost never spray the solution directly on components. Instead, wet a foam or chamois swab used for wiping the component. These electronic-component cleaning solutions are available at any good electronic parts stores.

#### 4.6 CONTACT CLEANER/LUBRICANTS

These are very similar to the standard cleaners but include a lubricating component. The lubricant eases the force required when plugging and unplugging cables and connectors, which reduces strain on the devices. The lubricant coating also acts as a conductive protectant that insulates the contacts from corrosion. These chemicals can greatly prolong the life of a system by preventing intermittent contacts in the future.

Contact cleaner/lubricants are especially effective on I/O slot connectors, adapter card edge and pin connectors, disk drive connectors, power supply connectors, and virtually any connectors in the PC.

An excellent contact enhancer and lubricant is Stabilant 22. It is more effective than conventional contact cleaners or lubricants. This chemical is available in several forms. Stabilant 22 is the full strength concentrated version, while Stabilant 22a is a version diluted with isopropyl alcohol in a 4 to 1 ratio. An even more diluted 8 to 1 ratio version is sold in many high end stereo and audio shops under the name "Tweek." Just 15ml of Stabilant 22a sells for about \$40, while a liter of the concentrate costs about \$4,000. While Stabilant 22 is expensive, very little is required and an applicant can provide protection for a long time. Stabilant is manufactured by D.W. Electrochemical, which is listed in the Vendor List in Appendix B.

#### 4.7 DUSTERS

Compressed gas often is used as an aid in system cleaning. The compressed gas is used as a blower to remove dust and debris from a system or component. Originally, these dusters used CFCs such as Freon, while modern dusters now use HFCs or carbon dioxide, neither of which is damaging to the ozone layer. Be careful when you use these devices because some of them can generate a static charge when the compressed gas leaves the nozzle of the can. Be sure that you are using the kind approved for cleaning or dusting off computer equipment, and consider wearing a static grounding strap as a precaution. The type of compressed-air cans used for cleaning camera equipment can sometimes differ from the type used for cleaning static sensitive computer components.

Most older computer-grade canned gas dusters consisted of dichlorodifluoromethane (Freon R12), the same chemical used in many automotive air-conditioning systems built until 1996, when a ban of the manufacture and use of R12 takes place. In 1992 many automobile manufacturers began switching to an ozone-safe chemical called R134a, and most had switched to the new refrigerant by 1994. Manufacturing of R12 has ceased, and the regulations placed on its use have forced companies to use other products such as carbon dioxide for compressed gas dusters. In addition to the environmental concerns about depleting the ozone layer, Freon can be dangerous if exposed to an open flame.

Related to compressed-air products are chemical-freeze sprays. These sprays are used to quickly cool down a suspected failing component, which often temporarily restores it to operation. These substances are not used to repair a device, but to confirm that you have found a failed device. Often, a component's failure is heat-related and cooling it temporarily restores it to function. If the circuit begins operating normally, the device you are cooling is the suspect device.

#### 4.8 VACUUM CLEANERS

Some people prefer to use a vacuum cleaner instead of canned gas dusters for cleaning a system. Canned gas is usually better for cleaning in small areas. A small vacuum cleaner is more useful when you are cleaning a system loaded with dust and dirt. You can use the vacuum cleaner to suck out dust and debris instead

of blowing them on other components, which sometimes happens with canned air. For outbound servicing (when you are going to the location of the equipment instead of the equipment coming to you), canned air is easier to carry in a toolkit than a small vacuum cleaner. There are also tiny vacuum cleaners available for system cleaning. These small units are easy to carry and may serve as an alternative to compressed air cans.

Note that there are special vacuum cleaners specifically designed for using on and around electronic components. They are designed to minimize ESD (Electro Static Discharge) while in use. If you are using a regular vacuum cleaner and not one specifically grounding wrist strap. Also be careful if the cleaner has a metal nozzle not to touch it to the circuit boards or components you are cleaning.

#### 4.9 BRUSHES AND SWABS

A small brush (makeup, photographic, or paint) can be used to carefully loosen accumulated dirt and dust before spraying with canned air or using the vacuum cleaner. Be careful about generating static electricity. In most cases the brushes should not be used directly on circuit boards but should be used instead on the case interior and other part such as fan blades, air vents, and keyboards. Wear a grounded wrist strap if you are brushing on or near any circuit boards, and brush slowly and lightly to prevent static discharges from occurring.

Use cleaning swabs to wipe off electrical contacts and connectors, disk drive heads, and other sensitive areas. The swabs should be made of foam or synthetic chamois materials that does not leave lint or dust residue. Unfortunately, proper

foam or chamois cleaning swabs are more expensive than the typical cotton swabs. Do not use cotton swabs because they leave cotton fibers on everything they touch. Cotton fibers are conductive in some situations and can remain on drive heads, which can scratch disks. Foam or chamois swabs can be purchased at most electronics-supply stores.

One item to avoid is an eraser for cleaning contacts. Many people (including myself) have recommended using a soft pencil type eraser for cleaning board contacts. Testing has proven this to be bad advice for several reasons. One is that any such abrasive wiping on electrical contacts generates friction and an Electro-Static Discharge (ESD). This ESD can be damaging to boards and components, especially with newer low voltage devices made using CMOS (Complimentary Metal Oxide Semoconductor) technology. These devices are especially static sensitive, and cleaning the contacts without a proper liquid solution is not recommended. Also, the eraser will wear off the gold coating on many contacts, exposing the tin contact underneath, which will rapidly corrode when exposed to air. Some companies sell premoistened contact cleaning pads that are soaked in a proper contact cleaner and lubricant. These pads are safe to wipe on conductor and contacts with no likelihood of ESD damage or abrasion of the gold plating.

