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All About Small Business Computers

There is general agreement throughout the business world today that the time of the small business computer has arrived. Compact, low-cost business data processing systems will soon be nearly as commonplace and indispensable in most offices as telephones and typewriters. The ever-increasing costs and complexities of doing business are forcing small businessmen to find new ways to cut their labor costs and gain tighter control over their operations—and a wisely chosen small computer can help immeasurably in both these critical areas.

But what, exactly, is a small business computer, and what can it be expected to do for your firm? Those are the key questions we'll try to answer in this report. We'll also discuss the companies that make small business computer systems and the makeup of their market. Then we'll explain how you can tell whether your firm could really benefit from installing a computer, and how to select the best one for your needs. We'll examine the reactions of 146 current users of small business computers, whose experiences can give you valuable insights into the pros and cons of these machines. And we'll wind up the report with 27 pages of detailed comparison charts that present the salient characteristics of 132 current small business computer systems from 46 vendors.

The Small Business Computer

A small business computer is an office machine that processes data entered by the user and produces calculations and reports as directed by its stored programs of instructions and the user's commands. Generally speaking, it's more accurate to think of a small business computer as a business computer scaled down than as a computer intended strictly for small businesses.

In price and performance, the small business computers span a wide range that fills the gap between conventional accounting machines at one extreme and medium-scale computer systems at the other. Though the current small business computer systems differ widely in their architecture, data formats, peripheral equipment, and software, they are generally characterized by purchase prices in the \$5,000 to \$100,000 range and by a strong orientation, in both their equipment and software, toward conventional business data processing applications.

These low-cost business data processing systems are known by various names, such as electronic accounting machines, office computers, electronic billing computers, or magnetic record computers. To simplify matters, we have chosen to use the generic term "small business computers" throughout this report.

A small business computer can calculate and print your payroll checks, customer invoices, and inventory status. It can print your directories or sales forecasts. It can keep track of stock on hand, stock on order, and supplies to be

This comprehensive report is designed to help you select and apply low-cost business data processing systems. The characteristics and prices of 132 current systems from 46 vendors are reported in detailed comparison charts, and the experience of 146 small business computer users is analyzed.

ordered. It can help to administer hospitals, hotels and motels, wholesale operations, retail establishments, meat packing houses, etc. In short, it can perform virtually any information handling or record-keeping operation that you do now, plus many desirable operations that cannot economically be performed by manual methods.

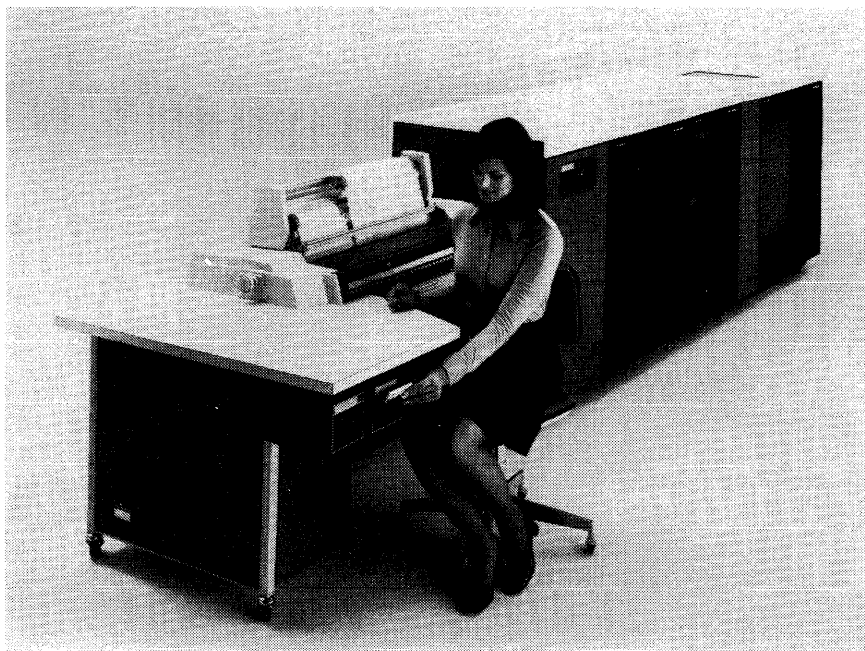
Physically, today's typical small business computer is made up of a processor with an integral main storage unit for data and programs, a keyboard device for data entry, a printer to record the results produced, and a magnetic disk unit for secondary (i.e., low-cost and relatively large-capacity) data storage. These four elements constitute the *input* (keyboard data entry), the *logic* ▷



The IBM System/32, introduced in January 1975, seems destined to become the world's most widely used computer within the next few years. In this fanciful photo, the compact System/32 is surrounded by representatives of the five industries it can serve by means of the initially available group of preprogrammed Industry Application Programs: construction, wholesale food, wholesale paper and office products, hospitals, and membership associations. The single desk-sized cabinet houses a central processor, 16K to 32K bytes of MOS memory, disk storage unit, diskette I/O drive, printer, keyboard, and display screen.

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Less than a month after IBM unveiled the System/32, Burroughs Corporation enhanced its competitive B 700 Series by introducing four new entry-level configurations and the more powerful B 721 (shown here) and B 723 systems. The smallest of the new systems, the B 702, includes a central processor, 32K bytes of core memory, 4.6 million bytes of disk storage, console keyboard/printer, and 85-lpm line printer—all for \$33,900 cash or \$858 per month.



▷ (processor), the *memory* (main storage and disk), and the *output* (printer), which are the four classic elements of every computer.

Substitutions can be made for the input device (e.g., a TV-like CRT display unit with keyboard or a punched card reader instead of the typewriter) and for the output device (e.g., a card punch instead of the printer). Many systems lack the disk storage unit, while others add magnetic tape units for secondary storage and/or high-speed data input and output. However, most of the basic systems from the small business computer vendors comprise the four elements listed above.

As for operating characteristics, the internal speed of the processor and the transfer rate of its main storage unit typically permit computational speeds in the range of thousands of calculations per second. The rated speeds of the associated input devices will usually range from about 10 to 200 characters per second, while the rated output speeds will typically range from about 10 to 500 characters per second. (By contrast, the average speed of even a first-rate typist will seldom approach 10 characters per second.)

Thus, the critical factor for judging a business computer's useful speed is usually the speed at which the input and output devices operate, because the processor can operate far faster than you can either enter the data or see the results printed. Many typical uses of small business computers are operator-oriented, meaning that a single human operator tends the machine and keys in all the data. And the input and output speeds of even the most basic computer systems are usually more than sufficient to match the requirements and speed of a single operator. But as your work-load grows, you'll need to add faster input and output units to the computer and switch to an

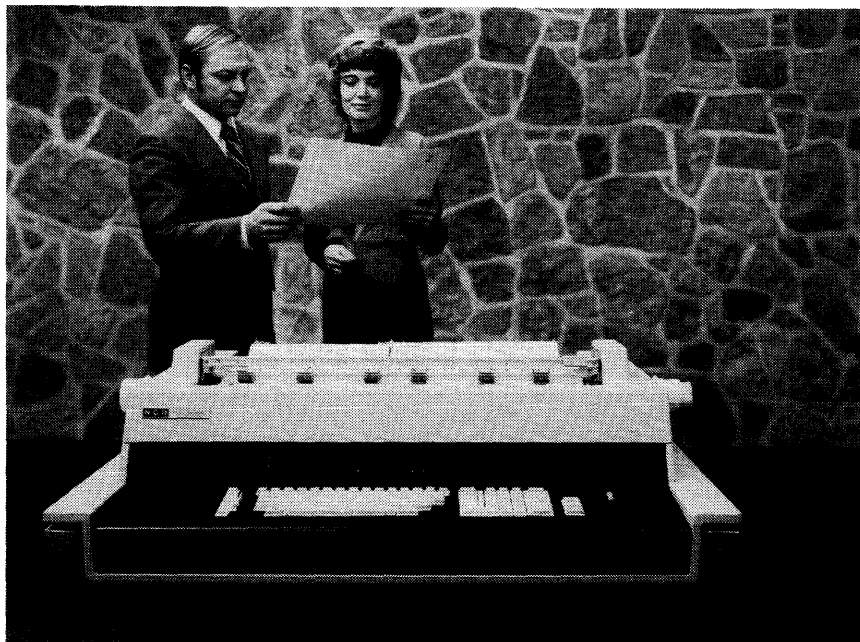
"off-line" mode of data entry that involves multiple operators at keypunches or similar devices.

Storage capacity typically ranges from 8,000 storage locations to 32,000 or more. In many systems, each storage location is called a "byte" or "character" and holds one alphabetic character or decimal digit. But in many other current systems, each location is a 16-bit "word" that can contain four decimal digits or two alphabetic characters. Thus, the minimum storage capacity available in most systems, for example, could hold enough data to perform calculations on a file with 100 entries, each 50 characters long, with additional storage space left over to hold the instructions that constitute the computer's program.

In the computer field, a "configuration" is the physical makeup and arrangement of the equipment to be used. The minimum configuration typically offered by the small business computer vendors comprises a processing unit, a minimal number of storage locations, a keyboard data entry unit, and a printer. A range of additions and substitutions is then generally available either to increase the number of storage locations, to speed up the input and output functions, or to add special capabilities to the system. For instance, users of some small business computers can add an optical card reader, which can recognize data that is hand-printed or marked on cards.

In most cases, substituting a faster device or adding a special device will significantly increase the performance of a small business computer, while at the same time substantially increasing its cost. A note of caution here is that some manufacturers' minimum configurations are barely adequate to perform useful work. These cases will soon become obvious because the salesman will work diligently to convince the prospect to upgrade various elements of the system. ▷

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The NCR 299 is a stored-program business minicomputer with a basic price tag of just \$7,250. It features a unique optical-scanning technique for program entry, plus other features designed to make it unusually easy to program and operate. NCR offers packaged application programs for the common business data processing functions.

➤ Usually, a small business computer is used in a manner similar to a printing calculator or an office typewriter. Even its physical appearance generally resembles that of more conventional office equipment. The small business computer is usually operated by a clerk dedicated to that one task. In use, the small business computer typically requires more training and more attention to specialized procedures than an office copier, but less than an offset printing press. No special air conditioning, flooring, or electrical work is required for most of the current small business computers.

Who Makes Small Business Computers?

