

*TRAINING COURSE*

*ON*

***BASIC COMPUTER SKILLS***  
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MODULE - 3

**KNOWING YOUR  
HARDWARE**

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# KNOWING YOUR HARDWARE

All personal computers consist of the same basic building blocks. What distinguishes them is what individual components they contain, and how they are connected. For example, machines may have different control units or microprocessors. All do basically the same job, but in different ways. Instruction sets, the primitive commands that they obey, vary. So does the way in which programs access disk drives or the display. In practice, most software can run only on a particular machine. For example, a Macintosh program cannot be run on an IBM PC.

The choice of components used in a computer, and how they fit together, is determined by its architecture. The PC architecture is based on microprocessors from the Intel 80 x 86 family. It uses components from Intel and other sources in other parts of the system. The way it uses memory is unique to it. Computers that conform to its architecture, even if made by different manufacturers, should all run the same software and produce the same results. This shared behavior is known as 'PC Compatibility'.

## 1.0 POWER SUPPLY

The power supply's job is to take the raw AC line voltage and turn it into the smooth, regulated, harm less, low DC voltages needed by the electronic circuits inside the PC. The power supplies used with PC's are switched mode power supplies because.

- It is more efficient as compared to transformer based PS as power is not wasted as heat in the regulator or transformer.
- Much lighter and smaller due to absence of the transformer.

## 1.1 Typical Current Requirement PC System Components.

PC SYSTEM COMPONENTS	(CURRENT DRAWN IN AMPS.)			
	+5V	+12V	-5V	-12V
System board, 1MB RAM	3.0	.05	.05	
FAN		.25		
Display adapter	.5			
I/O Card	.25	.1		.1
Disk Controller	.5			
Internal Modem	.8		.1	
Diskette drive	.5		.8	

HDD 5.25inch (Spin up)	1.2	4.0	
Half ht. (operating)	1.2		1.3
HDD 3.5inch (Spin up)	1.2	2.5	
1/2 ft. (operating)	1.2	1.2	
Network Card (Ethernet)	1.0	.1	

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## 2.0 KEY BOARDS

IBM PC Keyboard is a sophisticated device. It has its one microprocessor that detects the key movements. When a key is pressed, it sends a scan code, a byte that identifies the key's position to the computer. Next time, it sends a second scan code with a value 128 greater than the first one. The microprocessor also generates an interrupt request with each scan code. It informs the system that code has been sent. The interrupt controller translates the request into interrupt 9 which is serviced by a BIOS routine.

The keyboard repeats a key automatically if it is held down for more than a certain time is called auto repeat or a typematic feature. Keyboards suffer more wear and tear than any other part of a PC. If only one could persuade users not to beat on them so hard : and not to be so literal when instruction say to "STRIKE" a key : Though they contain electronics, it is very rarely the cause of failures. Most of the problems are jammed keys. They may be the result of broken springs, dirt or sticking substances impeding movements. Care of key board by preventive maintenance will help prevent them. Restriction for eating, drinking or smoking near a computer will also help.

## 3.0 PROCESSOR

The CPU or processor is the part that makes a computer smart. It actually does most of the work. It reads the program instructions held in memory and obeys them faithfully and very, very quickly. The term central processing unit originated in 1950's when it described a large box containing complex circuitry. In a computer like the PC, the CPU is a single integrated circuit, a microprocessor.

The original IBM PC and XT, and the cheapest, slowest compatible, use an Intel 8088 or 8086 microprocessor. Later, faster models use more powerful microprocessors from the

same Intel family, namely, in order of power, the 80286, 80386 and 80486 and Pentiums. There are also variant designations, such as SX and DX. Each chip runs all instructions of its less powerful predecessors, but is faster and adds new features. However, when a PC is running DOS, it uses even the fastest 80486 just like a superfast 8088, ignoring all its extra capabilities.

Typically, program instructions tell the CPU to move data from one memory location to another, or load it into on-chip local storage (a register) and add, subtract, multiply, or divide it. Or they may tell it to perform a test and then jump to another part of the program if it succeeds. These instructions, called machine code, are very primitive. For example, it takes dozens of instructions just to display a single character on the screen. But because the CPU can execute them quickly, often millions per second, even complex tasks take little time.

#### 4.0 MEMORY

The most important component of a computer after the CPU is the memory. The CPU does the work; the memory is its scratchpad or work area. The other parts simply help transfer information to and from the two main components, the secondary storage such as disk drives, and the outside world.

Memory consists of units called bytes, which may hold either programs or data. Each byte has a unique address by which it may be reached or accessed. Ordinary memory that the computer can both use (read) and change (write) is called RAM.

Each byte of RAM can hold a single typed character, usually stored in a code called ASCII (American Standard Code for Information Interchange). In the IBM PC family, the character set includes the digits 0 to 9, all letters (in both upper and lower case), punctuation, 32 control characters, and 128 special characters that include fractions, foreign letters, and line graphics for drawing boxes and forms.

Two bytes together, called a word, can hold two characters or a number in the range 0 to 65,535. Larger groups of bytes can hold larger values, including decimal or floating-point numbers.

