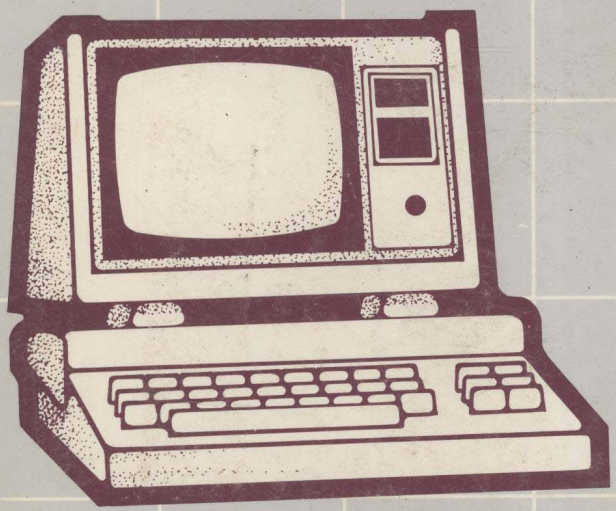
A Practical Guide to Selecting Small Business Computers



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PREFACE

This text is written to aid the small businessman in understanding computers. It is assumed that the reader knows no more about computers than what he might have read in a newspaper. We are entering a new era—The Information Age—where the computer will have a great impact on our society. The impetus for this change is the new advances in computer technology, primarily the microcomputer. In the past, significant changes in the way business was conducted occurred over decades. It is predicted, however, that with the microcomputer, significant changes will result in *less* than one decade. Consequently, the authors feel that there is a need for texts, such as this one, which will assist in transferring this new technology to the business world. We hope this text is useful in this regard. It is not meant to be a comprehensive text on computers. Rather, it is intended as a short, concise book for those who need a practical guide to small business computers.

We are grateful to the many people who made this book possible. Mr. William McCabe (Automated Business Systems); Mr. Robert Call (Bland, Call and Company); Mr. E. F. Sutliff (Moore Business Forms); and Mr. Pete Pappas and Mr. Glen Pappas (Stillwater Main Auto) all shared some of their experiences in implementing small business computers. Mr. Jim Martin of the Small Business Administration provided advice and assisted in the advertising of this effort. Also, the Chambers of Commerce throughout the State of Oklahoma provided valuable assistance in advertising. The cartoons appearing in the text are courtesy of Creative Computing, and are taken from their copyright publication, The Colossal Computer Cartoon Book. We are particularly grateful to the Oklahoma Regents of Higher Education who funded this project. The funding was administered through Mr. Jerry Hargis of the Regents' office through program IMPACT of the Higher Education Act. Without this funding, this book would not have been written.

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INTRODUCTION

In 1947 a fully electronic computer had 18,000 tubes, weighed 30 tons, and cost $500,000. Today a microcomputer with 20 times the computational power has been reduced in size to a ¼ inch square silicon chip costing $10.00. Technological advances such as this continue and the price of computer systems continue to decline. Declining to the point that, at some time in the near future, a computer will be as much a part of running a business as is a telephone and a cash register.

The development of the microcomputer occurred recently, in the early 1970's, and new related innovations, such as bubble memory, are occurring at a rapid rate. Unless an individual works in an environment directly related to this new technology, it is nearly impossible to keep up with new developments. This is particularly true of the small businessman who spends long hours managing his business. He cannot, however, afford to ignore this new technology because it can have a large impact on how he manages his business and possibly, if he can remain competitive. In the next five years, it is predicted that one of the largest growth segments of the computer industry will be the small business computer systems portion.

Not only is the technology changing rapidly, but the number of firms making and selling small business systems is virtually exploding. In 1977, Datamation conducted a survey of the number of firms supplying small business computer systems. They found 88 firms supplying 249 systems. In 1978 Datamation performed a similar survey in which they found that 750 firms were supplying 2,000 systems. In one year that

represents an 800% gain. This combination of a rapidly changing, complex technology; a tremendous growth in the number of firms supplying computer systems; and a tremendous growth in the number of computer systems available results in a very complicated environment in which to make decisions. Within this complexity, the small businessman must decide when, and if, he should use a computer.

