

All About Personal Computers

What is a Personal Computer?

One of the most often asked questions about personal computers—and one of the hardest to answer—is what kind of small computer product do we mean by the term “personal computer?” Datapro, for purposes of this report, recognizes a personal computer as one having a base purchase price of about \$2000 or less, and which includes software sufficient to permit a layman to gain productive use and enjoyment out of the system in a typical home, education, or small business environment.

A hallmark of personal computers is that these systems typically can be plugged in and begin working immediately, as opposed to other small computer systems that must first be professionally programmed. Personal computers are extremely flexible. They can be used for a variety of local processing tasks, and can serve as a timesharing terminal or as a means to gain access to major, commercially available data bases.

A personal computer is typically a general-purpose, stand-alone, microprocessor-based system that relies on conversational interaction between it and its operator. The microprocessor is often an Intel 8080-compatible Zilog Z80, a Motorola 6800, or an MOS Technology 6502 8-bit system. Built-in RAM memories range in size from 4KB (4,096 bytes) to as much as 64KB (65,536 bytes). The system is usually supplied with a keyboard and a limited configuration of peripherals.

Additional peripherals are widely available, either from the system vendor or independent sources. Most personal computer systems permit the use of cassette tape for program and data storage, and 5¼- or 8-inch diskettes are becoming increasingly popular. The user interface generally takes place through the keyboard and a black and white CRT display, or monitor, that is provided with the system. Sometimes an interface is available that allows the user to attach his own color or black and white TV set as the system's display monitor.

Because of the relatively low price of personal computers, these exciting new products cannot be sold with economic success by the computer industry's traditional (and costly) methods of door-to-door selling that include vendor-supplied support for individual customer problem solving.

Personal computers must be sold by other methods, including through department stores, computer retail stores, office equipment dealers, and direct mail. In some cases, they are even sold over-the-counter at industry trade shows or fairs. There are several thousand retail outlets all over the U.S. where personal computers are sold today, and no geographical location is so isolated that the local yellow pages will not contain at least one listing for such an outlet.

History of Personal Computers

The origins of personal computers are relatively recent. The main technological breakthrough that permitted the creation of these products was the integrated circuit (IC), or computer-on-a-chip. Although this technology has been available since 1968, it was not until the beginning of 1975 that advances in miniaturizing computer chips were combined with smaller, lower-priced input, output, and storage devices, permitting personal computers to become a practical reality.

The first personal computer was the Altair 8800, produced by the Albuquerque-based MITS, Inc., which sold in kit form during 1975 for about \$400. With a working complement of peripherals, the Altair 8800 cost about \$2,000. Although that system is no longer offered, its contribution to the creation of a personal computer marketplace will be well remembered. One specific feature pioneered by the Altair 8800 was the widely used S-100 interface bus to connect peripherals to the main computer board.

About a year later, Steve Wozniak and Steve Jobs began selling a system built in their garage. This system has since become the Apple—one of today's top selling personal computer systems. Also in 1976 three other pioneering firms, IMS Associates, Polymorphic Systems, and Processor Technology, brought out the IMSAI, Poly 88, and Sol systems, respectively. These systems, like the Altair, are no longer offered, but each did its share to help the personal computer marketplace develop.

In 1977, several important new systems were developed. Commodore introduced its Personal Electronic Transactor (PET); Heath entered personal computing with its H8 and H11 systems; and Radio Shack made its initial foray into the field with its TRS-80. By the end of 1977, the key elements necessary for the personal computer industry to unfold as we know it today were all in place. The three firms who would come to dominate today's marketplace (Radio Shack, Apple, and Commodore) had already entered the field. Also, several of today's leading personal computer magazines had been started, and consumers were quickly awakening to the lure of the personal computer.

In 1978 and 1979, the whole industry broke wide open. Dozens of small and large firms brought systems to the market. Peripherals vendors introduced a huge array of low-cost products of every type. And literally hundreds of individuals and firms began offering a wide variety of software packages for the more popular systems. Personal computer systems have become more fully developed year-by-year. Today's current products are no longer the bare-bones, hobby-type systems that were first introduced only a few short years ago for computer enthusiasts and engineers.

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Radio Shack's TRS-80, Model I, Level I system shown here consists of a cable-connected keyboard, a 12" B/W video display, and a cassette recorder for data storage. Imbedded within the keyboard is a RAM memory of 4KB or 16KB. With an optional expansion chassis, the Level I can be expanded to 48KB RAM. The basic system shown here for home/hobby use, with 4KB RAM, lists for \$499, and is programmable in BASIC.