#### 4.1 Memory Devices

Some of the more common memory devices found in computers and how they are typically used are as follows :

- DRAM (Dynamic Random Access Memory). DRAM is most commonly used in main memory subsystems. Memory technology is very slow compared to processor requirements, thus the common use of static RAM caches.
- Speeds today are in the 60 to 70-ns range.
- FPM (Fast Page Mode) DRAMs eliminated the need to assert the row address if sequential accesses were to the same row or "page".
- EDO (Extended Data Out) is when an output latch was added to FPM DRAMs. The output latch allows the DRAM to keep output data valid even when column access strobe CAS is de-asserted allowing one less access cycle.
- SDRAM (Synchronous DRAMs) are divided into two independent banks which can be accessed independently. Accesses to each bank can be interleaved such that sequential accesses are alternated back and forth to boost performance.
- SRAM (Static Random Access Memory). This is an extremely fast (5 to 25-ns range), volatile memory device. It is almost exclusively used in cache memories, takes up a large amount of space, and generates significant heat.
- EPROM (Erasable Programmable Read Only Memory). EPROMs are classified as a subset of ROMs. They have the same characteristics, however, and are erasable either electronically or with Ultra Violet light.
- EEPROM (Electrically Erasable Programmable Read Only Memory). EEPROMs are another subset of ROMs and are erasable electronically through

software.

- CMOS (Complementary Metal Oxide Semiconductor). CMOS devices are used frequently in ISA systems to store the system setup. CMOS devices use very low power and are volatile once the power is removed. There are a number of packages available that store not only system setup but also include a system clock and battery. The battery is used to maintain the stored configuration as well as the clock.
- ROM (Read Only Memory). ROM devices are very common and are available in a number of forms. These devices are fairly slow, cost-effective, and used to store boot code, power-on diagnostics code, and in many I/O boards, device-specific code.

#### 4.2 DRAM and SRAM Differences

Characteristics	DRAM	SRAM
Data bit stored on	Capacitor	Transistor
Requires refresh	Yes	No
Destructive Reads (Precharge delay)	Yes	No
Address multiplexing	Yes	No
Speed	Slow	Fast
Temperature	Cool	Hot
Cost	Low	High

#### 4.3 DRAM vs SRAM

Although DRAM and SRAM serve similar functions there are some significant functional and physical differences between the two memory types.

- A DRAM chip is relatively slow (typical 60 to 80 ns) but inexpensive.

- In a DRAM chip, the data bit (a zero or a one) that is stored at the intersection of a row and column is stored as a charge on a capacitor, whereas in a SRAM, a data bit is stored as the state of a transistor latch (a latch can be made of up to four transistors).
- Due to the capacitive nature of a bit in a DRAM chip, the very act of reading out a bit onto the data line causes the bit to be destroyed at the intersection of the row and column. Therefore, all DRAM chips have an internal process called Pre-Charge Delay that reconstructs the lost bit after a read cycle. During Pre-Charge Delay, the DRAM is unavailable for use.
- As data is stored in a DRAM chip as a charge on a capacitor, and since all capacitors lose their charge in time, DRAM chips must periodically be refreshed. This process re-energizes the bits before the charge is completely gone. A DRAM chip must be periodically refreshed; a SRAM chip does not suffer this limitation. While a DRAM chip is undergoing refresh, it is unavailable to the CPU or any other device in the computer that might need to use it. This is one of the reasons that DRAM shows poorer performance than SRAM.
- A SRAM is much faster (typical 7 to 12 ns) and also more expensive.
- The fact that SRAM relies on up to four transistors per data cell is the fundamental reason why SRAM chips are so much hotter than DRAM chips and why they consume so much power. This is also the reason for the higher cost of SRAM chips.

## 5.0 ERROR DETECTING

An error correction scheme is conceptually simple. It involves adding some redundancy to the data bits to enable duplication of some of the information.

These redundancy bits, or check bits, are generated by a systematic code that determines the scheme's capability. The hardware generates the necessary check bits based

on the data pattern of a memory location. The data and the check bits are then stored together. During a memory reference, the check bits are used to determine whether the data is valid, and if not, the location of the error.

When reading data, ECC memory hardware retrieves both the data and the corresponding check bits from memory and compares the information received from both by generating what is known as syndrome bits. If the syndrome bits are all zeros, the data is valid.

The ECC function is performed by an ASIC on the system board and not by the memory module. ECC can detect (not correct) double-bit errors. EDO RAM gives higher band width than FPM & ECC i.e. 267 MB/S.

When using FPM memory system will operate in ECC memory mode. ECC is switch off when EDO memory is installed. The faster EDO memory operates too quickly to support ECC. EDO & CPM cannot be mixed. Either all FPM or all EDO must be used.