This book is written for the small businessman as an aid to assist him in understanding the revolutionary technology that is now occurring, to help him decide if a computer would benefit his business, and to aid him in selecting the appropriate computer system. It is assumed that the reader knows little more about computers than what he might have read in a newspaper. A glossary of computer terms can be found in Appendix B of this text that will assist you in understanding the new terminology and computer related jargon.

The first sections of this text discusses computer fundamentals: computer system, system software, and application programs. After a basic understanding has been established, the subjects of software evaluation, system justification, and implementation considerations are discussed. Appendix A contains a small business computer system selection checklist. This checklist is discussed in the system justification section. The remaining sections of this text deal with consultants, turnkey systems, service bureaus, timesharing, and future technology.

This text was written for the person who has little knowledge of computers and related topics but wants to learn more. This individual is aware of the new advances in computer technology that have occurred and that these advances will have a tremendous impact on many facets of society. One facet will be the business environment.

A COMPUTER SYSTEM

In this text, the term computer will mean an electronic digital device that contains four major components: central processing unit (CPU), storage facility, and at least one input and output (I/O) device (see Figure 1). An analogy has been made between a human and a computer. Part of the brain might be the CPU as it can perform math calculations and control the various body functions. In another portion of the brain, information can be stored. Some of our input devices are eyes and ears; one of our output devices is our mouth.

This is a good analogy, but it becomes invalid upon closer investigation. Our mind can reason, but a computer can only do what someone has programmed it to do. The cliche "garbage in, garbage out" describes the inability of a computer to do no more than carry out a set of instructions. These instructions are called a program.

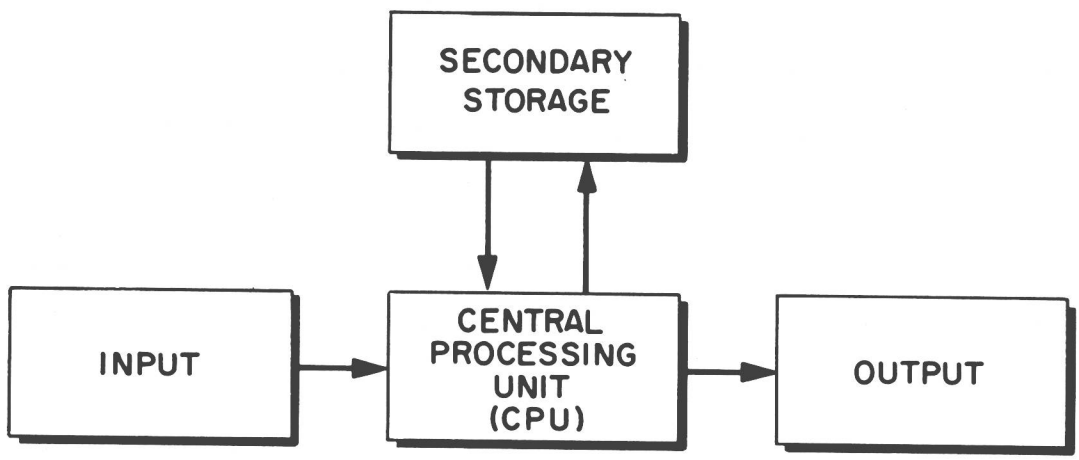
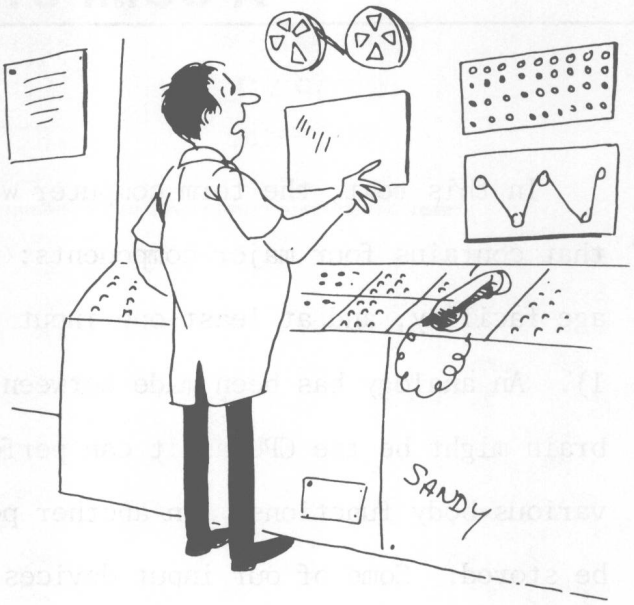