#### **4.10 FOAM TAPE OR RTV SEALER**

Hard disks usually use a small copper strap to ground the spindle of the disk assembly to the logic board, thus bleeding off any static charge carried by the spinning disk platters. Unfortunately, with most older drives, this strap often can

begin to harmonize, or vibrate, and result in an annoying squealing or whining noise. (Sometimes the noise is similar to fingernails dragged across a chalkboard). This spindle motor ground strap has been redesigned and can be hidden on newer rives, making it difficult to see. Fortunately, it rarely makes noise on the 3.5 inch or smaller drives.

To eliminate the source of irritation, you can stop the strap from vibrating by weighting it. One method is to use a piece of foam tape cut to match the size of the strap and stuck to the strap's back side. Another way to dampen the vibration is to apply a low-volatile RTV sealer. You apply this silicone-type rubber to the back of the grounding strap. After it hardens to a rubber-like materials, the sealer stops the vibrations that produce the annoying squeal. You can buy the RTV sealer from an automotive-supply house.

I prefer using the foam tape rather than the RTV because it is easier and neater to apply. If you use the RTV, be sure that it is the low-volatile type, which does not generate acid when it cures. This acid produces the vinegar smell common to the standard RTV seal, and can be highly corrosive to the strap and anything else it contact. The low-volatile RTV also eliminates the bad vinegar smell. You can purchase the foam tape at most electronics-supply stores, where it often is sold for attaching alarm switches to doors or windows. The low-volatile RTV is available from most auto-supply stores. To be sure that you buy low-volatile RTV look for the packaging to state specially that the product is either a low-volatile type or is compatible with automobile oxygen sensors.

#### 4.11 **SILICONE LUBRICANTS**

Silicone lubricants are used to lubricate the door mechanisms on floppy disk drives and any other part of the system that may require clean, non-oily lubrication. Other items you can lubricate are the disk drive head slider rails or even printer-head slider rails, which allow for smooth operation.

Using silicone instead of conventional oils is important because silicone does not gum up and collect dust and other debris. Always use silicone sparingly. Do not spray it anywhere near the equipment as it tends to migrate and will end up where it doesn't belong (such as on drive heads). Instead, apply a small amount to a toothpick or foam swab and dab the silicone on the components where needed. You can use a lint-free cleaning stick soaked in silicone lubricants to lubricate the metal print-head rails in a printer.

Remember that some of the cleaning operations described in this section might generate a static charge. You may want to use a static grounding strap in cases in which static levels are high to ensure that you do not damage any boards as you work with them.

#### 4.12 **OBTAINING REQUIRED TOOLS AND ACCESSORIES**

Most cleaning chemicals and tools can be obtained from a number of electronics supply houses, or even the local Radio Shack. A company called Chemtronics specializes in chemicals for computer and electronics industry. These and other companies that supply tools, chemicals, and other computer electronic cleaning



supplies are listed in the Vendor List in the Appendix. With all these items on hand, you should be equipped for most preventive maintenance operations.

#### 4.13 **DISASSEMBLING AND CLEANING PROCEDURE**

To properly clean the system, it must be at least partially disassembled. Some people go as far as to remove the motherboard. Removing the motherboard results in the best possible access to other areas of the system but in the interest of saving time, you probably need to disassemble the system only to where the motherboard is completely visible.

All plug-in adapter cards must be removed, along with the disk drives. Although you can clean the heads of a floppy drive with a cleaning disk without opening the system unit's cover, you probably will want to do more through cleaning. In addition to the heads, you also should clean and lubricate the door mechanism and clean any logic boards and connectors on the drive. This procedure usually requires removing the drive.

Next, do the same procedure with a hard disk: clean the logic boards and connectors, as well as lubricate the grounding strap. To do so, you must remove the hard disk assembly. As a precaution, be sure it is backed up before removal.

#### 4.14 **RESEATING SOCKETED CHIPS**

A primary preventive maintenance function is to undo the effects of chip creep. As your system heats and cools, it expands and contracts, and the physical expansion and contraction causes components plugged into sockets to gradually

work their way out of those sockets. This process is called chip creep. To correct its effects, you must find all socketed components in the system and make sure that they are properly reseated.

In most systems, all the memory chips are socketed or are installed in socketed SIMMs (Single Inline Memory Modules). SIMM drives are retained securely in their sockets by a positive latching mechanism and cannot creep out. Memory SIPP (Single Inline Pin Pin Pack-age) devices (SIMMs with pins rather than contacts) are not retained by a latching mechanism and therefore can creep out of their sockets. Standard socketed memory chips are prime candidates for chip creep. Most other logic components are soldered in. You can also expect to find the ROM chips, the main processors of CPU, and the math compressor in sockets. In most systems, these items are the only components that are socketed; all others soldered in.

Exceptions, however, might exist. A socketed component in one system might not be socketed in another – even if both are from the same manufacturer. Sometimes this difference results from a part-availability problem when the boards are manufactured. Rather than halt the assembly line when a part is not available, the manufacturer adds a socket instead of the component. When the components becomes available, it is plugged in and the board is finished. Many newer systems place the CPU in a Zero Insertion Force (ZIF) socket, which has a lever that can release the grip of the socket on the chip. In most cases there is very little creep with a ZIF socket.

To make sure that all components are fully seated in their sockets, place your hand on the underside of the board and then apply downward pressure with your thumb (from the top) on the chip to be seated. For larger chips, set the chip carefully in two movements, and press separately on each end of the chip with your thumb to be sure that the chip is fully seated. (The processor and math compressor chips can usually be seated in this manner). In most cases, you hear a crunching sound as the chip makes its way back into the socket. Because of the great force sometimes required to reseat the chips, this operation is difficult if you do not remove the board.