## 6.0 MEMORY CYCLES

The most common type of memory access transfers data to and from the CPU. We refer to each transfer (read or write) as a memory cycle. The processor obtains a data byte from memory as follows. First, it places the address of the location on the address lines or address bus. A bus is just a group of electrical connections with a common purpose. Then it sends a signal on the MEMR (memory read) line indicating that it wants to read memory. This tells the hardware to copy the location's contents onto the data bus so that it can be loaded into a register.

Writing a byte into memory works similarly. The processor puts the address on the address bus, and the data byte on the data bus. It sends a MEMW (memory write) signal, and the hardware then stores the data in the specified location, overwriting its previous contents.

## 7.0 INPUT/OUTPUT PORTS

I/O ports resemble memory addresses. However, they can be read from, or written to,



not only by the CPU but also by devices that interface with the outside world. They allow the computer to communicate with peripherals such as the keyboard or a modem. However, they do more than just transfer data into and out of the system. They are also used to set up and control parts of the hardware, and get information about its status.

For example, a serial port has one I/O address used to read and write data, and another used to set transfer rate, word length, parity, and other characteristics. Others are used to obtain information such as whether there is a device at the other end of the cable, or whether a character has been received. Normally, the low level software, such as the system BIOS, handles setup, control, and status management. All the users must do is read from or write to the device.

Data transfers to or from I/O ports work much like ones involving memory. For output, the CPU places the address on the address bus, and the data byte on the data bus. It then sets the IOW (I/O write) status line to show that it wants to write to an output port rather than a memory location. It follows a similar process for input.

A common support problem is a conflict in which two expansion cards in a PC are configured to use the same I/O port addresses. The usual result is that neither works. Established devices such as serial ports and disk controllers have standard I/O addresses reserved by IBM. However, items such as tape streamers and SCSI adapters were not envisioned when the IBM PC was designed. If there is such a device, it must be set to use addresses that are either unassigned or are reserved for a device not present in the system.

## 7.1 System Bus

The bus links the computer's main components-CPU, memory, control logic, and input/output (I/O) devices. Like its namesake, the bus is simply a means of conveying something, in this case information, from one place to another.

Figure 1 shows a simplified block diagram of a PC. The system bus consists of three parts: address bus, data bus, and control bus, which convey address, data, and control signals respectively among the CPU, memory, and other devices.

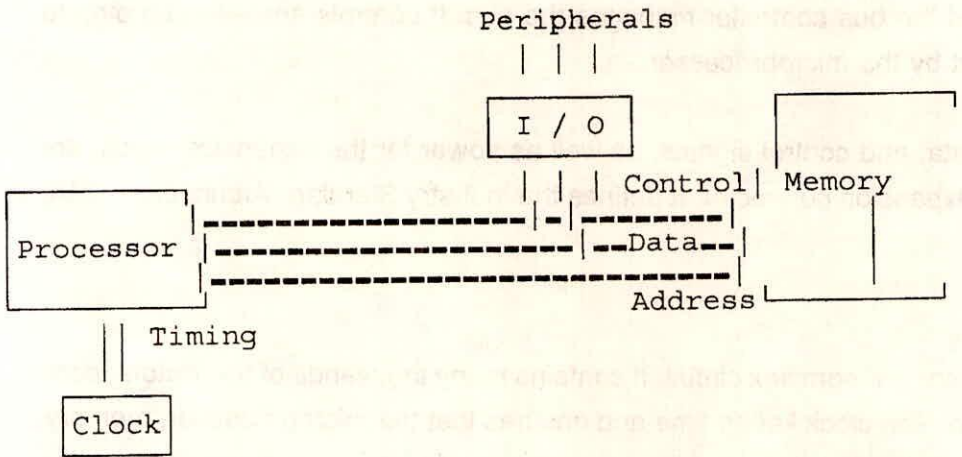


Fig. 1

Memory basically consists of 8-bit locations, each with a unique address. The 8086 and 8088 microprocessors used in the oldest PCs can address up to 1 megabyte (MB), just over a million bytes of memory. Twenty bits are needed to represent a million unique addresses, so these computers have an address bus 20 bits wide. That is, there are 20 address lines, A0 to A19. The data bus of an original PC is one byte (eight bits) wide, and therefore has eight data lines, D0 to D7.

The control bus is a set of signals that carry messages from one part of the hardware to another. Examples, as we have already seen, are the signals the microprocessor uses to indicate whether it wants to read from or write to memory. There are two lines involved, MEMR to read from memory and MEMW to write to it. Other control bus signals include interrupt requests (IRQs, signals to the microprocessor from external devices) and the system clock.

If the CPU and other devices could access the bus at any time, the result would be constant conflict. Nothing would work. In practice, the address and data buses hold meaningful information only at certain times, so control signals must show when they are valid. Other devices, such as interface cards, also must access the bus, and must do so only when they would not disrupt other activities.

A device called the bus controller manages the bus. It controls access according to status signals sent out by the microprocessor.

All address, data, and control signals, as well as power for the expansion cards, are accessible using the expansion connector. It defines the Industry Standard Architecture (ISA) bus.

## **8.0 CLOCK**

A microprocessor is a complex circuit. It contains many thousands of transistors, each with a specific function. The clock keeps time and ensures that the microprocessor, memory, and other parts of the computer's logic work together harmoniously, each doing its job at the appropriate time.