Figure 1. The Four Major Computer Components

Within the electronic digital computer everything is represented in terms of zero's and one's (binary notation), and each digit is called a bit. Letters and symbols can be represented by a certain code of zero's and one's. Thus, an "A" might be represented by the code '01000001.' Several codes exist but most small computers use ASCII (American National Standard Code for Information Interchange). Other codes are used in large computers such as the IBM 370 series. The 370 series uses a code called EBCDIC (Extended Binary Coded Decimal Interchange Code).



"Now hear this! I am the programmer. You are the programmee!"

A computer stores the binary code of zeroes and ones in electrical devices that have two states (high voltage/low voltage, on/off, and etc.). High voltage might represent a '1' and a low voltage might represent a '0.' It can take these 0's and 1's and add them, subtract them, compare them, and move them. This does not seem like much; but, by combining these operations, with a few more, the computer is very powerful. These operations are performed in the arithmetic/logic section of the Central Processing Unit (CPU). The CPU consists of three parts: the arithmetic/logic section, the primary memory section, and the instruction/control section (see Figure 2). The instruction/control section obtains the instructions that are stored in the memory, interprets the instruction, and controls the sequence in which the arithmetic/logic section executes

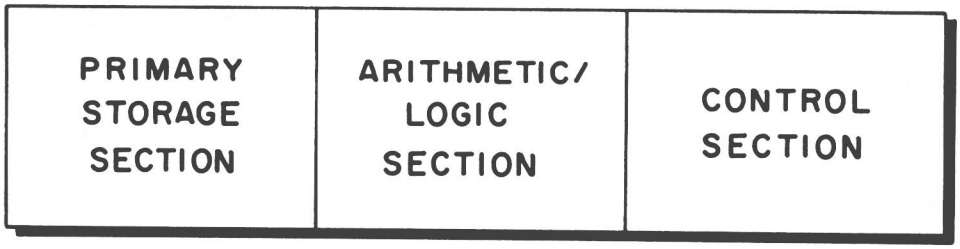


Figure 2. The Three Parts of a CPU

the instructions. The primary memory contains the instructions and the data that will be processed.

To work with a computer system, an input device and an output device is needed in addition to the CPU. Most small business systems will use a CRT (Cathode Ray Tube - T.V. type tube) instead of punched cards as the input device. For output, the CRT can also be used; however, in most cases a printed copy is desired, so a printer will be used.

Since it is impractical to key in programs and data every time they are used, a place within the computer system is needed to store information. This area is called secondary storage. Logically related information is read from or written into secondary storage devices as a unit. Each of these units is called a record. A group of logically related records is called a file. For example, the name of an employee might be one item. All data about the employee might be contained in one record. The data for all employees in a company might be contained in one file, the master payroll file. Files are assigned unique names to identify them.

Two common secondary storage devices are: magnetic tape and magnetic disk. A secondary storage device usually contains several files, each having a unique name so that the data could be retrieved upon the appropriate request.

A magnetic tape storage device is less expensive than a disk, but a tape has the disadvantage that everything has to be processed in sequence. If you want something on the last part of the tape, you must run the first part of the tape through the machine to get to the last part. Consequently, to read the 1000th record, you must first read records 1 through 999. For some types of data processing, sequential retrieval of data is satisfactory. However, if all the data is not normally processed sequentially, this type of processing is a very time consuming job. In this case, magnetic disk storage might be used. A magnetic disk can be visualized as a phonograph record. If you want to play the third song on a record you can move the needle to the third song. This is done the same way on a magnetic disk; instead of a needle, a read/write head is moved to a certain position to read the data. Disk storage is sometimes referred to as random access storage, because the 1000th data record can be read without reading the preceeding records.

The minimum business system consists of an input terminal (such as a CRT), a computer, a mass storage device (probably a disk), and a printer (see Figure 3). In small computers, the printer and disk storage may each cost as much as or more than the CPU.