For motherboards, forcibly seating chips can be dangerous if you do not directly support the board from the underside with your hand. Too much pressure on the board can cause it to bow or bend in the chassis, and the pressure can crack it before seating takes place. The plastic standoffs that separate and hold the board up from the metal chassis are spaced too far apart to properly support the board under this kind of stress. Try this operation only if you can remove and support the board adequately from underneath.

You may be surprised to know that, even if you fully seat each chip, they might need reseating again within a year. The creep usually is noticeable within a year or less.

#### 4.15 **CLEANING BOARDS**

After reseating any socket devices that may have crept out of their sockets, the next step is to clean the boards and all connectors in the system. For this step, the cleaning solutions and the lint-free swabs described earlier are needed.

First, clean the dust and debris off the board and then clean any connectors on the board. To clean the boards, it is usually best to use a vacuum cleaner designed for electronic assemblies and circuit boards or a duster and dirt off the boards.

Also blow any dust out of the power supply, especially around the fan intake and exhaust areas. You do not need to disassemble the power supply to do this, just use a duster can and blast the compressed air into the supply through the fan exhaust port. This will blow the dust out of the supply and clean off the fan blades and grille, which will help with system airflow.

#### 4.16 **CLEANING CONNECTORS AND CONTACTS**

Cleaning the connectors and contacts in a system promotes reliable connections devices. On a motherboard, you will want to clean the slot connectors, power-supply connectors, keyboard connectors, and speaker connector. For most plug-in cards, you will want to clean the edge connectors that lug into slot on the motherboard as well as any other connectors, such as external ones mounted on the card bracket.

Submerge the lint-free swabs in the liquid cleaning solution. If you are using the spray, hold the swab away from the system and spray a small amount on the foam end until the solution starts to drip. Then, use the soaked foam swab to wipe the

connectors on the boards. Pre-soaked wipes are the easiest to use. Simply wipe them along the contacts to remove any accumulated dirt and leave a protective coating behind.

On the motherboard, pay special attention to the slot connectors. Be liberal with the liquid; resoak the foam swab repeatedly, and vigorously clean the connectors. Don't worry if some of the liquid drips on the surface of the motherboard. These solutions are entirely safe for the whole board and will not damage the components.

Use the solution to wash the dirt off the gold contacts in the slot connectors, and then douse any other connectors on the board. Clean the keyboard connector, the grounding positions where screws ground the board to the system chassis, power-supply connectors, speaker connectors, battery connectors, and so on.

If you are cleaning a plug-inboard, pay special attention to the edge connector that mates with the slot connector on the motherboard. When people handle plug-in cards, they often touch the gold contacts on the connectors. Touching the gold contacts coats them with oils and debris, which prevents proper contact with the slot connector when the board is installed. Make sure that these gold contacts are free of finger oils and residue. It is a good idea to use one of the contact cleaners that has a conductive lubricant, which allows connections to be made with less force, and also protects the contacts from corrosion.

#### 4.17 CLEANING FLOPPY DRIVES

Because Chapter 13 explains the procedure for cleaning floppy drives, the information is not repeated here. The basic idea is to use a canned gas duster to dust off the interior of the drive, use the silicone lubricant on whatever items need lubrication, and follow up with a head cleaning, either manually with a foam swab or most likely with a chemical soaked cleaning disk.

For hard disk, take this opportunity to dampen or lubricate the grounding strap if you have a noise problem described earlier. Dampening is the recommended solution because if you lubricate this point, the lubricant eventually dries up and the squeal can come back. Because the dampening is usually a more permanent fix for this sort of problem, I recommend it whenever possible. Most newer disks have this dampening material applied at the factory and are not likely to generate noise like older drives.

#### 4.18 CLEANING THE KEYBOARD AND MOUSE

Keyboards and mice are notorious for picking up dirt and garbage. If you have ever opened up an older keyboard, you often will be amazed at the junk you will find in there.

To prevent problems, it is a good idea to periodically clean out the keyboard with a vacuum cleaner. An alternative method is to turn the keyboard upside down and shoot it with a can of compressed gas. This will blow out the dirt and debris.

that has accumulated inside the keyboard and possibly prevent future problems with sticking keys or dirty keyswitches.

If a particular key is stuck or making intermittent contact, you can soak or spray that switch with contact cleaner. The best way to do this is to first remove keycap and then spray the cleaner into the switch. This usually does not require complete disassembly of the keyboard. Periodic vacuuming or compressed gas cleaning will prevent more serious problems with sticking keys and keys and keyswitches.

Most mice are easily cleaned. In most cases there is a twist off locking retainer that keep the mouse ball retained in the body of the mouse. By removing the retainer, the ball will drop out. After removing the ball, you should clean it with one of the electronic cleaner. I would recommend a pure cleaner instead of a contact cleaner with lubricant because you do not want any lubricant on the mouse ball. The you should clean off the rollers in the body of the mouse with the cleaner and some swabs.

Periodic cleaning of a mouse in this manner will eliminate or prevent skipping or erratic movement that can be frustrating. I also recommend a mouse pad for most ball type mice because the pad will prevent the mouse ball from picking up debris from your desk.

Mice often need frequent cleaning before they start sticking and jumping, which can be frustrating. If you never want to clean a mouse again, I suggest you look into the Honeywell mouse. These mice have a revolutionary new design that uses two external wheels rather than the conventional ball and roller system. The wheels work directly on the desk surface and are unaffected by dirt and dust.