A computer's performance depends on its clock speed. Clock speeds are measured in cycles per second or Hertz (Hz). A million cycles per second is one megahertz (MHz). The IBM PC uses a clock of 4.77 MHz, the original PC AT uses a 6 MHz clock, and more recent PCs and compatibles use higher rates such as 8, 10, 12, 16, 20, 25, 33, 40, and 50 MHz. Manufacturers rate CPU chips for use at up to a certain clock rate. The user can determine the limit by examining the suffix to the part number. For example, an 8088 that can work at up to 8 MHz would be marked 8088-8.

Another way of expressing processor speed is in terms of cycle time. It is the reciprocal of the clock speed, so a 16 MHz CPU would have a cycle time of 62.5 ns. A NOP (no operation, i.e., do nothing) instruction takes a single clock cycle to perform. However, most machine instructions that do something useful take at least two cycles to execute. The average number of instructions per second that the microprocessor can execute is therefore only a fraction of the clock rate.

Later microprocessors in the 8086 family, such as the 80286, 80386, and 80486 and Pentiums perform instructions in fewer clock cycles than the oldest chips. So clock speed alone is not an accurate indicator of a computer's overall performance.

One performance measurement often seen in advertisements is the Landmark speed. It is expressed in MHz. It is always faster than the computer's actual clock rate. The Landmark speed approximates the rate at which the 8088 processor in an IBM PC would have to run to match the performance of the computer being tested.

## **9.0 AT COMPATIBLE and the 80286 PROCESSOR**

So far, we have examined the basic architecture defined by IBM's original PC. The AT contains several advances over the PC and XT, while remaining compatible with them. Most PCs sold today implement these advances, so it is important to understand what they are.

The AT uses the Intel 80286 processor, which can run in one of two models :

- o Real Address Mode.
  
- o Protected Virtual Address Mode

These modes are more commonly called simply real mode and protected mode. In real mode, the 80286 is compatible with the 8088 used in earlier PCs. All PC software will run without modification. Intel introduced a few new machine instructions in the 80286. However, PC software developers generally do not use them since they would not work on 8088 and 8086-based PCs.

In protected mode, the 80286 has much greater capabilities. It has more sophisticated memory addressing that gives it a 24-bit range, allowing access to up to 16 megabytes of memory. The new addressing methods also provide access control to memory segments. This enables code and data to be kept apart and allows code to be protected from corruption by other programs. Protection is essential in a multitasking operating system, so an error in one program cannot affect others or crash the entire system.

In an AT compatible running DOS, the 80286 operates in real mode simply as a faster 8086. Real mode software will not run properly in protected mode, nor will the ROM BIOS routines work. Consequently, it is impossible to exploit the potential of protected mode and

still maintain full PC compatibility.

The 80286's greater addressing capability allows for the attachment of memory above 1 MB called extended memory. However, DOS programs cannot access it; it can be accessed only using the 24-bit addressing available in protected mode.

The 80286 has a 16-bit data bus, unlike the 8088 used in the PC and XT. This means that it can read or write 16-bit (two-byte) values in a single cycle, which is obviously faster. The AT also provides seven more hardware interrupt request lines, and three more DMA channels that allow full 16-bit transfers. Consequently, the AT offers both higher performance and greater expansion potentials. Its expansion slots include an extra edge connector socket so cards can access the additional data, address, and IRQ lines, and DMA channels.

### 9.1 80386 and 80486 Processors

The Intel 80386, introduced in 1986, is a 32-bit processor; that is, it has a 32-bit data bus, 32-bit registers, and an instruction set that can manipulate 32-bit (four-byte) values. This increases performance greatly when working with large numbers.

Like the 80286 before it, the 80386 is compatible with the 8086 and 8088 processors. It has a real mode in which it runs simply as a fast 8086, offering higher clock speed and fewer cycles per instruction than earlier processors. It also has a protected mode, which resembles the one on the 80286 but has major improvements that enable it to multitask more efficiently. Finally, the 80386 has a virtual 8086 mode, which allows real mode applications to run in a protected mode environment. Microsoft Windows 3 uses it to multitask standard DOS programs.

Later Intel microprocessors are derivatives of the 80386. The 80386SX is the same as the original 80386—now known as the 80386DX—but has only a 16-bit data bus, so it must transfer 32-bit data to or from memory in two pieces. This lowers performance closer to 80286 levels, but also significantly reduces the complexity and hence cost of the associated hardware. The 80386SX offers all the memory management and multitasking benefits of its older brother, at only a little higher cost than an 80286.

The 80486 processor is more an improved 80386 than something new in its own right. It is essentially like an 80386 and its math coprocessor (the 80387) combined on a single chip. Performance gains arise from using fewer clock cycles to perform many instructions, closer integration between the CPU and the coprocessor, an on-chip cache, and a new fast memory access method called burst mode. The 80486SX processor is simply an 80486 without the coprocessor.