Central Processing Unit

Manufacturers have attached a lot of names such as mini-computers, microcomputers, main frames, and small business computers to describe the size of the Central Processing Unit. These names tend to overlap; and, as time progresses, it becomes more difficult to distinguish between the

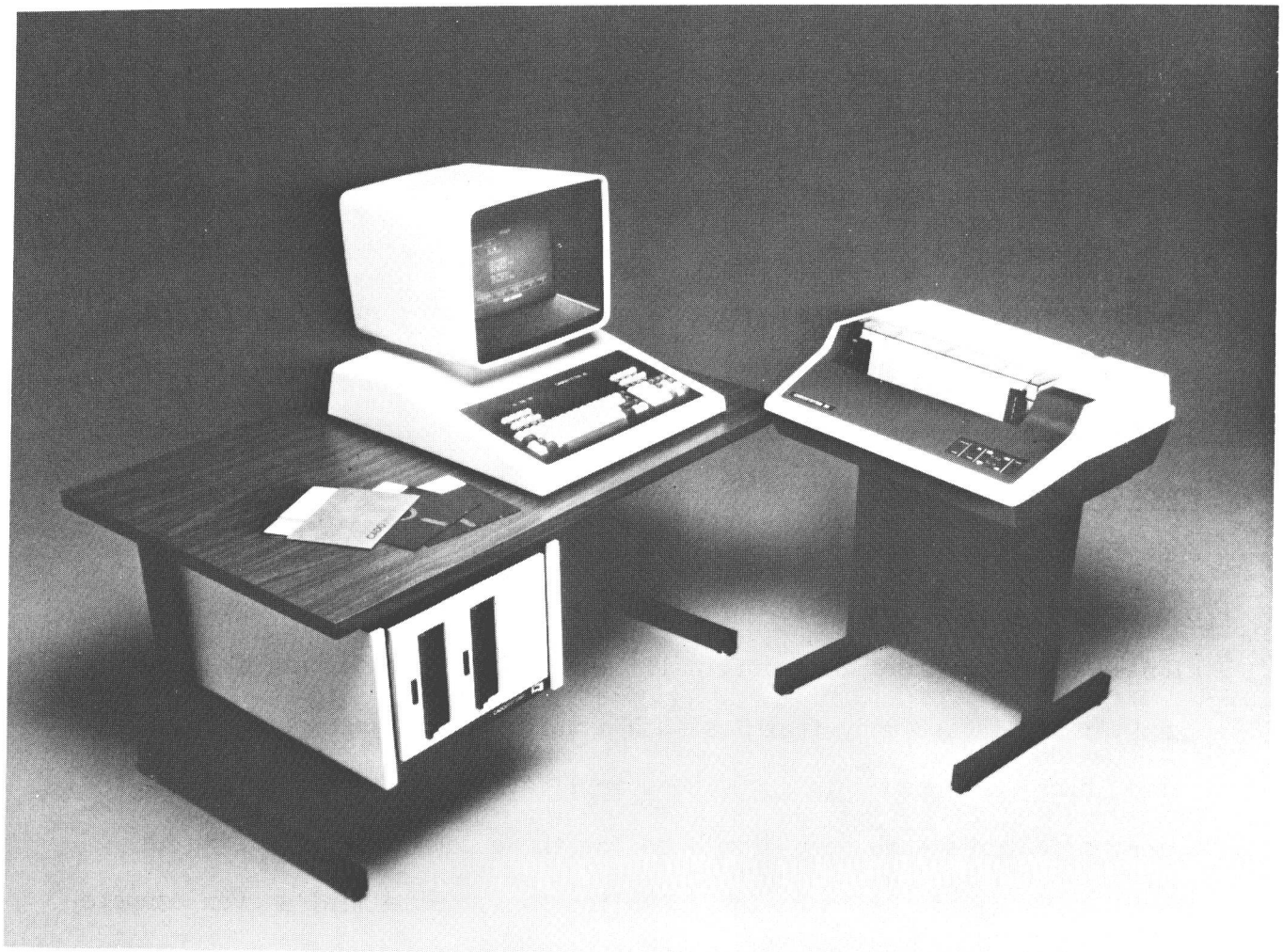


Figure 3. A Small Business Computer System

Courtesy of Cado Systems Corp.

groups. One of the main differences in computer sizes is word size. Word size is described as the number of bits, with a bit being a one or zero, that the computer manipulates at once in the CPU. The most popular large computers (IBM 370's) use a 32 bit word. These very fast and very expensive machines, which may cost $1 million or more, are referred to as main frames.