The small business computer market is served by two distinct types of vendors. The first type is the "Fortune 500" companies such as Burroughs, Honeywell, IBM, Litton, NCR, and Singer, all of whom have vast product lines and resources. For these companies, the small business computer is just one of a broad line of products (although in the cases of NCR and Burroughs, small business computers now account for a very sizeable portion of total corporate sales revenues). The second type is the dedicated, single-product-line company such as Basic/Four, Datapoint, Qantel, Ultimacc, and numerous others. These latter companies usually sell small business computers and services exclusively, and are themselves small businesses. What they lack in size or resources is often more than compensated for by their quick reaction time to problems, general expertise, and eagerness to satisfy. Altogether, there are approximately 40 such firms doing business in the U.S. and Canada.

From the former group come the leading U.S. suppliers of small business computers, which have long been Burroughs Corporation and NCR Corporation. It is no coincidence that Burroughs and NCR are also the leading suppliers of conventional adding and accounting machines and of the paper supplies for such machines. Both

companies have huge marketing and service organizations and have done an outstanding job of trading their customers up to progressively more powerful equipment as their data processing requirements expand in volume and complexity. Burroughs, the clear-cut leader in recent years, offers the industry's broadest line of small business computers; and NCR, whose development efforts lagged behind those of its arch-rival for several years, has effectively closed the gap with the attractive NCR 299 and 399 systems.

IBM, the dominant supplier of both larger computer systems and punched-card tabulating equipment, has only recently begun to achieve proportionate success in the small business computer market—but the odds are that IBM will soon be by far the largest producer of this class of equipment as well. The dramatic increase in IBM's penetration of this segment of the marketplace hinges largely upon the advent of two highly significant small business computers: the System/3 and System/32.

The IBM System/3, introduced in 1969, is a strong entry at the upper end of the small business computer market segment. It is now offered in four distinct versions—the keyboard-oriented Model 6, the diskette-based Model 8, the batch-oriented Model 10, and the more powerful Model 15—at system purchase prices ranging from about \$48,000 to more than \$300,000. IBM has already completed more than 30,000 installations of the System/3, making it the fastest-selling computer in the company's history.

The IBM System/32, unveiled in January 1975, is the smallest and lowest-priced general business computer ever announced by the industry giant. All components of the System/32—processor, main storage, keyboard, display, printer, disk storage unit, and diskette drive—are housed in a single compact, desk-sized cabinet. What's more, IBM is billing the System/32 as a "programmerless" machine ➤

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▷ whose software, for most users, will consist entirely of preprogrammed Industry Application Packages supplied by IBM. With equipment purchase prices beginning at \$33,100 and monthly rentals (on a 3-year lease) beginning at \$770, the System/32 should convince thousands of small businesses that it's time to take their first step into computer usage. Thus, the availability of the System/32, backed by IBM's powerful marketing forces, should substantially enlarge the total market for small business computers and lead to increased sales for both IBM and many of its competitors.

Digital Equipment Corporation, the leading builder of scientific minicomputers, offers business-oriented users its Datasystem 300 and 500 Series systems based upon the popular DEC PDP-8 and PDP-11 minicomputers, respectively. In January 1975, just 10 days after IBM introduced its System/32, DEC countered with the Datasystem 310, a complete business data processing system priced at just \$12,000. The basic Datasystem 310 includes a PDP-8/A microcomputer with 8,192 12-bit words of core storage, two diskette ("floppy disk") drives, CRT display unit, and typewriter-style keyboard. Optional extras include a printer, a communications interface, and expanded main or diskette storage. DEC hopes to achieve high-volume sales of the Datasystem 310 by selling it in two ways: directly to end users who are prepared to write their own applications programs, and through a distributorship network of software houses that will do the applications programming for less sophisticated users.

Hewlett-Packard, General Automation, and Microdata are three more major suppliers of scientific minicomputers that offer "packaged" hardware/software configurations oriented toward business data processing applications. Numerous other companies, such as Basic Four, Custom Computer, Scidata, and Ultimacc, produce business computer systems based upon minicomputers manufactured by other firms such as DEC and Data General.

European-made equipment is making a much greater impact upon the small business computer market than in any other segment of the U.S. computer market. Honeywell, International Computers Limited, Olivetti, Philips, and Nixdorf are marketing equipment which they manufactured in France, Great Britain, Italy, the Netherlands, and Germany, respectively.

Who Needs Small Business Computers?

As for the market served by these firms, it is estimated that in the United States there are currently more than half a million businesses or other organizations with fewer than 150 employees. These are the primary marketing targets of the small business computer manufacturers. These firms and their most promising computer applications, in rough order by size, include:

- 200,000 retail firms, for cycle-billing operations and inventory control.

- 125,000 manufacturing companies, for job costing, keeping track of work in process, and work center loading.
- 115,000 wholesaling firms, for order billing and sales analysis.
- 80,000 building and other types of contractors, for estimating, job costing, maintaining equipment records, and daily labor reporting.
- 46,000 transportation companies, for revenue analysis and compiling freight bill statistics.
- 22,500 automobile dealers, for monitoring parts sales, new and used car sales, dealer trades, service and repair accounting, and vehicle inventory.
- 15,000 printing and publishing companies, for advertising and circulation billing.
- 14,500 education institutions, for maintaining student records and handling appropriations accounting.
- 14,000 hotels and motels, for keeping track of departmental costs and maintaining the city ledger.
- 13,000 labor unions, for such applications as membership accounting.
- 12,000 insurance agencies, for premium billing and computing agents' commissions.
- 11,500 commercial banks and savings banks, for processing saving accounts and mortgage and trust accounting.
- 9,000 savings and loan associations, for savings and mortgage accounting, escrow analysis, and dividend processing.
- 8,500 municipal, state, and county government offices, for tax billing, utility billing, and appropriations accounting.
- 6,000 law firms, for maintaining time records and performing client accounting.
- 5,000 public accounting firms, for client billing and preparation of balance sheets and income statements.
- 4,500 bakeries and bottling companies, for handling route settlement, computing drive commissions, compiling sales reports, and performing vending machine accounting.
- 2,500 stock brokerage firms, for computing sales commissions, maintaining position records, and preparing purchase and sales confirmations. ▷

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- ● 1,500 hospitals, for maintaining in-patient records, insurance billing, revenue analysis, and census reporting.

Small business computers are, of course, designed principally to serve the business data processing needs of these small business and government organizations. For many of these companies, a computer—when properly selected, installed, programmed, and operated—can lead to far smoother operations and higher profits. In addition to processing routine transactions, a computer can provide reports that give management the information it needs to achieve improved customer service, reduced inventories, tighter cost control, and increased production efficiency. But in all too many cases, computers are poorly chosen, misused, and misunderstood, so that they actually become liabilities rather than assets. The best way to guard against this type of disaster is through a thorough management training program in the principles of EDP. But, since few small-company executives have the time or desire for such training, the best alternative is to seek competent outside advice in the selection and installation of an appropriate business computer system. One promising source of guidance for getting the outside help you need is likely to be your own industry, trade, or professional association.

In addition to their principal use in small companies, low-cost small business computers are also being productively used in some of the nation's largest corporations, in a variety of specialized applications such as:

- Local processing of some or all of the data generated in branch offices, divisions, and/or small subsidiaries.
- Individual, "dedicated" applications that involve extensive keyboard input and printed output, such as the preparation of accounts payable checks, insurance claim checks, and stock transfer certificates.
- "Intelligent terminal" applications, in which the small business computers perform both local data processing functions and communications control functions in company-wide data communications networks.

Overall, small business computers currently represent more than a billion-dollar annual market. Specifically, Creative Strategies pegs the size of the U.S. small business computer market as 29,400 systems worth \$1.119 billion in 1974, and expects these figures to grow to 33,900 systems worth \$1.215 billion in 1975 and to 51,800 systems worth \$1.564 billion in 1978. The total potential U.S. market for small business computers, in both large and small companies, is believed to be around 500,000 systems, and there are fewer than 100,000 installed at the present time.

How Are They Being Used?

When using a small business computer that has the typical basic configuration (consisting, as stated above, of a processing unit, a keyboard for data entry, and a

typewriter-style printer or low-cost line printer for data output), the operator enters all the necessary variable data for each transaction into the computer through the keyboard. The "master file" or ledger data required to process each transaction may also have to be entered through the keyboard. In systems equipped with appropriate input/output capabilities, however, the master file data can be read directly into the processor from magnetic ledger cards, punched cards, paper tape, magnetic tape, or magnetic disk, leading to greatly increased processing speeds and flexibility.

For most small business computers in most applications, the overall processing speed will be governed by the speed at which the operator can key in the data for each transaction. Wherever on-line keyboard entries are involved, the overall performance of a system will rarely exceed a few transactions per minute.

Many of the small business computer systems can optionally be equipped with sufficient input/output capabilities to handle conventional batch-mode data processing, in which the variable transaction data is recorded on cards or tape so that it can be read into the computer at higher speeds. This mode of operation is particularly suitable for the recently developed systems that are built around a comparatively powerful mini-computer. ➤



Digital Equipment Corporation's new Datasystem 310 is a complete business data processing system that can be purchased for just \$12,000. The basic system consists of an 8K PDP-8/A microcomputer, two diskette drives, CRT display, and keyboard. It can be expanded by adding a printer, a communications interface, more diskette drives, or increased storage capacity. DEC is setting up a distributorship network of software houses that will sell the Datasystem 310 to end users and develop their applications programs.

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➤ As their name implies, the small business computers are designed and used predominantly for applications of the accounting and business data processing type. A much smaller (albeit growing) number of systems are also suitable for applications in the scientific, engineering, management sciences, or information storage and retrieval categories.

The firms that can and do use small business computers effectively are legion. They range from banks and savings institutions to truckers and wholesalers. In fact, there is virtually no business enterprise that cannot benefit in some practical way from business computing. Any firm or division large enough to warrant a separate accounting, treasury, or comptroller's department is a promising candidate for such equipment. Any firm with a large shipping load, purchasing department, inventory turnover, or production scheduling task is also a suitable candidate.

Areas in which users are employing small business computers were clearly identified in a Datapro user survey conducted early in 1974. As shown in the following table, the applications in which the 80 respondents were using their small business computers fell mainly within the general business category, with several special-purpose applications sprinkled among them:

<u>Applications</u>	<u>% of Total Users</u>
Payroll	36
Accounts receivable	35
Invoicing/billing	19
General financial administration, including cash receipts journal and accounts payable	23
General ledger	29
Inventory management	23
Special industry applications, including securities/banking, distribution, medical/dental, and sales analysis	21
Miscellaneous (costing, remote job entry, etc.)	14
Order entry	15

The figures add up to well over 100% because most of the respondents were using their computers for several applications.