➤ At present, some of the top firms in both the consumer electronics and the computer industries have entered systems in the personal computer sweepstakes. There are now dozens of personal computers available in the marketplace. Twenty of the more popular units are described in the next section of this report. Altogether, there are well over 500 independent commercial sources of software and peripherals for personal computers. Some of the better-known of these firms are listed in the Directory section at the end of this report.

Current and Projected Market Sizes

According to the latest information available from International Data Corporation (IDC), there were about 200,000 desktop computers shipped in the U.S. during 1979 and the total installed base at year end was about 371,000. The number of units shipped each year will continue to grow and, according to IDC, will reach approximately 849,000 by 1984. The U.S. installed base at the end of 1984 will be about 3,114,000 units dispersed throughout four market areas—business/professional, home/hobby, scientific, and educational.

The IDC figures include all types of desktop computers which includes, but is not limited to, personal computers as defined by Datapro in this report. Based on the information available, Datapro estimates that at least 280,000 of the total of 371,000 installed desktop computers fit our description of personal computers. If the ratio of personal computers to all desktop computers reflected in the 1979 figures remains unchanged, there will be approximately 2,335,000 personal computers installed by the end of 1984.

This growth will occur even though many of the smaller retail stores that specialize in personal computers may in

time be squeezed out of business. Non-surviving computer stores will be replaced by outlets with more financial strength, including franchise and large-scale department stores, which may be able to offer more complete support packages, and in other ways to better help the customer fit the personal computer to his individual needs.

Current Applications

It has been said that the personal computer represents an avenue to increased personal power. As a recognition of this, personal computers are being used not only for games and entertainment, but also for a wide variety of applications aimed at improving the capabilities of their individual owners. They also have found their way into serious use in large and small businesses.

There are currently four major usage environments in which personal computers are being employed:

- home/hobby
- education
- professional
- business

Within these environments, the principal uses are typically as follows:

- **Home/hobby**—telephone answering/dialing, computer-assisted instruction (CAI), games, music, cartoons/art, environment/home appliance control, budgeting, investment analysis, personal records, calendars, recipes, message logs, security systems, and word processing.
- **Education**—Computer-assisted instruction (CAI), budgeting, personal records, work assignments, calendars, word processing, filing.
- **Professional**—telephone answering/dialing, budgeting, general ledger, tax/payroll accounting, personal records, work assignments, filing, calendars, report preparation, security systems, and word processing.
- **Business**—telephone answering/dialing, electronic mail, budgeting, general ledger, tax/payroll accounting, personal records, work assignments, filing, calendars, report preparation, and word processing.

Within these environments nearly 1,500 discrete applications have been identified. On the average each personal computer user has been found to be active in about five of these application areas. The dozen most popular uses of personal computers include games (played on virtually every personal computer at one time or another); text editing and report/letter preparation (also done on virtually every personal computer); music generation, general ledger accounting, education, speech ➤

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▷ recognition/generation, and inventory (each done on about 20% of all personal computers).

Other popular applications performed on smaller percentages of the installed personal computers include income tax preparation, stock/bond analysis, recipe storage, simulations, home appliance control, sales records, real estate investment analysis, scoring of touch typing tests, pharmaceutical/drug record keeping, home budgeting, a memory aid for important dates, personal/home asset inventory, etc.

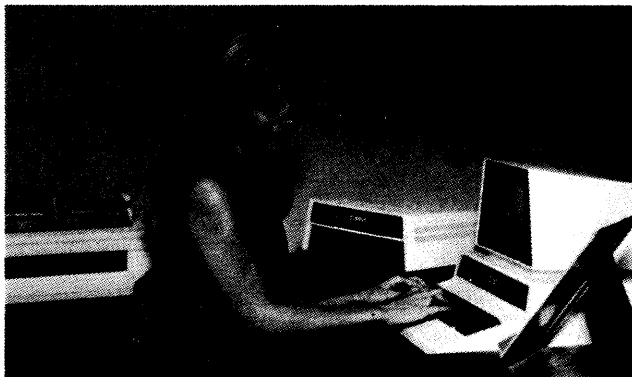
One of the most powerful applications of personal computers is made possible through the use of an often available data communications capability that can connect these small systems via telephone lines to other computer users and to the enormous wealth of information available through any of the independently available commercial data bases.

The programming languages used on personal computers are BASIC (used on virtually every personal computer), Assembly, FORTRAN, COBOL, APL, and PASCAL.

How Are Personal Computers Sold?