Since large computers have been and still are very expensive, the minicomputer was developed in the mid-1960's with a smaller word size, to reduce cost. Today, most minicomputers have a word size of 16 bits with a price ranging from about $1000 to over $20,000 (Central Processor price alone). Minicomputers were originally introduced as a scientific-oriented computer and lacked many features such as high level languages and application programs, needed in a business application. To date, business oriented features have been developed for these computers resulting in the wide use of mini's in business applications. Some mini's even compete with the main frames in size and speed.

Small business computers have about the same characteristics as a minicomputer. Currently, most microcomputers have 8 bit word sizes. They are named micro because the entire processing unit (except memory) is on one electronic chip. These microcomputers start at about $500 for the Micro Processing Unit (MPU) and a small amount of memory.

The difference in word size can be important to the user. For example, for large numbers, the small computer may perform an operation in several steps, where a large computer would take only one step. Other computer operations might be similarly affected. Consider the example of using a computer to find the name John Doe in a long list. There are eight characters, including the blank, in this name; and within a computer system,

each character is normally stored in eight bits (also called a byte). A microcomputer would have to make eight comparisons to determine if a name was John Doe, since it can only compare one word at a time (see Figure 4). A minicomputer with sixteen bit words would only have to make four comparisons, since it compares two characters at a time. A big main frame would only have to make two comparisons. Even if the computers operate at the same speed, the computer with the larger word size can perform more work in the same amount of time.

Some computers can only add and subtract integer numbers. So, if you want to subtract a fractional number such as $.10 from $20.00, a program has to be written to handle the decimal point. Hardware to do this calculation is called floating-point hardware. It may allow a system to perform mathematical calculations hundreds of times faster than a system that