Payroll, accounts receivable/payable, and general ledger were most often combined as principal applications by the users surveyed.

Does Your Organization Need One?

One of the most crucial and yet most difficult questions to answer is: "How do I know if I need a small business computer?" Realizing the nature of a business computer as a labor-saving and cost-reducing tool is the first step toward answering the question. For instance, an executive could easily make a big mistake by simply saying, "My

competitors are doing it so I will, too." However, if a businessman sees that his competition is automating and is able to underbid him on contracts, then maybe his firm should realize that a business computer can help to restore competitive parity. The point is that the business computer is an effective tool for streamlining your operations—not a miracle worker.

There are many compelling reasons for considering a small business computer:

- To gain a competitive edge.
- To reduce labor costs.
- To increase productivity.
- To control escalating clerical expansion.
- To improve customer service.
- To increase profits through better cost accounting.
- To reduce inventory through closer inventory control.
- To enhance management efficiency by instituting a management reporting system.

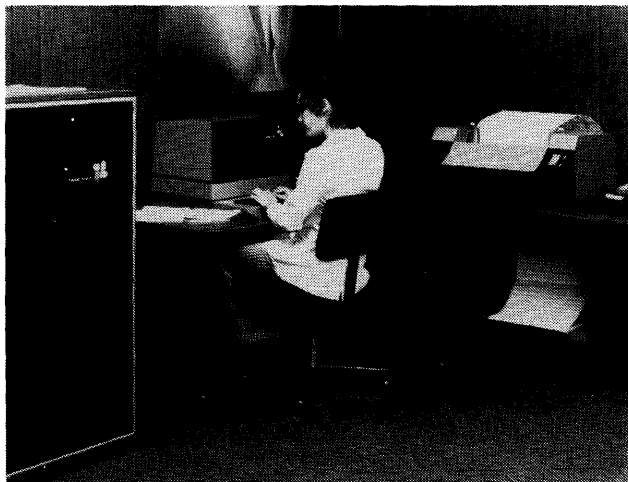
The small business computer is sufficiently mature and flexible to handle a wide variety of applications in business, commerce, and industry. It is also competitive enough to offer suitable solutions at a reasonable cost to the prospect. Thus, an important step in deciding whether or not such a system is appropriate for you is to develop confidence in small business computers as a viable solution to your needs.

The next step is to recognize a problem area or an opportunity for growth where one exists. Any area of your business that is chronically over budget, late in meeting schedules, or operating without effective management control is a clear indication that a small business computer can probably be of help. If your firm is subject to a cycle in which clerical workers are being hired each time work expands, a small business computer may be the way out of that cycle. All these situations are indications that some course should be taken to alleviate a problem or improve an existing company strength.

Once having recognized such a situation, your firm should conduct an informal feasibility study. This should include:

- Examination of the current business practices and operations.
- Assessment of their attributes, volume, and frequency.
- Determination of present costs and future budget to continue the present practices. ➤

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Basic/Four Corporation is a pioneer and current leader among the "systems houses"—companies that develop, market, and support complete data processing systems which utilize hardware manufactured by other companies. Based upon the Microdata 1600 minicomputer, the Basic/Four systems are oriented toward standard business applications and feature data entry via multiple CRT display terminals.



Microdata's own REALITY system is designed to fulfill transaction-oriented information management functions. Its innovative features include a virtual-memory operating system, a data base management system usable by nonprogrammers, and the capability to support up to 32 local or remote CRT terminals. Based upon the Microdata 1600 mini, the REALITY system is available through a network of authorized dealers on a purchase-only basis.

- ▷ ● Estimation of the costs of proposed alternatives to the present practices.
- Comparison of the *costs* and *benefits* of the current practices versus any proposed alternatives.

The feasibility study thus aims to determine whether or not it is economical and reasonable to install a business computer system (or any other new system or practice) at a given period in time. It involves a careful analysis of all the costs which are likely to be incurred during the process of converting from manual or mechanical operations to the new equipment. It also involves a careful analysis of the potential benefits that the company may gain by installing this new equipment. The feasibility study, then, attempts to measure the anticipated costs versus the potential savings in order to make an informed decision as to the most economical course of action for the company.

Buying Guidance

As with all categories of data processing equipment, the watchword in selecting a small business computer is "Buyer beware." These machines come in a wide range of types, sizes, and capabilities—with price tags to match—and there's a great deal to be gained through systematic selection of the most appropriate system for your particular needs.

But all too often, the buyers of this class of equipment have little or no understanding of data processing principles and are likely to buy the wares of the salesman who arrives first or sells hardest.

No company should *ever* buy a computer from the first salesman who comes through the door. It's always far

wiser to check out the offerings of at least a few of the other major suppliers, and you shouldn't hesitate to play one vendor against another in an effort to get the most for your money. Just remember that all promises of extra software, technical support, or other concessions should be specifically included in the final contract.

Prospective users who make a sincere effort to select the most appropriate equipment for their needs are likely to encounter a number of frustrations. Many of the small accounting computers are very poorly documented. The sales brochure and even the technical manuals often seem to be artfully contrived to conceal more than they reveal about the equipment's true characteristics and capabilities. The salesmen aren't likely to be much more helpful; typically, they've been trained to sell "instant solutions" to data processing problems rather than specific hardware or software. Clearly, the assumption is that the buyers of these machines are unsophisticated souls who have no reason to know or care what the basic product specifications are.

Before seriously considering the acquisition of any small business computer, you should demand:

- Detailed specifications of all the pertinent hardware and software.
- A full-scale demonstration of the equipment on at least one of your own principal applications—or, if that's not practical, on a demonstration program whose functions are similar enough to your own needs so that you can draw realistic conclusions about the system's processing speed and ease of programming and operation.
- A detailed proposal that spells out exactly what equipment, software, and *technical support* will be ▷

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➤ supplied, estimated processing times for each of your applications, all responsibilities of both the vendor and the buyer, and the total purchase price or monthly rental price.

- A list of users in your geographical area who are employing the system for applications similar to yours. Talk to several of these users and find out as much as you can about their experiences. While they may not be able to give you much help in developing a sophisticated comparison to other alternative systems, they *can* give you a good idea of what pitfalls to watch out for in installing and using that particular system.

A critically important area to be evaluated is *software*—the programming packages and languages used to program the computer and thereby direct its operations. It is important that you carefully investigate the available software. This investigation should include the programming languages, preprogrammed utility packages such as sorts and file maintenance, and application packages such as payroll, inventory control, general ledger, etc.

Vendors' claims and promises concerning the availability and capability of software should be carefully checked. This is particularly true of software that has been announced but not yet released. Vendors have frequently failed to live up to their marketing publicity.

Since small business computer users typically start with no programming staffs of their own, it is important that appropriate program packages be available to fit your specific requirements. If not, you should require the vendor to take on full responsibility to write and test the initial programs you'll need. Otherwise, you'll have to either recruit and train your own programmers or pay an outside software firm to develop your programs.

The availability of reliable and qualified vendor support for both equipment maintenance and software aid is another vitally important factor in the small business computer environment. The limited resources generally available to small computer users make you depend heavily on your vendor for such assistance. In many cases the vendor will even design the initial system and make any required changes to his program packages for you. Thus, the ability of the vendor to render competent and continuing service in these matters is a vital concern to you.

If all this buying advice sounds like too much trouble, or just plain incomprehensible, your company (like many others) could be heading for serious losses of time and money through installation of an unsuitable computer system. In that case, you should seek help from responsible industry or trade associations with problems similar to your own and/or from a qualified independent consulting firm.

User Experience

To assess the current level of user satisfaction with small business-oriented computers, Datapro conducted a survey of users of such systems in December 1974. A Small Business Computers Reader Survey Form was included in the December supplement to both DATAPRO 70 and DATAPRO REPORTS ON MINICOMPUTERS and mailed to all subscribers. By February 1, 1975, usable responses had been received from 146 users of small business computers with a total of 258 installed systems.

In order to gain as broad a picture of the subject as possible, subscribers were asked to rate their systems as Excellent, Good, Fair, or Poor in these eight areas: 1) Overall performance; 2) Ease of programming; 3) Ease of operation; 4) Ease of conversion; 5) Hardware reliability; 6) Maintenance service; 7) Technical support; and 8) Manufacturer's software. The responses to these questions from users of 21 models of small business computers are summarized in the "User Ratings" tables. Where only one response was received for a given computer system, Datapro combined it with the other responses of this type in the "All others" classification.

Totaling the responses to all eight of Datapro's rating categories for all systems, the results were as follows:

<u>Rating</u>	<u>No. of Responses</u>	<u>% of Total</u>
Excellent	417	36.9
Good	457	40.5
Fair	183	16.2
Poor	72	6.4

Displaying the responses in this manner indicates a reasonably high level of user satisfaction. In fact, 77 percent of the users rated their small business computer systems as *generally* "Good" or "Excellent." It is clear, however, that most users are considerably less enthusiastic about the software and technical support they received from their systems' manufacturers than they are about the other aspects, as shown by these "weighted averages" of the overall user ratings for each category:

<u>Category</u>	<u>Weighted Average User Rating</u>
Overall performance	3.4
Ease of programming	3.3
Ease of operation	3.4
Ease of conversion	2.9
Hardware reliability	3.2
Maintenance service	3.1
Technical support	2.4
Manufacturer's software	2.8

With the noteworthy exception of the IBM System/3, the numbers of responding users who rated most of the individual small business computer systems were disappointingly small. Because of the small sample sizes, ➤

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▷ readers are cautioned not to place undue emphasis upon the user ratings shown for individual computer systems.

The users were asked who wrote the programs for their applications, with the following results:

<u>Programming Done By:</u>	<u>No. of Users</u>	<u>% of Total</u>
In-house personnel	123	84.2
Manufacturer's staff	32	21.9
Ready-made programs	16	11.0
Others (consultants, etc.)	13	8.9

The figures total more than 100 percent because numerous users called upon multiple sources for their various applications programs.

In reply to the question, "Our annual budget (exclusive of hardware rental costs) for salaries, administration, supplies, and maintenance for *each* of our small business computer systems is approximately:", the 73 users who responded supplied the following data:

Highest budget: \$300,000 (IBM System/3 Mod 6
& Mod 10)
Average budget: \$ 63,600
Lowest budget: \$ 2,000 (IBM 360/20)

In response to the question, "During 1975, we expect to acquire these additional small business computers:" 34 respondents (23 percent of all the respondents) indicated that they would be obtaining more small business computer systems this year. Of these, two Burroughs users planned to stay with Burroughs and two planned to switch to another vendor. Eight IBM System/3 users expected to stay with IBM, while four others planned to switch their allegiance.