The first personal computers were sold by direct mail and at specialized trade shows. Although very successful initially, once the first surge of interest from engineers and other technically sophisticated computer hobbyists had been satisfied, this approach quickly faded as the primary method of selling these systems. Today, there are four primary ways in which personal computers are sold.

1. **Computer stores.** These specialty retail outlets can be either independently owned or franchises operating as part of a local or national chain of stores. The likelihood is that these stores will employ salespersons with considerable expertise to help you determine how you can use a personal computer, and to help you assemble the necessary configuration of hardware and software for your needs. In some cases, local stores may put together a hardware



The Commodore system pictured here is configured for business use, and features a 32KB RAM, a dual drive mini-diskette system capable of storing up to 340KB of data on-line, and a high-quality printer. With word processing applications software, this system is a fully-featured word processor and is priced at about \$5,000.

system with appropriate locally manufactured software and act more like a manufacturer or systems house than simply a retailer.

2. **General merchandise department stores.** Major mass-merchandising retail chains, such as Sears, Penney's, and Montgomery Ward's, have entered the personal computer market. They sell either popular personal computers or private label versions of these brands. Like computer stores, some of these chains may have contracted for special software development, and may be selling a unique configuration of equipment and software that is truly their own system. In many cases, tests are being conducted by these stores to see how successfully they can sell personal computers. Some stores have not yet made full-scale commitments to this market. Care should be taken to find out where to get on-going support if the store you buy from decides not to continue selling your chosen system.

3. **Computer companies.** Most computer companies, such as IBM, DEC, and others, are keenly aware of the potential business opportunity that personal computers represent. Many of them have already entered this dynamic marketplace with systems, and some—including DEC—have opened their own retail stores. Others sell their systems as part of the full product line of their in-the-field sales force. IBM has also come very close to opening retail outlets, with about 70 "showroom" locations nationwide where their smaller systems can be observed, tested, and purchased.

Mainframe computer and minicomputer companies who enter the personal computing field directly will usually have a greater amount of computer expertise within their firms than will some small, independent personal computer manufacturers. These larger companies may also offer a sizeable base of other users among whom very helpful user groups have formed. But, in many cases, those larger manufacturers who do not sell out of retail stores may not be able to devote as much of their considerable expertise to supporting individual customers as can the perhaps less technically qualified, but more consumer-oriented, smaller independent companies.

4. **Office equipment dealers.** There are thousands of these firms nationwide who are presently selling and servicing copiers, word processing systems, typewriters, etc. Mainly because of their already established base of customers, their in-place service operations, and their understanding of small business problems, these firms represent a potentially effective medium through which personal computers can be sold. Today, a growing number of office equipment dealers are beginning to test the selling of computers.

All vendors have found that a big problem in selling personal computers to date has been the lack of knowledge on the part of potential customers about what these systems can do. As we have seen, the systems can be (and many have been) applied to nearly any type of information processing activity. The challenge facing vendors is to ▷

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- ▷ develop and/or collect a comprehensive inventory of personal computer-related software packages, and to make these available, with adequate documentation and other support, to the interested personal computer buyer.

Who Uses Personal Computers?

Nearly anyone in today's modern world can derive considerable immediate benefit from owning a personal computer. Depending on how creative you are and how extensive your needs, it may be better for you to select a system that can attach a wide variety of different devices, and which can ultimately be expanded to considerable size. A good programming language will be vital if you intend to create new programs for yourself. Or, you may need "menu-driven" programs that help you tailor existing programs to fit your needs. In any event, everyone can profit from obtaining a system that already has a complement of ready-made programs.

Using ready made programs, some of which carry nominal pricetags, you can immediately begin to process any of the applications mentioned earlier. Many professionals have already turned to personal computers, and still more are expected to do so.

Another important way that you can use personal computers is for pre-set calculation routines in business offices of large corporations. The number of such potential uses is legion, ranging from omnipresent applications such as budget data accumulation and presentation, to industry-specific applications, such as finance and insurance industry calculations.

Future Trends

Among the many developments in personal computers that are expected during the next few years, perhaps one of the most significant will be the increasing ability for personal computers to be connected to one another (and to their larger computer cousins) via telephone lines. With these connections will come the ability to communicate with both people and vast computerized data banks. Various forms of electronic mail systems could easily be structured.

Also to be expected is a vast enrichment of the inventory of pre-programmed application programs available for the popular brands of personal computers. Many of these will be graphics-supported and will utilize color display screens. A great part of this development will focus on non-entertainment applications. Among these will be an ever-growing number of business as well as home uses. Personal computers will be able to offer menu-driven business applications which will perform many useful jobs in both large and small offices. This business utility will be enhanced further by the expected widespread availability of data communications features.