## 9.2 Pentium Processors

The core of Pentium processor is its "superscalar" design built around two Arithmetic logic Units(ALUs) and dual instruction pipe lines. The ALUs are capable of simultaneously executing code functions. To keep instructions and data supplied to the ALUs, the internal architecture of the microprocessor attaches one pipeline to each ALU, each pipeline being five stage deep. The Pentium processor has a 64 bit data bus, but the internal registers and address bus are 32 bit in size. The Pentium will process 64 bit instructions through two ALUs.

While the processor is executing an instruction in the ALU, it can also be decoding the next instruction from "pre-fetch" queue. The dual ALU combined with superscalar capability allows the processor to execute two integer instructions in one clock cycle, nearly doubling performance relative to a 486DX at equal frequency. Besides this two new features have been incorporated are integrated multiprocessor interrupt controller and a dual processor mode. First feature can control interrupts for upto 60 microprocessors. The dual processor mode enables two microprocessors to share a single second level cache.

## 9.3 Expanded Memory

In the early 1980s, megabyte PCs seemed as absurd as 500 mph cars or home nuclear reactors. However, as people began to use PCs for more complex tasks such as manipulating huge spreadsheets with Lotus 1-2-3, they started to need much more memory. To solve the problem, Lotus joined with Intel and Microsoft to produce a specification (the so-called LIM) for providing expanded memory. Many manufacturers developed hardware that implemented this specification, such as the Intel AboveBoard.

Because the 8086 and 8088 could address only 1 MB of memory physically, and since

IBM reserved the area above 640 KB for use by other things, Lotus and Intel designed a board that provided additional memory outside the PC's map. It is accessed using a 64 KB buffer area called a page frame, which is located in the reserved area at an address configurable by the user. The page frame is like a window into the expanded memory, through which it can be accessed by the DOS program as shown in Figure 1-6. A program called an Expanded Memory Manager (EMM) provides a way for applications to swap 16 KB pages of data into and out of the page frame. Since it is located within the 1 MB address space of the 8086/88, its contents can be manipulated just like any other data in memory. However, only four 16 KB pages can be kept there and accessed directly at any one time.

Expanded memory was intended originally to provide space for the storage of data such as large spreadsheets. However, software such as Quarterdeck's DESQview was developed that allowed it to be used to swap entire programs into and out of memory, a form of multitasking. Later versions of the expanded memory specifications added improvements to provide more flexibility and better performance, but the principles of operation remain the same.

When expanded memory is installed in a PC, the user must find an unused 64 KB of address space in the reserved memory area. This can sometimes be difficult. If the area selected is actually in use, problems will occur. If it happens to be used by a display adapter, ROM, network card, or whatever, corrupted data or system crashes are the likely result.

Expanded memory is the only type of extra memory that can be installed in 8088 or 8086-based machines. It is not really like standard memory at all. It is more like a peripheral, and data is read from and written to it in blocks. Fortunately, expanded memory is becoming obsolete as the old machines recede into history and software such as Windows comes into wide use.

#### **9.4 Extended Memory**

As we have seen, ATs and compatibles can utilize extended memory, addressable memory that extends beyond the 1 MB boundary. However, it is all but inaccessible to programs running under DOS. When running DOS, the CPU runs in real mode, in which it

emulates an 8086 and is subject to 8086 addressing restrictions. The ability to address extended memory is present only in protected mode.

One way to use extended memory is to emulate expanded memory. To do this, the 80286 needs an enhanced logic chip set which gives the hardware extra help. It must also run a machine-specific memory manager provided by the manufacturer. 80386s and above can achieve the same result using the memory management features inherent in the CPU architecture, so generic 80386 memory managers are possible. The most common, EMM386.SYS, is included with many versions of DOS.

If an expanded memory emulator is used, what happens is as follows. When a DOS real mode program requests a page data from expanded memory, the memory manager disables interrupts, switches the processor into protected mode, copies the data from extended memory into the appropriate page frame, switches back to real mode, reenables interrupts, and finally returns to the calling program. It can then access the data in the page frame just as if it were running on an XT with an expanded memory card.

Interrupts must be disabled while the processor is in protected mode because the service routines in the BIOS.DOS, or other user-installed programs can run only in real mode. They would not save the processor status correctly if an interrupt caused them to be executed in protected mode. Because interrupts are turned off while a program such as a disk cache accesses extended memory, they may be lost altogether. This can cause problems with serial communications at speeds above 9600 bits per second (bps), and with other devices that generate a large number of interrupts.

## 9.5 High Memory Area

The 8088 and 8086 processors with their 20 address lines can access memory in the range 00000 to FFFFF. The topmost location can be represented in the segment : offset notation as FFFF : 000F. What happens if we increase the offset value in the example by 1? If we do the arithmetic :



```

Segment      : FFF0
              +
Offset       : 0010
-----
Address      :100000
-----

```

The resulting address, 100000 hex, would require the hardware to generate a 21st address line. On an 8088 or 8086, this line does not exist. The address is truncated to 20 bits, and maps to location 00000 at the bottom of system memory.