It looks as if the days of the so-called computer brand "lifer" are gone. Users are apparently willing to switch to

another vendor (and, in some cases, to undergo significant conversion expenses) when they're not treated as well as they'd like to be.

The Comparison Charts

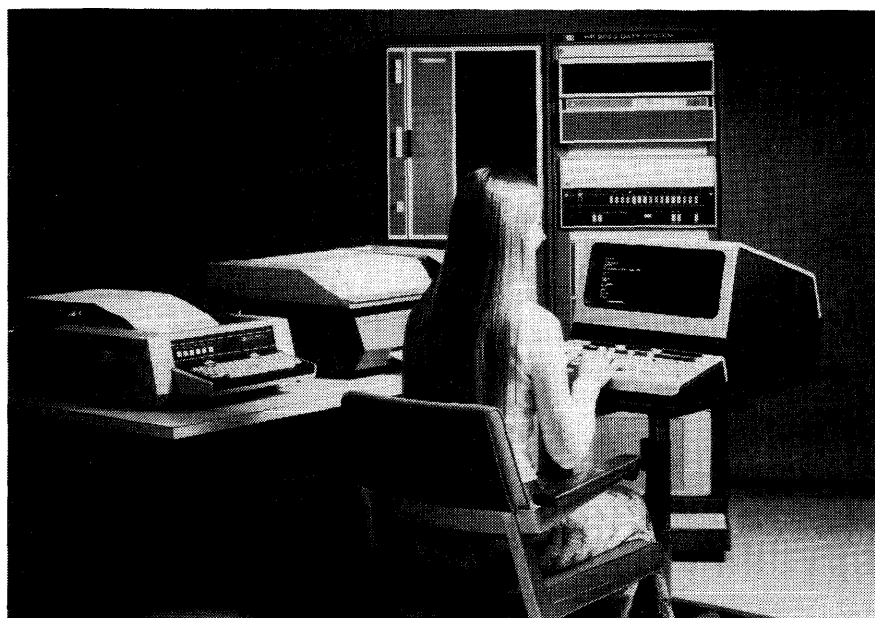
The characteristics of 132 small business computers from 46 different manufacturers are presented in the accompanying comparison charts. All of these systems are currently being commercially marketed in the United States. The information in the charts was supplied and/or verified by the manufacturers or U.S. suppliers during December 1974 and January 1975; their close cooperation with the Datapro Research staff in the preparation of these charts is gratefully acknowledged.

The comparison chart entries and their significance to potential users of small business computers are explained in the following paragraphs, together with some useful guidelines for selecting the equipment that will most effectively meet your needs.

Data Formats

This section of the comparison charts describes the formats used to store and process data within each system.

Word length is the number of bits (binary digits) of data that can be stored in or retrieved from the internal storage unit during a single cycle. Some small business computers have a "fixed word length," meaning that each machine word or operand always has the same number of bits, digits, or characters. Others have a "variable word length," meaning that their operands may consist of a variable number of bits, digits, or characters. In the latter case, the "word length" entry shows the number of data bits used to represent each byte or character within the variable-length operands. ▷



The Hewlett-Packard M/280 Sales Order Processing System is one of a series of "packaged" applications-oriented systems based upon HP's 2100 Series minicomputers. Designed specifically for on-line order entry and inventory updating, it uses HP's ON-TOP (On-line Terminal Order Processor) application software and IMAGE/2000 data base management package. HP also offers the M/230 Transaction Processing System and the M/260 Data Base Management System.

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USER RATINGS OF SMALL BUSINESS COMPUTERS

Manufacturer and Model	No. of User Replies	No. of Computers Represented	Users' Ratings*																			
			Overall Performance					Ease of Programming					Ease of Operation					Ease of Conversion				
			WA	E	G	F	P	WA	E	G	F	P	WA	E	G	F	P	WA	E	G	F	P
Basic/Four	2	2	3.0	0	2	0	0	4.0	2	0	0	0	3.5	1	1	0	0	3.0	0	2	0	0
Burroughs B 1700 Series	4	19	3.5	2	2	0	0	4.0	2	0	0	0	4.0	4	0	0	0	3.3	1	3	0	0
Burroughs L Series	7	9	3.0	3	1	1	1	2.5	0	4	1	1	3.5	4	1	1	0	2.5	1	2	2	1
Burroughs TC Series	4	20	2.8	0	3	1	0	3.0	0	4	0	0	3.3	1	3	0	0	2.5	0	1	1	0
Data General Nova Series	5	32	3.8	4	1	0	0	3.0	0	4	0	0	3.2	2	2	1	0	3.0	0	3	0	0
Datapoint 2200	2	2	4.0	2	0	0	0	4.0	2	0	0	0	3.5	1	1	0	0	4.0	1	0	0	0
DEC Datasystem 300 Series	2	2	4.0	2	0	0	0	4.0	2	0	0	0	3.5	1	1	0	0	4.0	1	0	0	0
DEC PDP-11/40	2	2	4.0	2	0	0	0	3.5	1	1	0	0	3.5	1	1	0	0	2.0	0	0	1	0
IBM System/3 Model 6	8	8	3.6	5	3	0	0	3.8	6	2	0	0	3.5	4	4	0	0	2.5	2	0	3	1
IBM System/3 Model 10	43	51	3.6	24	18	0	0	3.5	24	16	1	1	3.4	22	16	5	0	3.4	18	16	7	0
IBM System/3 Model 15	5	5	3.4	3	1	1	0	3.2	1	4	0	0	3.0	1	3	1	0	3.0	2	2	0	1
IBM System/360 Model 20	7	7	3.0	0	7	0	0	3.0	0	7	0	0	3.1	1	6	0	0	2.9	1	4	2	0
IBM 1130	5	5	3.8	3	1	0	0	3.8	4	1	0	0	3.8	4	1	0	0	3.3	1	3	0	0
Microdata 1600/REALITY	2	2	3.0	0	2	0	0	3.0	0	2	0	0	3.0	1	0	1	0	3.0	1	0	1	0
NCR 399	2	2	4.0	2	0	0	0	3.0	0	2	0	0	3.0	1	0	1	0	2.0	0	1	0	1
NCR Century Series	4	4	3.0	1	2	1	0	3.0	1	2	1	0	3.3	2	1	1	0	2.3	0	2	0	1
Olivetti P603	2	3	4.0	2	0	0	0	3.5	1	1	0	0	4.0	2	0	0	0	3.0	0	1	0	0
Sweda International Litton 1200	3	3	3.0	1	1	1	0	2.0	0	0	3	0	3.3	2	0	1	0	2.7	0	2	1	0
UNIVAC 9200 & 9300	4	4	2.5	0	2	2	0	3.5	2	2	0	0	3.0	1	2	1	0	2.8	1	1	2	0
Wang 2200B	5	5	4.0	5	0	0	0	3.8	4	1	0	0	3.8	4	1	0	0	2.6	0	3	2	0
All others**	28	71	3.3	11	13	2	1	3.1	10	12	2	3	3.5	15	9	1	1	2.8	8	8	8	3
Totals	146	258	3.4	72	59	9	2	3.3	64	65	8	5	3.4	75	53	14	1	2.9	38	54	30	8

*Ratings are expressed in terms of number of user responses. Where individual columns do not equal number of responses, a user has chosen not to rate a given area. The legend is E for Excellent, G for Good, F for Fair, and P for Poor. WA is Weighted Average, calculated on the basis of 4 for each user rating of Excellent, 3 for Good, 2 for Fair, and 1 for Poor.

▷ *Digits per word* is the number of decimal digits that can be represented within each machine word as defined above. At least four binary bits are required to represent each decimal digit, and in some systems six or eight bits are used.

Characters per word is the number of alphanumeric characters that can be represented within each machine word as defined above. Most systems use either six or eight bits to represent each character. Some small business computers are incapable of processing or storing alphanumeric information, in which case that entry is blank.

Operand length is the length of each data element upon which such basic internal processing operations as addition and subtraction are performed. Fixed word-length computers usually have an operand length of one word. For variable word-length computers, the ranges of permissible operand lengths for addition and subtraction are shown.

Instruction length is the number of words (or bits) used to specify each operation to be performed by the system. This entry is relevant only for systems with internally stored programs. In general, each instruction indicates the specific operation to be executed (add, multiply, move, print, etc.) and the storage locations of one or more of the

operands involved. Since some small business computers store their data and their programs in separate storage units, the instruction length may be unrelated to the data word length.

Internal Storage

One of the principal characteristics that distinguishes computers from adding machines and conventional accounting machines is the provision of an internal storage unit capable of holding and selectively retrieving a significant quantity of data and/or instructions. This section of the comparison charts describes each system's internal storage facilities.