Because the body of the mouse is sealed, dirt and dust cannot enter it and gum up the positional sensors. I find this mouse excellent to use with my portable system because it works well on any surface. This mouse is virtually immune to the sticking and jumping that plagues ball and roller designs and never needs to be cleaned, so it is less frustrating than conventional mice.

Other pointing devices requiring little or no maintenance are the IBM designed Trackpoint and similar systems introduced by other manufacturers, such as the Glidepoint by Alps. These devices are totally sealed and use pressure transducers to control pointer movement. Because they are sealed, cleaning need only be performed externally, and is as simple as wiping the device off with a mild cleaning solution to remove oils and other deposits that have accumulated from handling them.

#### 4.19 **HARD DISK MAINTENANCE**

Certain preventive maintenance procedures protect your data and ensure that your hard disk works efficiently. Some of these procedures actually minimize wear and tear on your drive, which will prolong its life. Additionally, a high level of data protection can be implemented by performing some simple commands periodically. These commands provide methods for backing up (and possibly later restoring) critical areas of the hard disk that, if damaged, would disable access to all your files.



#### 4.20 DEFRAGMENTING FILES

Over time, as you delete and save files to a hard disk, the files become fragmented. This means that they are split into many noncontiguous areas on the disk. One of the best ways to protect both your hard disk and the data on it is to periodically defragment the files on the disk. This serves two purposes. One is that by ensuring that all of the files are stored in contiguous sectors on the disk, head movement and drive wear and tear will be minimized. This has the added benefit of improving the speed at which files will be retrieved from the drive by reducing the head thrashing that occurs every time a fragmented file is accessed.

The second major benefit, and in my estimation the more important of the two, is that in the case of a disaster where the File Allocation Table (FATs) and Root Directory are severely damaged, the data on the drive can usually be recovered very easily if the files are contiguous. On the other hand, if the files are split up in many pieces across the drive, it is virtually impossible to figure out which pieces belong to which file without an intact File Allocation Table (FAT) and directory system. For the purposes of data integrity and protection, I recommend defragmenting your hard disk drives on a weekly basis, or immediately after you perform any major backup.

The main functions are found in most defragmenting programs:

- \*File Defragmentation
- \*File Packing (Free Space Consolidation)
- \*File Sorting

Defragmentation is the basic function but most other programs also add file packing. Packing the files is optional on some programs because it usually takes additional time to perform. This function packs the files at the beginning of the disk so that all free space is consolidated at the end of the disk. This feature minimizes future file fragmentation by eliminating any empty holes on the disk. Because all free space is consolidated into one large area, any new files written to the disk will be able to be written in a contiguous manner with no fragmentation necessary.

The last function, file sorting, is not usually necessary and if performed as an option by many defragmenting programs. This function adds a tremendous amount of time to the operation, and has little or no effect on the speed at which information is accessed. It can be somewhat beneficial for disaster recovery purpose because you will have an idea of which files came before or after other files if a disaster occurs. These benefits would be minimal compared to having the files be contiguous no matter what their order. Not all defragmenting programs offer file sorting and the extra time it takes is probably not worth any benefits you will receive. Other programs can sort the order that files are listed in directories, which is a quick and easy operation compared to sorting the file ordering the disk. Several programs are available that can defragment the files on a hard disk. Both the Windows 95 and DOS contain built-in defragmenters. The Windows 95 version is a graphical application that runs within the Win 95 environment. It has the ability to defragment disks in the background while other applications are

running, making it more convenient than conventional defragmenters. While it is running, you can see details of the defragmenting process or display a minimal status view of the process.

DOS 6 and newer versions also include a defragmenting programme called DEFRAG. This is a reduced function version of the SPEEDISK program that is normally sold as a part of the Symantec Norton Utilities. If you have the Norton Utilities, by all means use the higher function (and faster) SPEEDIS program instead of DEFRAG. The DOS DEFRAG program offers all three functions including defragmenting, packing, and sorting. The SPEEDIS program performs these operations faster and with more efficient use of memory. Many of these programs will have problems on very large disks, and SSPEEDIS will work on drives as large as 2G (the maximum DOS volume size), while DEFRAG is limited to disks of about 512M or less due to memory constraints.

Several aftermarket defragmenting programs are more powerful or faster than the DOS DEFRAG program. They include:

- \*SPEEDIS by Symantec (Norton Utilities)
- \*Power Disk by PC-KWIK
- \*Optune by Gazelle
- \*VOPT by Golden Bow

All of these are highly recommended and usually perform much better than the DEFRAG program in DOS. The power Disk, Optune, and VOPT programs are also much faster than DEFRAG. The VOPT program is the simplest and quickest

of these, and is the one I use myself. It is a simple command-line program – not a menu driven program – like the others. Although VOPT does not offer a sort capability, the speed at which it operates is second to none, and the visual display is very entertaining as well! VOPT offers the ultimate in speed and efficiency in defragmenting and packing files.

Currently, some of these programs may have problems with large partitions and lots of files, however VOPT will handle partitions of up to 2G (the maximum allowable under DOS). These types of programs are updated constantly; contact the manufacturer for more detailed specifications if you are interested. Each of these manufacturers is listed in Appendix B.

No matter which program you end and using, defragmenting and packing you disk helps to reduce drive wear and tear by minimizing the amount of work required to load files. It also greatly increases the chances for data recovery in the case of serious corruption in the File Allocation Tables (FATs) and directories on the disk.