Machines based on 80286 or later processors have 24 address lines, and so can generate a 21-bit address. To maintain compatibility with the PC and XT, a device called the A20 gate is used. It ensures that attempts to access memory above 1 MB are mapped into the bottom of the address range as they would be by an 8088 or 8086. However, the A20 gate can be turned off. In that case, such machines can access 65,520 memory locations above the 1 megabyte limit of the 8088/8086, while remaining in real mode. This facility is exploited by memory management software such as 386MAX, HIMEM.SYS, and both Microsoft's and Digital Research's latest operating systems, which include utilities that can load device drivers and utilities into the high memory area (or HMA). Using them releases space within the 640K base memory for applications programs.

One can only hope that the incredible confusion caused by strange concepts such as extended memory, expanded memory, and the high memory area will eventually disappear.

## 10.0 HARDWARE PROBLEMS

For computer users the distinction between hardware and software is unclear. If something does not work as they think it should, the computer has broken down. The exact cause (Hardware, Software or user error) is no more significant to them. The possibility that they might have pressed the wrong key, a change may have been made to the software configuration, or disk is full is unlikely to occur to them.

Two real life examples will help in illustrating typical situations. One morning a user called me to complain angrily that his monitor has failed. He had left his PC on overnight but, in the morning the screen was blank. I went to his office and soon spotted the cause of the problem. The monitor power switch was off. Now I could have asked him on the telephone to check the switch but, I did not. I made an unwarranted assumption that since the monitor had been on and working when he went home. It would still be switched on next morning. I did also assume that he would notice something as obvious as the power switch being off. I had therefore wrongly suspected a more serious fault. The only remaining problem was to note gently that the power switch was off without any screening or laughing that would produce a life long enemy.

On another occasion a user called to say that his PC which he used for word processing, was very slow. Some one went to his office dismantled the case, reseated all the boards and cables, checked the processor clock speed and ran Norton's speed disk to defragment the hard disk. The machine was still slow. After further examination it was found that there was no CONFIG.SYS in the root directory so the system was running with a default of BUFFERS = 2 and FILES = 8. With BUFFERS = 2 it could not keep more than two disk blocks in memory at a time, so it had to reread the disk whenever it accessed a file. Creating a CONFIG.SYS file with BUFFERS = 20 and FILES = 20 immediately restored the performance to normal.

There is a lesson to be learned here, never overlook the obvious, which may seem trite but it is something we all do. There is an irresistible tendency to look for a solution in terms of things we know best. So be logical, look for simple explanation of a fault before investigating the complicated ones.

If a PC is working normally except when a particular application is run, the fault probably relates only to that application. It might be a user error or a software configuration error. If a PC fails after something has been changed, no matter how convinced the user is that the change has nothing to do with problem, it should still be the prime suspect.

## 10.1 Some peripheral not working.

If some peripheral like printer is powered but not working, then check whether self test of the printer could be performed and the data cable is connected properly at both ends and is connected to correct port of the PC. If the sockets are not labeled, check the manual. Frequently, the explanation for a not working printer turns out to be a cable that is loose, disconnected or plugged in to wrong port.

If the hardware connections all appear to be fine, then check the software configuration. Is it possible to get output using a different package? For a printer, try a DOS command such as DIR > PRN. If the user is able to write to printer from DOS, but not from a software package, perhaps the package has been setup to a different type printer or a different port, check the configuration, do not assume that it would be correct. Someone else may have come along and changed it. The configuration file may have been overwritten or erased accidentally. Look at its directory entry and check the date when it was created. If it is recent, then it has probably been altered. If the problem started after the date, the fault can be certainly found.

Do not over look basics, examine CONFIG.SYS. Check that the normal parameters are present, FILES, BUFFERS and so on and they have the appropriate values. Look for any unusual additions, such as device drivers, which might be affecting system operation.

## 10.2 FIGURING OUT THE FAULT

A Computer expert is equipped with sophisticated items that make blip sounds when they uncover the faulty part. A common user is merely equipped with a cheap screwdriver.

If user already knows what computer needs, a bigger hard drive or a better monitor for example or he is still searching for the real error, then following discussion will help to find out which part of computer is bad.

### 10.2.1 If PC Doesn't Work Anymore

PCs don't die very often as PCs don't have any moving parts, leaving less to wear out. When computers do start to cause problems, usually just one small piece has gone bad,

spoiling the rest of experience.

The biggest problem is not fixing the problem. It's simply finding the problem. Is the software acting up ? Or disk drive ? Or both ? Or is it some complicated mystery part never heard before.

Before doing operation check for the following :

Make sure that the computer is plugged in and turned on

It sounds so obvious that people neglect it, but it may somehow happen, so we have to check it.

Make sure that the cables are fastened securely

Make sure that PCs power cord nestles between the back of the computer and the wall outlet. Check the monitor's power cord as well. Finally check the monitor's second cord, the one that runs back of the PC.

Turn the PC off, wait 30 secs. and turn it back on again

Turning the computer off and waiting a few seconds before turning it back on has solved many PC problems. Be sure to wait for 30 secs., before turning on again.