Type of storage. As in large computers, magnetic cores are the most commonly used internal storage medium. Magnetic core storage has been widely used for more than a decade, and has proved to be fast, flexible, and reliable. Unfortunately, core storage is also rather expensive, so the designers of some small business computers have elected to use other storage media, including rotating magnetic discs and drums, delay lines, and magnetic tape cartridges. All of these alternative media are inherently slower and less reliable than magnetic cores, yet their lower cost gives them considerable appeal to both manufacturers and buyers of small business computers. Semiconductor ▷

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USER RATINGS OF SMALL BUSINESS COMPUTERS (Continued)

Manufacturer and Model	Users' Ratings*																			
	Hardware Reliability					Maintenance Service					Technical Support					Manufacturer's Software				
	WA	E	G	F	P	WA	E	G	F	P	WA	E	G	F	P	WA	E	G	F	P
Basic/Four	4.0	2	0	0	0	3.5	1	1	0	0	2.0	0	0	2	0	1.5	0	0	1	1
Burroughs B 1700 Series	2.8	1	1	2	0	3.0	1	2	1	0	3.0	1	2	1	0	3.8	3	1	0	0
Burroughs L Series	2.4	2	1	2	2	2.0	1	1	2	3	1.9	1	1	1	4	1.9	0	2	2	3
Burroughs TC Series	2.5	0	3	0	1	2.7	0	2	1	0	2.0	0	1	2	1	3.3	1	2	0	0
Data General Nova Series	3.4	2	3	0	0	3.0	1	3	1	0	2.4	0	2	3	0	2.8	1	2	2	0
Datapoint 2200	3.5	1	1	0	0	3.5	1	1	0	0	3.0	0	2	0	0	4.0	2	0	0	0
DEC Datasystem 300 Series	3.5	1	1	0	0	3.5	1	1	0	0	3.0	0	2	0	0	4.0	2	0	0	0
DEC PDP-11/40	3.5	1	1	0	0	3.0	0	2	0	0	2.5	0	1	1	0	3.0	0	2	0	0
IBM System/3 Model 6	3.6	5	3	0	0	3.0	3	3	1	1	3.0	3	3	1	1	3.5	4	4	0	0
IBM System/3 Model 10	3.3	20	18	5	0	3.1	17	16	7	2	2.4	5	13	19	5	2.8	7	25	8	3
IBM System/3 Model 15	3.2	2	2	1	0	3.6	3	2	0	0	2.8	2	1	1	1	2.4	1	1	2	1
IBM System/360 Model 20	3.0	1	5	1	0	2.7	0	5	2	0	2.6	1	3	2	1	3.4	3	4	0	0
IBM 1130	3.8	4	1	0	0	3.6	3	2	0	0	2.0	0	1	3	1	3.4	3	1	1	0
Microdata 1600/REALITY	3.0	1	0	1	0	3.0	1	0	1	0	1.0	0	0	0	2	1.5	0	0	1	1
NCR 399	3.5	1	1	0	0	4.0	2	0	0	0	2.0	0	1	0	1	2.0	0	0	2	0
NCR Century Series	3.0	1	1	1	0	2.8	1	1	2	0	1.8	0	1	1	2	2.3	0	2	1	1
Olivetti P603	4.0	2	0	0	0	4.0	2	0	0	0	3.5	1	1	0	0	3.0	0	2	0	0
Sweda International Litton 1200	3.0	1	1	1	0	3.0	1	1	1	0	2.7	1	0	2	0	2.7	0	2	1	0
UNIVAC 9200 & 9300	2.8	0	3	1	0	2.8	0	3	1	0	2.5	1	1	1	1	2.5	0	3	0	1
Wang 2200B	3.2	1	4	0	0	3.6	3	2	0	0	2.4	1	2	0	2	2.0	0	2	1	2
All others**	2.9	8	10	6	2	3.1	11	10	3	3	2.5	6	6	11	4	2.9	8	9	5	3
Totals	3.2	57	60	21	5	3.1	53	58	23	9	2.4	23	44	51	26	2.8	35	64	27	16

**"All others" category consists of 28 small business computers which received only one user mention each.

▷ storage, which is gradually superseding core storage as the principal storage medium for larger computers, is becoming quite popular in small business computers as well.

Storage capacity. The amount of internal storage is one of the most significant characteristics in appraising the power of any computer. The amount of productive processing that a computer can perform during any one run is largely determined by the number of instructions and/or operands it can hold. Computers that store their programs externally (on plugboards, punched tape, etc.) can get by with correspondingly less internal storage, since only the data needs to be stored internally—but the externally programmed computers are inherently limited in processing power and flexibility.

The charts indicate the number of words of internal storage available for each computer. Where a range of storage capacities is offered, the minimum and maximum capacities are shown. Some of the small business computers have two or more distinct internal storage units, and in these cases the situation is further explained in the "Comments" entry at the bottom of the comparison charts.

Cycle time. This is the minimum time interval that must elapse between the starts of two successive accesses to any one storage location. The storage cycle time normally ranges with word length as one of the most significant

individual indicators of a computer's performance potential. However, the throughput of the equipment covered in this report is usually determined by the operator's keying speed or an I/O device's speed rather than by the machine's internal performance. Therefore, the storage cycle time is of considerably less importance—as long as the machine is fast enough so that the operator seldom has to wait for it to finish processing one transaction before she can key in the data for the next transaction. Several manufacturers actually refuse to specify the storage cycle times of their machines—and Datapro believes every prospective buyer has a right to know all the basic specifications of every computer, even in cases where the data's relevance may ultimately prove to be of minor significance for a specific application environment.

Storage usable for data/programs. These two chart entries tell whether each computer's internal storage can be used to store data and/or programs. Data can be stored internally for rapid retrieval in all of the computers covered in our survey, but a few of the systems use external media to hold their programs.

Processing

This section of the comparison charts describes each computer's capabilities for internal processing of the data that is presented to it. "Processing" is a general term for ▷

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▷ the various arithmetic and logical operations that must be performed to solve a particular problem or achieve a desired result. Virtually all of the computers covered in this survey are equipped, through either machine instructions or standard software, to perform all the basic arithmetic and logical operations upon decimal operands; the usual complement of operations includes add, subtract, multiply, divide, compare, test, branch, print, etc.

Programming technique. A computer program is a set of instructions that cause a computer to perform a particular sequence of operations. Most current computers use *internally stored* programs, meaning that their instructions can be stored, retrieved, and altered as if they were data. This capability to modify their own programs gives stored-program computers great flexibility and enables them to respond to changing problem conditions.

Some small business computers, however, are *externally programmed*. The instructions which constitute their programs may be stored on punched tape loops or magnetic tape cartridges, or wired into plugboards. Plugboards, usually called "control panels" by the equipment manufacturers, are perforated boards whose holes (called "hubs") are manually interconnected by means of wires terminating in plugs (called "patchcords"). The specific interconnections determine the sequence of operations which the machine will perform. Control bars or rods on the printers constitute another external programming technique that is sometimes used to control the format of printed output.

Although externally programmed computers are inherently less flexible and powerful than their stored-program counterparts, their use can sometimes be justified on the basis of lower equipment costs, lower programming costs, and/or less retraining for employees who are familiar with conventional accounting machines or tabulating equipment. But the trend is clearly toward ever-increasing use of stored-program computers for all types and volumes of applications, and it is likely that most of the externally programmed models will disappear from the market within the next few years.

Operational registers. A register is a device that stores a small quantity of data (usually one word) and serves some special purpose. Most computers have one or more accumulators (in which arithmetic operations are performed), an instruction register, and a sequence counter. Multiple registers can facilitate programming and increase program execution speeds. In many small computers, reserved locations in internal storage, rather than special hardware elements, serve as registers in order to keep the cost down. The comparison charts show the number of operational registers and their capacities in all cases where the manufacturers have released this information.

Add time. The time required to develop the arithmetic sum of two operands is another widely used measure of computer performance—and another figure that turns out to be of comparatively little importance in the selection

of a small business computer. Once again, the reason is that the overall speed of these systems in most applications is largely determined by the operator's keying speed. Add times for the systems covered in our survey span the range from a few microseconds to more than half a second—yet the key question is still whether the operator can "beat the machine." If not, the machine is probably as fast as it needs to be for these keyboard-oriented accounting applications. (It should be noted that for larger equipment configurations, in applications where the transaction data is prerecorded on cards or tape, add times—and internal speeds in general—become highly significant considerations.)

Keyboard Input

The principal source of input to most small business computers is data keyed in by a human operator. Therefore, the keyboard facilities for on-line data entry deserve careful consideration.

Alphanumeric (typewriter) keyboard. Virtually all of the systems covered in our survey include a keyboard, arranged in the conventional typewriter format, that permits direct entry of both alphabetic and numeric information.

10-key numeric keyboard. A 10-key adding-machine-style keyboard, standard in many of the systems and optional in others, permits all-numeric data to be entered at considerably higher speeds than via a typewriter-style keyboard. The numeric keys are usually accompanied by control keys which activate various machine functions.

Full accounting keyboard. Most "classic" accounting machines have multiple columns of keys, with each column consisting of the digits 0 (or 1) through 9. Though used in only a few of the current small computers, these full keyboards have the advantage of being familiar to most accounting machine operators.

Standard Printed Output

Printed documents and reports represent the principal form—and frequently the only form—of output from most small business computers. Therefore, printing and document-handling capabilities receive strong emphasis in the comparison charts.

Printing speed. The computers in this class generally use typewriter-style printing elements that print one character at a time. Thus, their printing speeds are usually in the range of 10 to 40 characters per second. A few systems offer line printers with considerably higher speeds. Rated printing speed is of little significance if most of the data to be printed is keyed in by the operator. But if a high proportion of the printing is done from the computer's memory, under program control, then higher printing speeds can yield major improvements in throughput.

Carriage width. The width of the printer's carriage naturally determines the maximum width of the forms it ▷

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The new Olivetti Audit 7 features a digital display (just above the keyboard), from 16K to 48K bytes of MOS memory, and a 40-cps serial printer with unusually flexible forms handling facilities. The Audit 7 can be equipped to handle a wide array of input/output media, including edge-striped magnetic cards, magnetic-striped ledger cards, magnetic tape cassettes, punched cards, punched tape, cartridge disks, and data communications.

➤ can handle. Carriage widths of 15 to 26 inches are common in this class of equipment, permitting two or more separate forms to be inserted and printed upon in side-by-side fashion.

Split platen. This useful feature, standard in some printers and optional in others, permits two (or occasionally three) separate forms to be inserted and advanced independently of one another. Thus, in payroll applications, suitably equipped machines can produce a journal, earnings ledger, and payroll checks with earnings statements in a single operation. Machines that lack the split platen capability will frequently require two or more runs (or multiple on-line printers) to produce the printed outputs that can be prepared in a single run by a split platen printer.

Pin-feed forms handling. For efficient feeding of continuous, fanfold printer forms, pin-feed forms-handling facilities are a virtual necessity. Drive sprockets or "tractors" on the printer engage holes punched into the margins of the forms, permitting positive feeding with little chance of misalignment or jamming.

Friction-feed forms handling. When printing on individual documents, such as ledger cards, a conventional friction feed mechanism (as on a typewriter) is preferable because the documents can be inserted more easily than into a pin-feed mechanism. Therefore, most of the small business computers can (and should) be equipped with both pin-feed and friction-feed facilities. An additional useful feature of some machines is the ability to insert and align individual friction-fed documents, such as ledger cards, from the front by simply dropping them into a "chute."

Journal roll handling. Some machines can be equipped to handle continuous rolls of paper tape of the type used on adding machines. This facility can be useful for maintaining a journal record of each transaction.