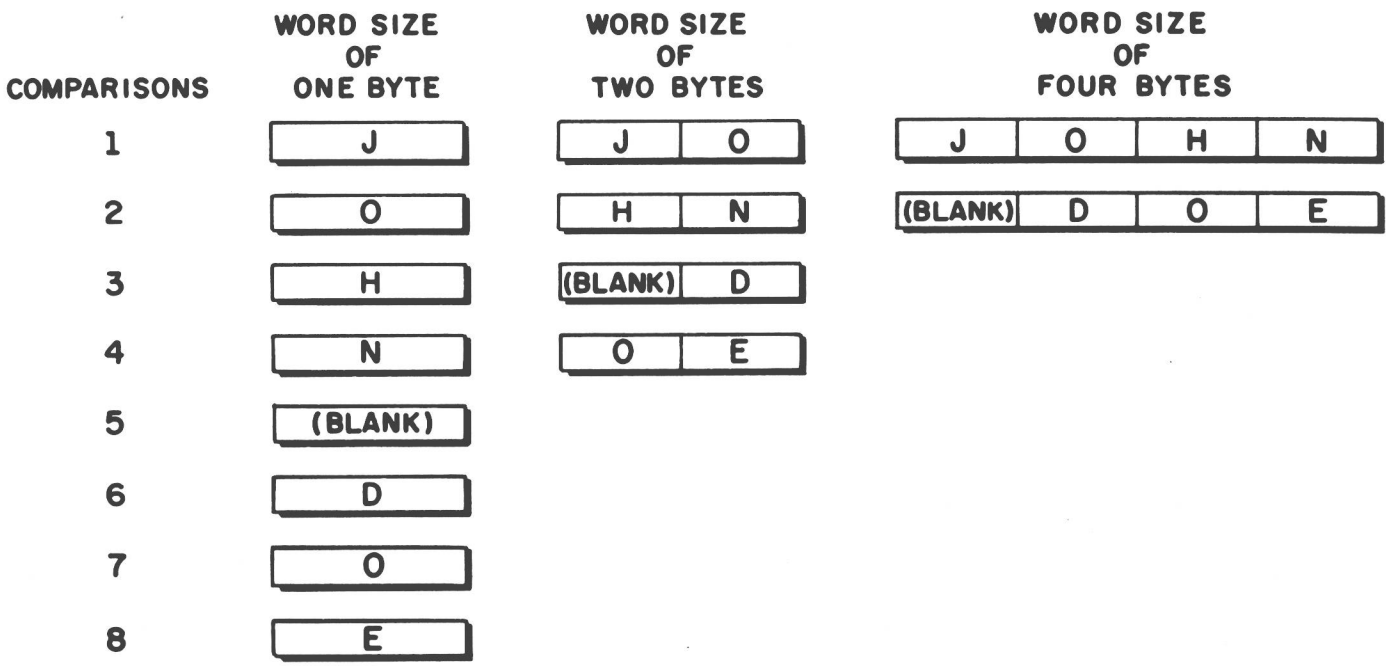


Figure 4. Word Size Comparison

"What good is our new 50 million results per second when our best operator is hunt and peck?"

uses software to maintain the decimal point. Also, many computers use a program to multiply and divide numbers, while others have hardware features to do this. These hardware features allow the computer to perform multiplication in one instruction or division in one instruction; however, these features are not inexpensive and are not available for all microcomputers.

Hardware to maintain the decimal point and to perform multiplication and division operations increase the speed of the CPU, which may not be important in a single user (one terminal) environment. In this case, the CPU will be idle most of the time because the response speed is primarily determined by secondary storage characteristics and the speed of the printer. Consequently, the speed of the CPU may not be one of the most important aspects to consider in choosing a CPU. However, one consideration that cannot be overlooked is what <u>software</u> (programs) is available for that computer. There should be at least one software package that does the jobs you want to implement now or in the near future.

Another important factor to consider in selecting a CPU is the amount of memory that can be addressed. In some small business systems, only 64K bytes (K represents the number, 1024) can be addressed. As noted earlier, normally one byte is used to store one character. Most business application programs will require 32-40K bytes, or more, of memory; which is much more memory than the "least expensive" systems contain.

Memory

Random Access Memory (RAM) for a computer in the past was referred to as core, because computers used iron ferrite cores as the internal storage media. In recent years, core memory has been replaced by semi-conductor memory. Relative to core memory, semi-conductor memory has the following characteristics:

1. Can be faster.
2. Is less expensive to produce.
3. Needs less power.
4. Is smaller in physical volume.
5. Is volatile.

These characteristics are discussed below.

Semi-conductor memory has replaced core memory in small machines primarily because of its low cost, since the speed of core was sufficient for the small computer. In 1973, the cost of 8K bytes of core memory was about $3000; today, the cost of 8K bytes of semi-conductor memory can be bought for less than $50. This is one of the primary reasons computers are affordable today for the small businessman. One disadvantage to semi-conductor memory is its volatility; or, in other words, when you turn off the computer, semi-conductor RAM memory forgets everything. Core memory does not forget when the power is lost.

Because of the volatility of semi-conductor memory, another important installation factor is inconsistent electrical current. For example, if your lights blink or dim when a piece of equipment starts up in your business, your computer might loose its memory. This can be minimized by using a separate circuit for the computer. Also, to avoid this problem some computers use batteries or other electronic devices to always keep the power to the memory during a power failure.

Since RAM loses all memory when power is lost, another type of memory, Read Only Memory (ROM), is usually used to store at least a part of the operating system of the computer. Operating systems will be discussed in the system software chapter. Information stored in ROM is programmed during the manufacturing process of this type of semi-conductor chip; consequently, ROM is non-volatile and has an unchangeable memory. Also, a program error stored in a ROM is impossible to correct because the program is created in the semi-conductor production process. Programmable Read Only Memory (PROM) is similar to a ROM; however, it is programmed using a special device to apply high voltages to the memory. Erasable Programmable Read Only Memory (EPROM) is the same as a PROM except it can be erased by ultraviolet light or high electrical voltage and reprogrammed (reused). By using EPROM's, PROM's, or ROM's microcomputers are being used for many dedicated applications such as controllers in microwave ovens and radio scanners.

Printers

One of the most important parts of a small business system is the printer. Printers come in two primary types: impact and non-impact. Non-impact printers are of two basic types: special paper (thermal, electrostatic, and electrographic) and plain paper (ink jet and xerographic). The special paper printers can be low in price with speed sufficient for small business