#### 4.21 **BACKING UP THE FAT AND DIRECTORY SYSTEM**

The operating system uses several areas on a formatted disk to manage the files stored on the disk. These areas are extremely critical. If they are damaged, all access to the drive volume may be compromised or completely disabled. In some cases, these critical areas can be rebuilt using known data recovery procedures and tools, but the easiest and best way to recover from damage to these areas is to simply have a backup of them to restore.

The critical areas of hard disk file system are the following:-

- \*Master (Partition) Book Record (MBR)
- \*Extended (Partition) BOOK RECORD (EBR)
- \*DOS Boot Record (DBR)
- \*File Allocation Tables (FATs)
- \*Root Directory

These areas are stored on the disk in the order listed, except that each volume will start with an MBR or EBR but not both.. Unlike complete file backups of the entire hard disk, a backup of these system areas is relatively quick and easy. This is because these areas are very small in comparison to the remainder of the drive and normally occupy a fixed amount of space on the disk. For example, the MBR,EBRs, and DBRs are only one sector long each, while the two FATs used on each volume cannot exceed 256 sectors each (512 sectors or up to 256K total for both), and the Root Directory is limited to 32 sectors (16K). This means that even for the largest hard disk drive, these areas will not consume more than about 300K of space.

The book record (sector) areas do not change during day to day usage of the disk. These areas will change only if you reformat, repartition, or change operating system versions. Because they are relatively constant, it makes good sense to back up these areas to a file on a floppy disk for later restoring if necessary.

Each normal disk volume will have two File Allocation Tables and a single Root Directory. These areas change constantly as files are written and deleted from the disk. A backup of these areas is only good for temporary purposes and can be

useful when trying to undelete files. Because of this, these backups are often written on the hard disk in a special hidden file near the end of the disk. Other recovery or restoration programs can then look for this special file and use the information within it to rebuild the FATs or directory system. Often this type of backup is very useful in a situation where file need to be undeleted.

#### 4.22 PASSIVE PREVENTIVE MAINTENANCE PROCEDURES

Passive preventive maintenance involves taking care of the system in an external manner: basically, providing the best possible environment -- both physical as well as electrical -- for the system to operate in. Physical concerns are conditions such as ambient temperature, thermal stress from power cycling, dust and smoke contamination, and disturbances such as shock and vibration. Electrical concerns are items such as electron-static discharge (ESD), power-line noise and radio-frequency interference. Each of these environmental concern is discussed in this section.

#### 4.23 EXAMINING THE OPERATING ENVIRONMENT

Oddly enough, one of the most overlooked aspects of microcomputer preventive maintenance is protecting the hardware-and the sizable financial investment it represents-from environmental abuse. Computers are relatively forgiving, and they generally are safe in an environment that is comfortable for people.

Computers, however, often are treated with no more respect than desktop calculators. The result of this type of abuse is many system failures.

Before you acquire a system, prepare a proper location for your new system, free of air born contaminants such as smoke or other pollution. Do not place system in front of a window: The system should not be exposed to direct sunlight or temperature variations. The environmental temperature should be as constant as possible. Power should be provided through properly grounded outlets, and should be stable and free from electrical noise and interference. Keep your system away from radio transmitters or other sources of radio frequency energy. This section examines these issues in more detail.

#### 4.24 HEATING AND COOLING

Thermal expansion and contraction from temperature changes place stress on a computer system. Therefore, keeping the temperature in your office or room relatively is important to the successful operation of your computer system.

Temperature variations can lead to serious problems. You might encounter excessive chip creep, for example. If extreme variations occur over a short period, signal traces on circuit boards can crack and separate older joints can contacts in the system undergo accelerated corrosion. Solid-state components such as can be damaged also, and a host of other problems can develop.

Temperature variations can play havoc with hard disk drives also. Writing to a disk at different ambient temperatures can, on some drives, cause data to be written

at different locations relative to the track centers. Read and write problems then might accelerate later.

To ensure that your system operates in the correct ambient temperature, you first must determine your system's specified functional range. Most manufacturers provide data about the correct operating temperature range for their system. Two temperature specifications might be available one indicating allowable temperatures during operation and another indicating allowable temperatures under non-operating conditions. IBM, for example, indicates the following temperature ranges as acceptable for most of its system:

System on: 60 – degree Fahrenheit

System off: 50 to 110 degrees Fahrenheit

For the safety of the disk and the data it contains, avoid rapid changes in ambient temperatures. If rapid temperature changes occur—for example, when a new drive is shipped to a location during the winter and then brought indoors—let the drive acclimate to room temperature before turning it on. In extreme cases, condensation forms on the platters inside the drive Head Disk Assembly—disastrous for the drive if you turn it on before the condensation can evaporate. Most drive manufacturers specify a timetable to use as a guide in acclimating a drive to room temperature before operating it. You usually must wait several hours to a day before a drive before a drive is ready to use after it has been shipped or stored in a cold environment.



Most office environments provide a stable temperature in which to operate a computer system, but some do not. Be sure to give some consideration to the placement of your equipment.

#### 4.25 **POWER CYCLING (ON/OFF)**

The temperature variations a system encounters greatly affects the system's physical components. The largest temperature variations a system encounters, however are those that occur during system warm-up when you initially turn it on. Turning on (also call powering on) a cold system subjects it to the greatest possible internal temperature variations. For these reasons, limiting the number of power-on cycles a system is exposed to greatly improves its life and reliability.

#### **PHONE LINE SURGE PROTECTORS**

In addition to protecting the power lines, it is critical to provide protection to your systems from any phone lines that are connected. If you are using a modem or fax board that is plugged into the phone system, any surges or spikes that travel the phone line can potentially damage your system. In many areas, the phone lines are especially susceptible to lightning strikes, which is the largest cause of fried modems and any computer equipment attached to them.