Magnetic Ledger Cards

Magnetic ledger cards are among the most popular input/output media for small business computers. Their principal attraction is that they enable small businesses to retain the individual, hard-copy ledger records they have long been accustomed to using. In addition, machine-readable data can be recorded on the cards, usually on one or more vertical magnetic "stripes." Identity and status information about each account can be recorded on the appropriate card in both printed and magnetically encoded form, and the encoded data can be re-read and updated whenever necessary.

Thus, magnetic ledger cards combine many of the advantages of both traditional visible records and machine-readable media such as punched cards or magnetic tape. Their chief disadvantage is that the low speed of most of the available card-handling equipment precludes the use of magnetic ledger cards in high-volume data processing applications.

Data capacity. This entry specifies the maximum number of digits of information that can be recorded on each magnetic ledger card.

Automatic card alignment. Processing speed is considerably enhanced if the magnetic ledger cards can simply be inserted into a chute by the operator and automatically advanced to the first blank line on the card, ready for posting. This entry states whether the automatic alignment facility is standard, optional, or not available.

Automatic card feeding and stacking. In most systems, the magnetic ledger card for each account to be processed must be selected by the operator and manually inserted into the machine. A few manufacturers offer automatic ledger-card readers, which feed, read, and stack the cards sequentially at substantially higher speeds. Most of these high-speed ledger card readers, however, lack the capa- ➤

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▷ ability to record updated information on the cards. Thus, their usefulness is largely limited to the preparation of reports from data previously recorded on the cards; transaction processing and ledger-card updating must still be performed on the console printer, with manual insertion of one card at a time.

Magnetic Disc I/O

The inclusion of magnetic disc units can greatly increase the data storage and processing capabilities of a business data processing system. Disc units enable millions of characters of information to be constantly accessible to the computer. Moreover, any desired record can be retrieved, updated, and re-recorded on the disc, usually within a fraction of a second.

By replacing or augmenting slower, less flexible file storage media such as punched cards, paper tape, or magnetic ledger cards, disc units can enable small business computers to handle applications and processing volumes that would otherwise be impossible. The principal disadvantages of disc units are their comparatively high costs and the software complexities that are encountered by users who attempt to harness their full potential. One or both of these considerations will make disc units impractical for many small computer buyers, despite the obvious appeal of disc-oriented data processing.

The diskette, or "floppy disc," is a recent innovation that can significantly reduce the cost of disc-oriented data processing. The diskette itself consists of a flexible Mylar disc, about 8 inches in diameter, that is permanently housed in a plastic envelope. It can serve as an input/output and/or random-access storage medium that is considerably smaller in capacity and slower in performance than conventional disc units—but also far lower in cost. Introduced by IBM in 1972, diskettes and diskette drive units are now being produced by dozens of vendors and are finding their way into numerous small business computer systems, such as the IBM System/32 and DEC Datasystem 310.

Maximum on-line disc capacity. This entry specifies the maximum quantity of disc-stored information that is directly accessible to the computer at any one time. The indicated figure may be the capacity of a single disc drive or the total capacity of two or more drives that can be connected.

Disc I/O speed. This is the rate at which data is transferred between the disc unit and the computer's internal storage during either a disc read or write operation.

Interchangeable discs. Most of the current disc-oriented computers use removable cartridges or "disc packs," which can be easily removed from the drive units and interchanged in much the same manner as magnetic tape reels. Interchangeable discs provide great flexibility and make it practical to use a computer for both sequential and random data processing applications. In sequential

applications, files of virtually unlimited size can be handled through the use of multiple disc packs or cartridges.

Other I/O Units

Many of the small business computers can be equipped with optional input/output devices such as card readers and punches, paper tape readers and punches, line printers, magnetic tape units, and data communications interfaces. The comparison charts indicate the availability and rated speed of each type of device. These I/O units, when judiciously selected and matched to your requirements, can greatly increase a system's versatility and power.

Punched cards, paper tape, and magnetic tape can be used either to store master-file records or to accumulate previously recorded transaction data. For a detailed comparison of the advantages and disadvantages of each medium, please refer to DATAPRO 70 Report 70D-010-70, "How to Select and Use Data Entry Devices." It's worth noting that many of the paper tape readers and punches employed in these systems can also accommodate edge-punched cards, which represent an effective unit-record storage medium for many applications. Also, many of the magnetic tape drives used in small business computers employ tape cassettes rather than the more conventional tape reels. Cassettes offer increased convenience and lower cost at the expense of considerably lower speeds and reduced on-line storage capacities.

Line printers can be added to some small business computers to provide printed output at far higher speeds than the standard typewriter-style printers. But the line printers generally have much higher price tags and lack the flexible forms-handling capabilities of the slower standard printers.

Communications interfaces enable some of the small business computers to function as "intelligent terminals" in data communications networks. The interface equips the small computer to send and receive data over a common-carrier communications link, usually to a larger central computer installation. The small computer's internal processing and storage capabilities enable it to do some data processing locally and to handle a variety of code translation, editing, and control functions in connection with the data communications activities.

Software and Support

Virtually as important as the computer hardware are the software and technical support each manufacturer furnishes to aid the user in utilizing the hardware effectively. The available software (if any), together with the pricing policies for both software and support, are summarized in this section of the comparison charts.

Assemblers. An assembler is a special-purpose program that uses the computer's power to facilitate the prepara- ▷

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▷ tion of other programs. It enables the programmer to write his programs in a simplified format that uses mnemonic operation codes and symbolic operand addresses. The assembler program then converts these symbolic instructions into their machine-language equivalents, producing computer programs ready for loading and execution.

Compilers. A compiler is another type of software designed to shift part of the program preparation task from the user to the computer itself. A compiler converts programs written in a simplified, procedure-oriented language such as COBOL into machine-language object programs. Compilers are now being used in virtually all large and medium-scale computer installations because of their demonstrated ability to slash programming costs—and they are becoming increasingly available for the small business computers. This trend is possible because of the more powerful minicomputers now being used, since compilation is an intricate process that requires more storage space and processing power than the earlier small business computers provided. Where compilers are offered, however, they frequently limit the programmer to restricted subsets of the standard programming languages and/or require the use of a larger computer to perform the compilation process.

Application programs. Most of the small computer manufacturers offer libraries of ready-made programs designed to handle commonly encountered data processing applications. If suitable programs are available, the user can sometimes save thousands of dollars worth of programming effort. But no two companies have exactly the same data processing requirements, so some modification of the standard packages, by either the user or the manufacturer, will be required in most cases. Even so, a library of application programs can be an important asset to consider when choosing a computer. Space precludes a complete listing of available application programs in the charts, so the entries attempt to summarize the size and scope of each system's program library, if any. The entry "standard business applications" indicates that programs are available to handle the most common business functions: billing, payroll, inventory control, etc.

Software separately priced. This entry tells whether the software described in the preceding entries, and any other available software, is included in the equipment price or offered at some additional cost. Separate pricing of software was virtually unheard of in the computer field until June 1969, when IBM "unbundled" by placing separate price tags on many of its software products and professional services. Since then, the various manufacturers have adopted a wide range of software pricing policies. Separate pricing of software, of itself, is neither good nor bad; the buyer must carefully assess the cost of the total package consisting of the equipment and all the software and support his installation will require. One of the major "unbundled" manufacturers states that the total software bill for a typical small business computer

installation usually falls within the \$1,500 to \$2,000 range.

Technical help separately priced. This entry tells whether the services of the manufacturer's technical support staff are included in the equipment cost or separately priced. Nearly every company that is installing a computer for the first time will need a good deal of help from the equipment maker's systems analysts, programmers, and/or instructors (or, alternatively, from an independent consulting firm). In fact, the manufacturer does *all* the programming for the great majority of small business computer installations (more than 90 percent, according to one major supplier). The additional cost of these services, if any, should be carefully estimated and considered in all equipment comparisons.

Pricing and Availability

Purchase price of basic system. For each computer, this entry shows the minimum purchase price of a system equipped to perform basic business data processing functions. All of the facilities identified as "standard" in the charts (but none of the "optional" ones) are included in the listed prices. The addition of expanded storage capacities or optional input/output capabilities can lead to large price increases in nearly every case. For detailed pricing information, the manufacturers should be contacted directly.

Monthly rental of basic system. This entry shows the monthly rental for the basic configuration of each system, as described above. All rental prices are based on a one-year lease and include equipment maintenance unless otherwise indicated. Longer-term leases are frequently available at lower monthly charges.

Date of first U.S. delivery. This entry tells when the first production models of each system were delivered (or are scheduled to be delivered) to customers in the United States.

Number installed in U.S. to date. This entry shows how many systems of each type had been delivered to U.S. customers as of approximately January 1, 1975. All figures were supplied by the manufacturers themselves, and the entry "not specified" appears in all cases where the manufacturers chose not to release this information.

Comments

This final entry on the comparison charts is used to explain or amplify the preceding entries and to provide other pertinent information about each system's hardware, software, pricing, or applications.

Suppliers

Listed below, for your convenience in obtaining additional information, are the full names, addresses, and ▷

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▷ telephone numbers of the 46 suppliers whose products are listed in the comparison charts that follow.

Admaster Systems, Inc., 416 Junipero Serra, San Gabriel, California 91776. Telephone (213) 285-1121.

Anderson-Jacobson, Inc., 1065 Morse Avenue, Sunnyvale, California 94086. Telephone (408) 734-4030.

Basic/Four Corporation (subsidiary of MAI), 18552 MacArthur Boulevard, Santa Ana, California 92707. Telephone (714) 533-0200.

Burroughs Corporation, Business Machines Group, Burroughs Place, Detroit, Michigan 48232. Telephone (313) 972-7000.

Business Controls Corporation, 324 Passaic Avenue, Nutley, New Jersey 07110. Telephone (201) 661-4950.

Cascade Data, Inc., 3000 Kraft Avenue, S.E., Grand Rapids, Michigan 49508. Telephone (616) 942-1420.

Cincinnati Milacron Inc., Process Controls Division, Mason Marrow Road, Lebanon, Ohio 45036. Telephone (513) 494-1200.

CNA Systems, CNA Plaza, Chicago, Illinois 60685. Telephone (312) 822-5178.

Codon Corporation, 11 DeAngelo Drive, Bedford, Massachusetts 01730. Telephone (617) 275-2000.

Computer Automation, Inc. 18651 Von Karman Avenue, Irvine, California 92664. Telephone (714) 833-8830.

Computer Development, 13500 Midway Road, Suite 112, Dallas, Texas 75240. Telephone (214) 233-3238.

Computer Interactions, Inc. 425 Northern Boulevard, Great Neck, New York 11021. Telephone (516) 487-9810.