Business applications in general are certain to be among the most important future areas of usage for personal



The Apple II Plus computer shown here is running under control of the Apple Stock Quote Reporter program. This program enables the system to be connected to a central data base, and receives a current display of stock prices and allows the operator to place a corresponding bid. Price of the 32KB RAM system as shown, with a printer, modem, 116KB mini-diskette drive, and user-furnished color TV is about \$2,700 (not including the TV). A dial-up telephone connection must be made by the user to access current stock information from an on-line data base.

computers. Many small professional offices already use personal computers, and more will do so.

It is already clear to today's major manufacturers of personal computers that the trend toward business usage will accelerate, and most of them have already extended the top of their present lines upward to permit growth from individual system usage in the home, to varied uses in a full business environment.

Voice recognition devices and speech synthesizers, already available for personal computers, will increase in sophistication and will become supported in much of the applications program development work currently being planned. Also to be expected for the home is a wider range of support for appliance and other device controllers, including security and environmental control systems.

Among the other personal computer hardware and software trends that will become more pronounced in the future are: 1) greater use of color monitors, supported by multi-color graphics display capabilities; 2) increased diskette mass storage capacity; 3) the increasing usage of hard disks, permitting, for example, 10 million bytes or more of data to be stored on-line using the Winchester technology; 4) more 16-bit microprocessors employed as engines for personal computers, replacing the 8-bit devices so common today; 5) more high-level programming language availability, such as COBOL and PASCAL; and 6) better information storage and retrieval software systems, such as data base management and user inquiry systems.

How to Buy a Personal Computer

Datapro offers the following suggestions to prospective personal computer buyers as an aid in determining what, ▷

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▷ if any, personal computer system is most suitable to your needs.

1. First, you must evaluate your own specific needs and desires that a personal computer could reasonably satisfy. Prepare a list of tasks for which you intend to use the personal computer. Identify for each task just how you expect your personal computer to be helpful to you, whether it be printing lists, visually displaying information, presenting color graphics, etc.

2. Next, seek to identify and locate which systems *appear to* offer the hardware and software sufficient to satisfy your requirements.

To help you with this important second step Datapro has included within this report descriptions of 20 of the more popular personal computers available today. Datapro has selected these 20 computer systems from among several dozen such systems currently being sold. Each system is well-suited to one or more personal computing tasks. Included in this group are not only the personal systems most widely used for home/hobby applications (such as the Radio Shack TRS-80 Model I/Level I, the Apple, the Atari 400 and 800, etc.), but also several personal computer systems often used for scientific (such as the Hewlett-Packard HP-85) and professional or small business applications (such as systems from Cromemco, Ohio Scientific, and North Star). The complete listing of systems covered can be found in the Table of Contents at the beginning of this report. A more comprehensive listing of most of the current personal computer vendors is contained in the Directory section at the end of this report.

You must also determine whether or not you expect to use ready-made software packages, or whether you will require high quality programming language support, such as is offered with BASIC, COBOL, and PASCAL programming systems. It is also important to determine whether or not the types of printers, mass storage, voice I/O, music, or other peripheral devices you will need are

available either from the maker of the personal computer or from independent companies.

Datapro has also compiled a listing of more than a dozen of the more popular periodicals that cover personal computers. Once again, please see the Directory section at the end of this report to review these lists.

3. Datapro recommends that your next step should be to get hands-on trial of the system(s) you have identified as likely candidates to meet your needs. The best way to do this is to visit your local computer stores. With several thousand retail computer outlets spread across the country, there should be one or more computer stores within a reasonable distance of anyone investigating personal computers. These stores will not only have the system you are investigating, but they will also have personnel trained in their use. Further, these stores will be very agreeable to giving you a hands-on, reasonably lengthy demonstration.

4. Finally, you are ready to make your selection. At this point, you are not only selecting a particular brand of equipment and configuration of hardware/software components to serve your needs, but you are also selecting a vendor (i.e., a source from which to buy this system and its service in the future).

Your hands-on exposure to personal computers through local computer stores will now prove valuable not only in picking the equipment, but also in verifying that the computer store in question is the right place for you to buy your system.

When buying through an independent sales organization, such as a local computer store, a good part of your future support will come from this store rather than from the often-distant personal computer manufacturer. Be certain that you are comfortable with this retailer, and that he is financially stable, reliable, and capable and willing to give you the level of support you will need.□