Several companies manufacture or sell simple surge protectors that plug between your modem and the phone line. These inexpensive devices can be purchased from most electronics supply houses. Most of the cable and communication products vendors listed in Appendix B sell these phone line surge protectors.

## LINE CONDITIONERS

In addition to high-voltage and current conditions, other problems can occur with in-coming power. The voltage might dip below the level needed to run the system and result in a brownout. Other forms of electrical noise other than simple voltage surges or spikes might be on the power line, such as radio-frequency interference or electrical noise caused by motors or other inductive loads.

Remember two things when you wire together digital devices (such as computers and their peripherals). A wire is an antenna and has a voltage induced in it by nearby electro-magnetic fields, which can come from other wires, telephones, CRTs, motors, fluorescent fixtures, static discharge, and of course, radio transmitter. Digital circuitry also responds with surprising efficiency to noise of even a volt or two, making those induced voltages particularly troublesome. The wiring in your building can act as an antenna and pick up all kind of noise and disturbances. A line conditioner can handle many of these types of problems.

A line conditioner is designed to remedy a variety of problems. It filters the power, bridges brownouts, suppresses high-voltage and current conditions, and generally acts a buffer between the power line and the system. A line conditioner does the job of a surge suppressor, and much more... It is more of an active device functioning continuously rather than a passive device that activates only when a surge is present. A line conditioner provides true power conditioning and can handle myriad problems. It contain transformers, capacitors, and other circuitry that temporarily can bridge a brownout or low-voltage situation. These

units usually cost several hundreds of dollars, depending on the power-handling capacity of the unit.

## **BACKUP POWER**

The next level of power protection includes backup power-protection devices. These units can provide power in case of a complete blackout, which provides the time needed for an orderly system shutdown. Two types are available: the standby power supply (SPS) and the uninterruptible power supply (UPS). The UPS is a special device because it does much more than just provide backup power: it is also the best kind of line conditioner you can buy.

## **STANDBY POWER SUPPLIES (SPS)**

A standby power supply is known as an offline device: it functions only when normal power is disrupted. An SPS system uses a special circuit that can sense the AC line current. If the sensor detects a loss of power on the line, the system quickly switches over to a standby battery and power inverter. The power inverter converts the battery power to 110-volt AC power, which then is supplied to the system.

SPS systems do work, but sometimes a problem occurs with the switch to battery power. If the switch is not fast enough, the computer system unit shuts down or reboots anyway, which defeats the purpose of having the backup power supply. A truly outstanding SPS adds to the circuit a ferroresonant transformer, a large transformer with the capability to store a small amount of power and deliver it

during the switch time. Having this device is similar to having on the power line a buffer that you add to an SPS to give it almost truly uninterruptible capability.

SPS units also may or may not have internal line conditioning of their own; most cheaper units place your system directly on the regular power line under normal circumstances and offer no conditioning. The addition of a ferroresonant transformer to an SPS gives it additional regulations and protection capabilities due to the buffer effect of the transformer. SPS devices without the ferroresonant transformer still require the use of a line conditioner for full protection. SPS systems usually cost from \$200 to several thousand of dollars, depending on the quality and power-output capacity.

#### **UNINTERRUPTIBLE POWER SUPPLIES (ups)**

Perhaps the best overall solution to any power problem is to provide a power source that is both conditioned and that also cannot be interrupted – which describes an uninterruptible power supply. UPSs are known as online systems because they continuously function and supply power to your computer systems. Because some companies advertise ferroresonant SPS devices as though they were UPS devices, many now use the term true UPS to describe a truly online system. A true UPS system is constructed much the same as an SPS system; however, because you always are operating from the battery, there is not switching circuit.

In a true UPS, your system always operates from the battery, with a voltage inverter to convert from 12 volts DC to 110 volts AC. You essentially have your

own private power system that generates power independently of the AC line. A battery charger connected to the line or wall current keeps the battery charged at a rate equal to or greater than the rate at which power is consumed.

When power is disconnected, the true UPS continues functioning undisturbed because the battery-charging function is all that is lost. Because you already were running off the battery, no switch takes place and no power disruption is possible. The battery then begins discharging at a rate dictated by the amount of load your system places on the unit, which (Based on the size of the battery) gives you plenty of time to execute an orderly system shutdown. Based on an appropriately scaled storage battery, the UPS functions continuous, generating power and preventing unpleasant surprises. When the line power returns, the battery charge begins recharging the battery, again with no interruption.

## CHAPTER FIVE

### 5.0 COMPUTER VIRUSES/RECOMMENDATION

5.1 A Virus is a program that reproduces its own code by attaching itself to other executable files in such a way that the virus code is executed when the infected executable file is executed.

### 5.2 TYPES OF INFECTION

#### VIRUSES

A virus is small piece of software that piggy backs on real programs. For example, a virus might attach itself to a program such as a spread sheet program. Each time the spread sheet program runs, the virus too, and it has the chance to reproduce (by attaching to other programs) or wreak havoc.

#### E-MAIL VIRUS

An E-mail virus moves around in email messages and usually replicates itself by automatically mailing itself to dozens of people in the victim's e-mail address book.

#### WORM

A worm is a small piece of software that uses Computer networks and security holes to replicate itself. A copy of the worm scans the network for another machine that

has a specific security hole. It copies itself to the new machine using the security hole, and then starts replicating from there, as well.

## **TROJAN HORSES**

A Trojan horse is simply a computer program. The program claims to do one thing (it may claim to be a game) but instead does damage when you run it (it may erase your HARD DISK). Trojan horses have no way to replicate automatically.