Datapoint Corporation, 9725 Datapoint Drive, San Antonio, Texas 78284. Telephone (512) 696-4520.

Digital Computer Controls, Inc., 12 Industrial Road, Fairfield, New Jersey 07006. Telephone (201) 227-4861.

Digital Equipment Corporation (DEC), Business Products PK3/M33, 146 Main Street, Maynard, Massachusetts 01754. Telephone (617) 897-5111.

Digital Scientific Corporation, 11455 Sorrento Valley Road, San Diego, California 92121. Telephone (714) 453-6050.

Fujitsu Limited, 680 Fifth Avenue, New York, New York 10019. Telephone (212) 265-5360.

General Automation, Inc., 1055 South East Street, Anaheim, California 92805. Telephone (714) 778-4800.

GRI Business Systems, 320 Needham Street, Newton, Massachusetts 02164. Telephone (617) 969-0800.

Hewlett-Packard, Data Systems, 11000 Wolfe Road, Cupertino, California 95014. Telephone (408) 257-7000.

Honeywell Information Systems, Inc., 200 Smith Street, Waltham, Massachusetts 02154. Telephone (617) 890-8400.

International Business Machines Corporation (IBM), General Systems Division, 875 Johnson Ferry Road, N.E., Atlanta, Georgia 30342. Telephone (404) 252-6820.

International Computers (USA) Limited, 555 Madison Avenue, New York, New York 10022. Telephone (212) 758-5220.

International Computing Company, 7316 Wisconsin Avenue, Bethesda, Maryland 20014. Telephone (301) 654-9120.

Jacquard Systems, 1505 Eleventh Street, Santa Monica, California 90404. Telephone (213) 393-3711.

Linolex Systems, Inc., 5 Esquire Road, Billerica, Massachusetts 01862. Telephone (617) 667-4151.

Litton Industries: see Monroe and Sweda International.

Martin, Wolfe, Inc., 8369 Vickers Street, San Diego, California 92111. Telephone (714) 277-3700.

Micro Computer Machines, Inc., 4 Lansing Square, Willowdale, Ontario, Canada M2J 1T1. Telephone (416) 492-1693.

Microdata Corporation, 17481 Red Hill Avenue, Irvine, California 92705. Telephone (714) 540-6730.

Microline Corporation, 1751 Langley Avenue, Irvine, California 92705. Telephone (714) 557-9378.

Mini-Computer Systems, 525 Executive Boulevard, Elmsford, New York 10523. Telephone (914) 592-8812.

Monroe (subsidiary of Litton Industries), 550 Central Avenue, Orange, New Jersey 07051. Telephone (201) 673-6600.

NCR Corporation, Main and K Streets, Dayton, Ohio 45409. Telephone (513) 449-2000.

Nixdorf Computer Incorporated, O'Hare Plaza, 5725 East River Road, Chicago, Illinois 60631. Telephone (312) 693-6600.

Olivetti Corporation of America, 500 Park Avenue, New York, New York 10022. Telephone (212) 371-5500.

Philips Business Systems, Inc., 175 Froelich Farm Boulevard, Woodbury, New York 11797. Telephone (516) 921-9310.

Qantel Corporation, Business Computer Systems, 3525 Breakwater Avenue, Hayward, California 94545. Telephone (415) 783-3410.

QI Corporation, 6 Dubon Court, Farmingdale, New York 11735. Telephone (516) 293-0700.

RPG Data Systems, Inc., 1317 West Olympic Boulevard, Los Angeles, California 90015. Telephone (213) 381-3716.

Scidata, Inc., 4126 Pleasantdale Road, Atlanta, Georgia 30340. Telephone (404) 448-5620.

Singer Company, Business Machines Division, 2350 Washington Avenue, San Leandro, California 94577. Telephone (415) 357-6800.

Sweda International (subsidiary of Litton Industries), 34 Maple Avenue, Pine Brook, New Jersey 07057. Telephone (201) 575-8100.

Synectics Incorporated, 4925 Stillwell, Kansas City, Missouri 64120. Telephone (816) 483-7848.

Ultimacc Systems, Inc., 9 Brook Avenue, Maywood, New Jersey 07607. Telephone (201) 845-0500.

UNIVAC Computer Systems (division of Sperry Rand Corporation), Post Office Box 500, Blue Bell, Pennsylvania 19422. Telephone (215) 542-4011.

Xerox Corporation, 9920 La Cienega Boulevard, Inglewood, California 90301. Telephone (213) 679-4511. □

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MANUFACTURER & MODEL	Addmaster Systems 404	Anderson- Jacobson 140	Anderson- Jacobson 150	Basic/Four Models 350, 400, & 500	Basic/Four Model 600
DATA FORMATS Word length, bits Digits per word Characters per word Operand length, words Instruction length, words	16 4 2 1 to 4 1 or 2	8-bit byte 1 per byte 1 per byte 1 or 2 bytes 1-3 bytes	8-bit byte 1 per byte 1 per byte 1 or 2 bytes 1-3 bytes	8-bit byte 1 per byte 1 per byte Variable Variable	8-bit byte 1 per byte 1 per byte Variable Variable
INTERNAL STORAGE Type of storage Storage capacity, words Cycle time, microseconds/word Storage usable for data Storage usable for programs	Core 12K 2.25 Yes Yes	Core 8K-65K bytes 1.2 Yes Yes	Core 8K-65K bytes 1.2 Yes Yes	Core 8K-48K 1.0 Yes Yes	Core 8K-48K 1.0 Yes Yes
PROCESSING Programming technique No. of operational registers Capacity of each register Add time, milliseconds/word	Internally stored 5 16 bits 0.98	Internally stored 128 2 bytes 0.004	Internally stored 128 2 bytes 0.004	Internally stored 6 Variable 0.00528	Internally stored 6 Variable 0.00528
KEYBOARD INPUT Alphanumeric (typewriter) keyboard 10-key numeric keyboard Full accounting keyboard	Standard Standard Standard	Standard Standard No	Standard Optional No	1 per system std. Standard No	1 per system std. Standard No
STANDARD PRINTED OUTPUT Printing speed, chars/sec or lpm Carriage width, inches Split platen Pin-feed forms handling Friction-feed forms handling Journal roll handling	15 cps 15 — Standard — —	15 cps to 600 lpm 15.5 No Standard Standard No	30 or 100 cps 15.5 No Standard Standard No	165 cps 132 char./14 in. No Standard No No	165 cps 132 char./14 in. No Standard No No
MAGNETIC LEDGER CARDS Data capacity, digits per card Automatic card alignment Automatic card feeding & stacking	No — — —	No — — —	No — — —	No — — —	No — — —
MAGNETIC DISC I/O Max. on-line disc capacity, chars Disc I/O speed, chars/sec Interchangeable discs	Optional 10,000,000 200,000 No	Optional 40,000,000 300,000 Yes	Optional 40,000,000 300,000 Yes	Standard 16,800,000 195,000 Yes	Standard 40,000,000 312,500 Yes
OTHER I/O UNITS Punched card input speed, cols/sec or cpm Punched card output speed, cols/sec or cpm Paper tape input speed chars/sec Paper tape output speed, chars/sec Line printer output speed, lines/min Magnetic tape I/O speed, chars/sec Communications interface	— — 300 60 125 9,000 —	400 cps No 300 75 100, 300, 600 500, 20,000 Optional	400 cps No 300 75 — 500, 20,000 Standard	400 cpm No 300 75 200 10,000 Optional	400 cpm No 300 75 200 10,000 Standard
SOFTWARE/SUPPORT Assembler Compilers Application programs Software separately priced Technical help separately priced	Yes RPG, BASIC Many available Yes Yes	Yes ESP, BASIC Std. business applications Partially Partially	Yes ESP, BASIC None Partially Partially	No BASIC Std. business applications Yes No	No BASIC Std. business applications Yes No
PRICING & AVAILABILITY Purchase price of basic system, \$ Monthly rental of basic system, \$ Date of first U.S. delivery Number installed to date	20,000-50,000 — 1969 15	22,500 490 (60-month lease) 1970 250	25,500 575 (60-month lease) January 1974 Not specified	32,400-37,900 928-1,061 August 1971 See Comments	54,400 Not specified July 1975 See Comments
COMMENTS		Formerly produced and marketed by Eldorado Com- puter Corp.	Midrange system with CRT and character printer; CRT is from ADDS or Lear- Siegler; printer from Printec	Systems are based upon Microdata 1600 minicomputer and can control up to 8 CRT display terminals. More than 1500 systems of all models installed to date	