Flipping a computer off and on quickly can send damaging shocks to the sensitive internal organs.

Does the monitor say something like : Non system disk or disk error Replace and press any key when ready

This message usually means one has turned on computer with a floppy disk sitting in drive A. Push the disk drives, eject button, press space bar (or any key) and wish that all problems are thus easy to fix.

Narrowing down the problem

The only way to find a cure is to keep narrowing down the problem. Does the computer

only act strangely when a certain program is running ? Or does it just act up when trying to print the eighth page ? Is there any unusual sound inside the case.

When confronted with a real head scratcher, think over the following questions.

#### Has a new software been added lately

Sometimes new software not only doesn't work right, but it keeps everything else on the computer from working right, too. No easy solution here. The best bet is to reinstall the suspect software.

#### Dealing with AUTOEXEC.BAT & CONFIG.SYS files

When the PC is switched on it looks for two important files AUTOEXEC.BAT & CONFIG.SYS. Many programs add their own stuff to these files—things like program's location on the hard drive and how the program should be treated sometimes however one program's additions upset those left by another program.

The best way is to copy those two important files to a floppy disk before installing a new program. Then if something goes wrong, the new program can be deleted and the two files can be copied back to the hard drive.

Of course, this advice comes after the fact, so it probably isn't helpful. But it will be next time.

Note that some program will save the old AUTOEXEC.BAT & CONFIG.SYS by renaming them when the program is installed. Check the Installation manual.

#### Is there a weird file that didn't do anything & deleted it ?

Some of the most important files on the PC have the weirdest name. If an adventurous urged caused to delete a useless file and now the software doesn't work there are two choices:

Choice 1 : Ask an expert to figure out the wrong action.

Choice 2 : Reinstall the software which is not working right.

Has the user moved any files or directories around ? Changed any of their names?

When a program installs itself, it often tells the computer where its living on the hard drive. If a program is moved from C:\Fish to C:\FISH\TUNA for example the computer may not work.

Windows programs are notorious for this, leading to big trouble if the files are moved around, change a directories location, or simply change some names. The fix ? Try to remember which files or directories one has moved and move them back. Change the file names back to their originals, too. If the program still doesn't work, user's best bet is to delete the programs that aren't working and reinstall them.

It's bad to delete unidentified files because they often turn out to be important. Don't delete a file unless there is a compelling reason.

Have user changed the computer's location on desktop ?

Had the computer been pulled from the wall when plugging something or during cleaning ? Cables often fall off or loosen themselves when computers case is moved even just a few inches.

If monitor is too far in one direction, the monitor's cables can often come loose. Leave a little slack in the cables so they won't get yanked around. Often, loose cables don't dangle or give other visible warning signs. When in doubt give them all a little push inward for good measure.

### 10.2.2 Trying a Different Part

If one's hard drive is not working or floppy drive is not acting up, try to swap these with a "text drive" computer. Computer doesn't get power. Try another wall socket. By combining part swapping with other clues user can continue to narrow down PC's problem.

### 10.3 WATCH THE SCREEN WHILE TURNING ON THE PC

Whenever a PC is turned on, it sits still for a while, flashes some words & numbers on the screen and then belches out a beep or two before one can take work out of it.

During this time computer examines itself, it is trying to figure out what user can afford to attach to it & whether everything is working upto the mark.

This series of wake up checks is called the power-on self test (POST).

- Listen to the no. of beeps when computer is turned on. It tells which part has problem.
- Sometimes PC display a cryptic code rather than anything really helpful like the mouse doesn't work instead it says something like Error Code 1105.
- Most POST errors happen after installation of something on a card that computer didn't like.
- When computer's battery dies, POST message may say error code (6) & computer will not be able to locate hard drive.
- POST make sure that keyboard is plugged in that's the reason for keyboard light flash when computer is turned on. The lights on disk drives flash, too, as computer checks to see whether they are really there.
- The most visible part of POST comes with the memory check. PC first counts all its memory and then checks to make sure that all the memory works.

### 10.4 CURES FOR QUARRELLING CARDS

For a recently replaced or a new card POST alerts for the potential problem or a chain reaction of replacements. Card problems leave four possible fixes.

- Fiddle with the buttons on the new card so it won't interfere with the old card.

- Fiddle with the buttons on the old card so it won't interfere with the new card.
- Buy a different brand of card.
- Replace the older card that's conflicting with new card.

### 10.5 LISTEN TO BEEPS

A single beep after few seconds of turning on of computer is a happy beep. It means computer has found all its parts.

If it beeps more than once, it's bad news by counting the no. of beeps one can figure out what computer is trying to tell.

POST messages & beeps sound serious, but they aren't always that bad. Sometimes just a loose cable can start PC beeping & weeping.

### 10.6 THE VERSION OF THE OPERATING SYSTEM

User should know what version of DOS or Windows he is using. For DOS type VER at the C:\> prompt & press enter. While in Windows program manager press ALT H & then A. A little box listing the version number will pop up.