### **5.3 PREVENTION**

-If you are truly worried about traditional (as opposed to e-mail) viruses, you should be running a more secure operating system like UNIX. You never hear about viruses on these operating system because the security features keep viruses (and unwanted human visitors) away from your hard disk.

-If you are using an unsecured operating system, then buying VIRUS PROTECTION SOFTWARE is a nice safe guard.

-If you simply AVOID PROGRAMS FROM UNKNOWN SOURCES (like the internet), and instead stick with commercial software purchased on CDs, you eliminate almost all of the risk from traditional viruses. In addition, you should DISABLE FLOPPY DISK BOOTING – most computers now allow you to do this, and that will eliminate the risk of a boot sector virus coming from a floppy disk accidentally left in the drive.

-You should make sure that MACRO VIRUS PROTECTION is enabled in all Microsoft applications and you should NEVER run MACROS in a document unless

you know what they do. There is seldom a good reason to add macros to a document, so avoiding all macros is a great policy.

-You should NEVER DOUBLE-CLICK ON AN ATTACHMENT THAT CONTAINS AN EXECUTABLE THAT ARRIVES AS AN E-MAIL

ATTACHMENT.. Attachments that come in as word files (.DOC), spread sheets (.XLS), images (.GIF and .JPG), ETC. are data files and they can do no damage (noting the macro virus problem in word and Excel documents mentioned above).

A file with an extension like EXE, COM or VBS is an executable, and an executable can do any sort of damage it want. Once you run it, you have given it permission to do anything on your machine. The only defence is to never run executables that arrive via e-mail.



#### 5.4 RECOMMENDATION

There are currently over 1000 products of micros in the market. It is important to note that this proliferation of systems and their purchase in the absence of any well defined guidelines, have some advantages and disadvantages.

The aim of this project is to find a way maintaining a faulty computer at a minimum cost, and also suggest possible guiding principles in selecting computers for home and business use. Therefore, we wish to make the following recommendations.

1. Avoid rushing at new systems as spare parts may not be easily available.
2. The compatibility issues should be carefully studied when selecting computer systems. This is important for easy access to the available software packages and peripherals.
3. Some system are very fanciful and too fragile in nature. They should be avoided if possible.

The above mentioned points are deemed necessary because of the maintenance problems of the proliferation of systems.

REM SIMPLE PROGRAMS ON TROUBLESHOOTING OF COMPUTER  
SYSTEM

REM TUTORIAL PROGRAM FOR SYSTEM TROUBLE SHOOTING

REM DESIGNED BY DARAMOLA KAYODE

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CLS

10 LOCATE 12, 20: PRINT "WELCOME TO TUTORIAL ON COMPUTER  
TROUBLESHOOTING"

20 LOCATE 20, 20: INPUT "INPUT "CONTINUE WITH THE TUTORIAL (y/n)";

ANS: IF ANS ="N" OR ANS = "n" THEN END ELSE GOTO 80

80 CLS

LOCATE 12, 35: PRINT "(1): SYSTEM UNIT"

LOCATE 13, 35: PRINT "(2): MONITOR"

LOCATE 14, 35: PRINT "(3): KEYBOARD"

LOCATE 15, 35: PRINT "(4): EXIT"

LOCATE 17, 35: INPUT " SELECT ONE OPTION FROM OPTIONS 1 - 4";

N IF N<1 OR N > 4 THEN GOTO 10:

ON N GOSUB 200, 10

ON N GOSUB 100, 290, 400, 430: END: RETURN 80

100 REM SUBROUTINE TUTORIAL FOR SYSTEM UNIT

CLS

PRINT "IF SYSTEM DOES NOT POWER UP"

PRINT "\_\_\_\_\_"

PRINT "\*SYSTEM UNIT PLUG IN": PRINT "\*POWER CORD LOOSE OR  
BROKEN"

PRINT "\*WALL SOCKET FAULTY OR CIRCUIT BREAKER OPEN"

PRINT "\*SHORT CIRCUIT IN COMPUTER SYSTEM CAUSING POWER  
SUPPLY SHUTDOWN"

PRINT "\*POWER SUPPLY FAULTY"

PRINT

PRINT "\*IF SYSTEM DOES NOT BOOT": PRINT "\_\_\_\_\_"

PRINT " \*NON-BOOTABLE DISKETTE IN DRIVE A"

PRINT "\*HARD DISK DRIVE NOT INITIALISED"

PRINT "FAULTY CMOS SETUP INFORMATION"

PRINT "\*LOOSE DISK DRIVE CONTROL, DATA OR POWER CABLE"

PRINT "POWER SUPPLY LOADED PAST WATTAGE LIMIT"

PRINT "\*EXPANSION CARD LOOSE IN SLOT"

PRINT "\*IF SYSTEM FREEZES, CRASHES, OR REBOOTS  
SPONTANEOUSLY"

PRINT "\_\_\_\_\_"

PRINT "\*FAULTY RAM DEVICE": PRINT "\*LOOSE MOTHERBOARD POWER  
CONNECTOR"

PRINT "\*EXPANSION CARD LOOSE IN SLOT"

PRINT"\*CONFLICTING HARDWARE ASSIGNMENTS (DMA CHANNEL, IRQ,  
HARDWARE PORT AD

PRINT “\*MEMORY-RESIDENT PROGRAM AND DRIVER CONFLICT”

200 PRINT “NOISE FROM SYSTEM UNIT”

210 PRINT “\_\_\_\_\_”

220 PRINT “\*NORMAL POWER SUPPLY NOISE (FAN HUM, AIR  
MOVEMENT)”

PRINT”\*NORMAL HARD DISK DRIVE NOISE (HUM, OR SLIGHT WHINR  
RUNNING,”

PRINT “CHATTER OR FAINT SQUEAKING WHEN HEADS MOVE)”

PRINT “\*FAULTY COOLING FAN (LOUD HUM, CHATTER,  
OVERHEATING SMELLS)”

230 PRINT “\*HARD DISK DRIVE (LOUD OR REPEATED CHATTER OR  
THUMP,”

PRINT “LOUD WHINE)”

240 PRINT “NO SOUND FROM SPEAKER”

250 PRINT “\_\_\_\_\_”

260 PRINT “A SPEAKER CONNECTION TO MOTHER BOARD LOOSE.”

PRINT “\*PROGRAMS NOT MAKING USE OF SPEAKERS.”

261 PRINT “DISK DRIVES”

262 PRINT " \_\_\_\_\_ "

263 PRINT "HARD AND FLOPPY DISK DRIVES CAN DISPLAY THE  
FOLLOWING PROBLEMS:"

264 PRINT "READ FAILURE": PRINT " \_\_\_\_\_ "

265 PRINT "\*NO DISK IN DISKETTE DRIVE."  
PRINT"\*DISKETTE NOT FIRMLY SEATED IN DRIVE (3.5-INCH  
DRIVES) OR DRIVE"  
PRINT "DOOR NOT CLOSED (5.25-INCH DRIVE)"  
PRINT "\*DISK NOT FORMATTED OR (HARD DRIVE ONLY) NOT  
INITIALIZED"

266 PRINT "WRITE FAILURE": PRINT " \_\_\_\_\_ "

267 PRINT "\*NO DISK IN DISKETTE DRIVE"  
PRINT "\*DISKETTE NOT REALLY SEATED IN DRIVE (3.5-INCH  
DRIVES) OR DRIVE"  
PRINT "DOOR NOT CLOSED (5.25-INCH DRIVES)"  
PRINT"\*DISKETTE WRITE PROTECTED" : PRINT

270 INPUT "CONTINUE WITH THE DIAGNOSES", AS  
IF AS = "Y" OR AS ="Y" THEN CLS : GOTO 20

```
280     RETURN: CLS
290     REM SUBROUTINE TUTORIAL FOR THE MONITOR: CLS
300     CLS : PRINT "IF THERE IS NO VIDEO DISPLAY"
310     PRINT "_____ "

320     PRINT "**MONITOR NOT PLUG IN, OR NOT TUNED ON"
PRINT "**VIDEO CABLE NOT CONNECTED TO VIDEO ADAPTER"
PRINT "**VIDEO CABLE FAULTY"
PRINT "**INCORRECT MONITOR TYPE FOR THE VIDEO ADAPTER IN
USE"
PRINT " A MOTHERBOARD COLOR/MONO SELECT DIP-SWITCH SET
INCORPORATED"

330     PRINT "**INCORRECT VIDEO TYPE SPECIFIED IN SET UP
(80386/8048 SYSTEM ONLY)
PRINT "VIDEO ADAPTER INCORRECTLY CONFIGURATED"
PRINT "**INCORRECT VIDEO MODE SELECTED"
PRINT "SOFTWARE INCORRECTLY CONFIGURED"

340     PRINT "**MONITOR INCORRECTLY CONFIGURED (APPLIES
MOSTLY TO MULTISCAN AND PRINT "VGA MONITOR"
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PRINT “*SOFTWARE SCREEN-BLANKING UTILITY IN OPERATION.”

350 PRINT “FAULTY VIDEO DISPLAY”

360 PRINT “_____”

370 PRINT “*INCORRECT VIDEO MODE SELECTED.”

PRINT “*VIDEO ADAPTER INCORRECTLY CONFIGURED.”

PRINT “*MONITOR VERTICAL AND/OR HORIZONTAL HOLD
AND SIZE CONTROLS”

PRINT”MISADJUSTD”

PRINT”*MONITOR BRIGHTNESS AND/OR CONTRAST
CONTROLS MISADJUSTED.”

PRINT”*SOFTWARE INCORRECTLY CONFIGURED.”

PRINT”*INSUFFICIENT VIDEO RAM (VGFA, OLDER EGA ONLY).”

PRINT”*MOTHERBOARD MASTER OSCILLATION INCORRECTLY
TRIMMED”

PRINT” (OLDER CGA SYSTEMS ONLY).”

390 RETURN: CLS

400 REM SUBROUTINE TUTORIALS FROM THE KEYBOARD
MALFUNCTIONS”

410 CLS: PRINT “IF THE KEYBOARD MALFUNCTIONS”

PRINT “*KEYBOARD NOT FIRMLY PLUGED INTO MOTHERBOARD PORT.”

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PRINT"\*XT-STYLE USED WITH 80386 OR 80486 MOTHERBOARD."

PRINT " OR AT STYLE KEBOARD USED WITH 9038 OR 8086 MOTHERBOARD."

420 PRINT "\*\*SWITCHABLE KEYBOARD SET TO WRONG TYPE (XT/AT) FOR  
MOTHERBOARD."

PRINT "\*\*KEYBOARD LOCK SWITCH IN LOCK POSITION."

PRINT "\*\*KEYBOARD LOCKED SWITCH WIRING LOOSE ON  
MOTHERBOARD,"

PRINT " OR CONNECTOR REVERSED."

430 INPUT "DO YOU WANT TO EXIT THE TUTORIAL"; YS

IF YS = "N" OR YS = "n" THEN GOTO 20 ELSE

440 END



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