### 10.7 COPY OF CONFIG.SYS & AUTOEXEC.BAT FILES

These two files contains important information that the computer needs. In Windows Program Manager press ALT F & then R. When little box comes up, type SYSEDIT & press Enter. A program with four heads listing these two files will appear. Take print out of this.

In DOS, type these two lines

```
PRINT C:\AUTOEXEC.BAT  
PRINT C:\CONFIG.SYS
```

Press Enter twice after first line & once after second line.



## 10.8 COMMON ERROR MESSAGES

### 10.8.1 Insert disk with COMMAND.COM in drive A Press any key to continue

This message shows that the computer can't find DOS. Place a system floppy in drive A and press enter or if the user has to boot off the hard drive, remove the disk from drive A and press enter.

### 10.8.2 Invalid media or Track 0 bad, disk unusable Format terminated.

When the computer hides its most important file on a system floppy, it sticks them in some front row seats called track 0. If those seats are damaged - they are full of gums or some thing even worse - the computer can't stick its important stuff on them. That's what happens when this message appears. Throw the disk away and try another. If no fruitful result, wait. Call the service Engineer.

### 10.8.3 Access denied

The user is probably trying to write (or delete) something on a write protected floppy disk. If is sure that the contents of the disk are to be changed, disable its write protection. This message may be received, while trying to delete a file which is protected on the disk ( that may be floppy or hard drive). Or perhaps the user is trying to read or write to a file that is in use or manipulated by another program in Windows.

### 10.8.4 Divide Overflow

This one leaves no choice but to reboot the computer. The computer is fine, but the software did something that has confused everybody since their first math course; it tried to divide by zero. Try reinstalling the software on the hard disk from original disks. if that too doesn't click try to get a working copy of program. Also make sure that the most current driver has been selected.

### 10.8.5 Drive not ready, Abort, Retry, Ignore, Fail?

The computer is probably startled because it didn't find a floppy disk in one of the

drives. If the user put a floppy in there, is the drive's latch closed? Is the floppy right-side up? Make sure that the floppy's in the right drive and press R for retry.

#### **10.8.6 Insufficient Memory**

The computer doesn't have enough memory to run this particular program. Or perhaps the memory has not set up right. The best way is to put the System disk in drive A and reboot the computer. When the computer reboots from the boot disk, it'll come up "clean" of anything that's sucking memory from the available pool. Don't try to run Windows after this trick.

#### **10.8.7 Track 0 Bad-Disk Unusable**

The user is probably trying to format one of those high density, 1.2 MB floppies in a 360 KB floppy drive. It just can't be done. If not using a 360 KB drive, the floppy disk itself is probably bad. If the message refers to the hard drive, however, it's particularly bad news.

#### **10.8.8 Bad command or file name**

The user probably typed something at the C:\> prompt and DOS couldn't figure out what the user was trying to do. Or, there may be some spelling mistake. If this message is displayed while booting up, it indicates that one of the lines in the AUTOEXEC.BAT file is confusing the computer.

#### **10.8.9 Bad or missing filename**

If this message is displayed while booting, it means that the computer couldn't find a driver listed in the CONFIG.SYS file. The CONFIG.SYS file to see what's amiss. Otherwise, the computer's telling the user it couldn't find a file.

#### **10.8.10 General failure**

when DOS has trouble trying to read information from a hard drive or floppy disk, it offers a specific error message. But when it's really confused, it slings out this one. Check to make sure that the hard drive is configured correctly. On a floppy drive, check to make sure that the disk's formatted properly, that it's inserted right-side up, and, if a low-density drive is using a high-density disk.

### 10.8.11 Incorrect DOS version

This message usually pops up when the command and programs in the computer's DOS directory come from a version of DOS that's different from the DOS version that boots up from its hard drive. Suppose that the hard drive is formatted to bootup and start running under DOS-3.3. Then backup of DOS-6 may be obtained and copied to the DOS directory. The computer still thinks that it's running DOS3.3. When one of the DOS-6 commands is typed, the computer gets confused: the two versions of DOS don't match each other. The solution? Buy DOS-6 (or the latest version of DOS ) and run the installation program that come with it.

### 10.8.12 Insufficient disk space

When this message is displayed, the disk - hard drive or floppy disk -doesn't have enough room on it to store the incoming files. The user has to delete some files from it to make room. Of course, just put a clean floppy or buy another hard disk.

### 10.8.13 Internal stack failure. System halted

Reboot the computer. The user may need to use a system disk before the computer will stop finging out this message and come back to the file. Next add the following line to the hard disk's CONFIG.SYS file.

STACKS 9, 256

When the computer is rebooted, it should be back to normal. If not try changing the 9 in the STACKS LINE TO 12. If the message is still there then increase the number to 15. Don't change the 256 number. though That won't help.

### 10.8.14 Sector not found

DOS is having trouble finding information on a disk. Try running CHKDSK. If the user has not backed up the disk- whether it's a hard disk or a floppy - do it as quickly as possible. The hard drive may be on its last legs in need of formatting.

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