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MANUFACTURER & MODEL	Burroughs B 700 Series	Burroughs B 1712	Burroughs B 1714 & B 1718	Burroughs B 1726	Burroughs B 1728
DATA FORMATS Word length, bits Digits per word Characters per word Operand length, words Instruction length, words	64 15 8 Variable Variable	8 2 1 Variable Variable	8 2 1 Variable Variable	8 2 1 Variable Variable	8 2 1 Variable Variable
INTERNAL STORAGE Type of storage Storage capacity, words Cycle time, microseconds/word Storage usable for data Storage usable for programs	Core 32K-48K bytes 2.0 or 1.0 Yes Yes	MOS 16K-40K bytes 3.0 Yes Yes	MOS 16K-64K bytes 1.5 Yes Yes	MOS 24K-131K bytes 1.0 Yes Yes	MOS 65K-256K bytes 1.0 Yes Yes
PROCESSING Programming technique No. of operational registers Capacity of each register Add time, milliseconds/word	Internally stored 4 1 word 0.500 or 0.430	Internally stored — — Not specified	Internally stored — — Not specified	Internally stored — — Not specified	Internally stored — — Not specified
KEYBOARD INPUT Alphanumeric (typewriter) keyboard 10-key numeric keyboard Full accounting keyboard	Standard Standard No	Standard Standard —	Standard Standard —	Standard Standard —	Standard Standard —
STANDARD PRINTED OUTPUT Printing speed, chars/sec or lpm Carriage width, inches Split platen Pin-feed forms handling Friction-feed forms handling Journal roll handling	20 cps 15.5 or 26 Optional Standard Standard Standard	— — — — — —	— — — — — —	— — — — — —	— — — — — —
MAGNETIC LEDGER CARDS Data capacity, digits per card Automatic card alignment Automatic card feeding & stacking	No — — —	No — — —	No — — —	No — — —	No — — —
MAGNETIC DISC I/O Max. on-line disc capacity, chars Disc I/O speed, chars/sec Interchangeable discs	Standard 36,800,000 193,000 Yes	Standard 18,400,000 193,000 Yes	Standard 18,400,000 193,000 Yes	Standard 698,000,000 625,000 max. Yes	Standard 698,000,000 625,000 max. Yes
OTHER I/O UNITS Punched card input speed, cols/sec or cpm Punched card output speed, cols/sec or cpm Paper tape input speed, chars/sec Paper tape output speed, chars/sec Line printer output speed, lines/min Magnetic tape I/O speed, chars/sec Communications interface	300 cpm 60 cpm 40 40 85/160/250/400 10,000 Optional	300 cpm max. 100 cpm 1000 100 300 max. 10,000 max. No	600 cpm max. 100 cpm max. 1000 100 750 max. 36,000 max. No	1400 cpm max. 300 cpm max. 1000 100 1040 max. 120,000 max. Optional	1400 cpm max. 300 cpm max. 1000 100 1040 120,000 max. Optional
SOFTWARE/SUPPORT Assembler Compilers Application programs Software separately priced Technical help separately priced	No COBOL, RPG Many available Yes Yes	No COBOL, FORTRAN, BASIC, RPG Many available Yes Yes	No COBOL, FORTRAN, BASIC, RPG Many available Yes Yes	No COBOL, FORTRAN, BASIC, RPG Many available Yes Yes	No COBOL, FORTRAN, BASIC, RPG Many available Yes Yes
PRICING & AVAILABILITY Purchase price of basic system, \$ Monthly rental of basic system, \$ Date of first U.S. delivery Number installed in U.S. to date	33,900-112,830 858-2,715 May 1973 Not specified	70,835 (min.) 1,600 (min.) 3rd qtr. 1972 Not specified	105,900 (typical) 2,560 (typical) 3rd qtr. 1972 Not specified	256,400 (typical) 5,900 (typical) 2nd qtr. 1973 Not specified	451,500 (typical) 10,200 (typical) 3rd qtr. 1973 Not specified
COMMENTS	Available in numerous models and packaged configurations; I/O devices include cassette, diskette, displays, & MICR	These comparatively powerful systems offer dynamically variable microprogramming, virtual storage, automatic multiprogramming, and other advanced features, plus a wide range of peripheral and communications equipment and a library of Business Management Systems software			

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MANUFACTURER & MODEL	Burroughs L 2000, 3000, 4000, & 5000	Burroughs L 6000 Series	Burroughs L 8000 Series	Business Controls Corporation System/80	Cascade Data Concept II
DATA FORMATS Word length, bits Digits per word Characters per word Operand length, words Instruction length, words	64 15 + sign 8 1 4 instr./word	64 15 + sign 8 1 4 instr./word	64 15 + sign 8 1 Variable	12 2 or 4 2 1 or 2 1	16 4 2 16-32 16-40
INTERNAL STORAGE Type of storage Storage capacity, words Cycle time, microseconds/word Storage usable for data Storage usable for programs	Disc 128-1280 See Comments Yes Yes	Disc 128-1280 See Comments Yes Yes	Semiconductor 4K-49K bytes 1.5 Yes Yes	Core 32K 1.2 Yes Yes	Core 32K 1.0 Yes Yes
PROCESSING Programming technique No. of operational registers Capacity of each register Add time, milliseconds/word	Internally stored — — 50	Internally stored — — 50	Internally stored — — 1.55	Internally stored 8 1 word 0.0026	Internally stored 3 1 word 8.8
KEYBOARD INPUT Alphanumeric (typewriter) keyboard 10-key numeric keyboard Full accounting keyboard	Standard Standard No	Standard Standard No	Standard Standard No	Standard Optional No	Standard Standard Standard
STANDARD PRINTED OUTPUT Printing speed, chars/sec or ipm Carriage width, inches Split platen Pin-feed forms handling Friction-feed forms handling Journal roll handling	20 cps 15.5 or 26 Standard Optional Standard Standard	20 cps 15.5 or 26 Standard Optional Standard Standard	20 or 30 cps 15.5 or 26 Standard Optional Standard Standard	165-660 cps 132 positions No Standard Optional No	30 or 165 cps 14-7/8 Optional Standard No No
MAGNETIC LEDGER CARDS Data capacity, digits per card Automatic card alignment Automatic card feeding & stacking	Std. on L 5000 349 Standard Standard	Std. on L 6500 349 Standard Standard	Std. on 8500,8900 349-699 Standard Standard	No — — —	No — — —
MAGNETIC DISC I/O Max. on-line disc capacity, chars Disc I/O speed, chars/sec Interchangeable discs	No — — —	No — — —	No — — —	Standard 12,800,000 1,440,000 Yes	Standard 40,000,000 200,000 Yes
OTHER I/O UNITS Punched card input speed, cols/sec or cpm Punched card output speed, cols/sec or cpm Paper tape input speed, chars/sec Paper tape output speed, chars/sec Line printer output speed, lines/min Magnetic tape I/O speed, chars/sec Communications interface	100 cpm 60 cpm 40 40 No 10,000 Optional	100 cpm — 40 40 No 10,000 Optional	200 cpm 45 cpm 40 40 85/160 10,000 Optional	400 cpm — 150 75 245-1,100 36,000 Optional	400 cpm — 150 75 125-600 60,000 Optional
SOFTWARE/SUPPORT Assembler Compilers Application programs Software separately priced Technical help separately priced	Yes COBOL Many available Yes Yes	Yes COBOL Many available Yes Yes	Yes COBOL Many available Yes Yes	Yes FORTRAN, DIBOL Std. business applications No No	Yes RPG Std. business applications Yes Yes
PRICING & AVAILABILITY Purchase price of basic system, \$ Monthly rental of basic system, \$ Date of first U.S. delivery Number installed in U.S. to date	6,995-21,990 243-687 Feb. 1969 Over 12,000	7,350-22,480 Purchase only May 1974 Not specified	12,990-28,780 Purchase only 1st qtr. 1973 Not specified	40,000-50,000 1,100 (66-month lease) 1971 25	29,500 Not specified April 1970 Not specified
COMMENTS	Main storage is head-per-track disc with 5-millisecond average access time; numerous models available	Main storage is head-per-track disc with 5-millisecond average access time; features expanded I/O buffers and electronic keyboard	I/O units include 1000-cps tape cassette drives and both 80- and 96-column card equipment	Turnkey systems, utilizing DEC hardware, for wide range of business applications	Turnkey systems; extensive application software

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MANUFACTURER & MODEL	Cincinnati Milacron CIP/2200	CNA/Systems SERVUS 100	Codon CB 100	Computer Automation MegaByter	Computer Development OPUS III
DATA FORMATS Word length, bits Digits per word Characters per word Operand length, words Instruction length, words	16 2 2 1 2	16 4 2 Variable Variable	12 2 2 Variable 1	16 2 2 ½, 1, or strings 1, 2, or 3	8, 16, 24 4-24 8, 16, 24 Variable 8 bits
INTERNAL STORAGE Type of storage Storage capacity, words Cycle time, microseconds/word Storage usable for data Storage usable for programs	Core 32K-64K 1.1 Yes Yes	Core 8K-32K 1.0 Yes Yes	Core 12K-32K 1.2 Yes Yes	MOS, PROM, core 32K-1M 0.98 Yes Yes	MOS, core 64K 1.3 Yes Yes
PROCESSING Programming technique No. of operational registers Capacity of each register Add time, milliseconds/word	Internally stored 6 16 bits 0.0117	Internally stored 7 16 bits 0.00279	Internally stored 8 12 bits 0.0026	Internally stored 2 16 bits 0.0116	Internally stored 12 — 0.020-0.030
KEYBOARD INPUT Alphanumeric (typewriter) keyboard 10-key numeric keyboard Full accounting keyboard	Standard No No	Standard Standard No	Standard Standard No	Optional No No	— Optional Standard
STANDARD PRINTED OUTPUT Printing speed, chars/sec or lpm Carriage width, inches Split platen Pin-feed forms handling Friction-feed forms handling Journal roll handling	1,320 cps 19.5 Optional Standard No No	100 cps 16 No Standard No No	165 cps or 300 lpm 14.5 No Standard No No	100 cps 8.5 No Yes No No	85-350 lpm 132 positions No Optional No Standard
MAGNETIC LEDGER CARDS Data capacity, digits per card Automatic card alignment Automatic card feeding & stacking	No — — —	No — — —	No — — —	No — — —	No — — —
MAGNETIC DISC I/O Max. on-line disc capacity, chars Disc I/O speed, chars/sec Interchangeable discs	Standard 40,000,000 195,000 Yes	Standard 20,000,000 199,000 Yes	Standard 51,200,000 120,000 Yes	Optional 40,000,000 195,000 Yes	Standard 30,000,000 Not specified Yes
OTHER I/O UNITS Punched card input speed, cols/sec or cpm Punched card output speed, cols/sec or cpm Paper tape input speed chars/sec Paper tape output speed, chars/sec Line printer output speed, lines/min Magnetic tape I/O speed, chars/sec Communications interface	480 cps 96 cps 300 75 60-600 20,000 Optional	300 cpm No No No 300 or 600 No Optional	Optional No 300 50 60-1,200 36,000 Optional	200-1,000 cpm — 300 75 300-1,250 10,000-30,000 Optional	300-600 cpm — — — 85-350 — Standard
SOFTWARE/SUPPORT Assembler Compilers Application programs Software separately priced Technical help separately priced	No RPG II Bill of Materials Yes Yes	Yes RPG II Std. business applications; see Comments No No	Yes RPG II See Comments Yes Partially	Yes FORTRAN, BASIC No Yes No	Yes BASIC, FORTRAN All accounting applications No Yes
PRICING & AVAILABILITY Purchase price of basic system, \$ Monthly rental of basic system, \$ Date of first U.S. delivery Number installed in U.S. to date	28,655 956 1973 47	Lease only 1,200 (5-year lease) September 1972 Not specified	62,000 1,700 (5-year lease, incl. maint.) 1972 35	30,075 Purchase only December 1974 15	20,000-50,000 650 February 1971 485
COMMENTS	Basic system has 32K, 5MB disk storage, comm. controller, CRT display terminal with keyboard, & 60-lpm printer	Turnkey MIS and service system for insurance agents	Turnkey distribu- tion management system based upon DEC PDP-8; can support up to 10 CRT's	224 instructions standard; sold mostly to OEM's	Replaces account- ing machines in small businesses; hard-copy terminal

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MANUFACTURER & MODEL	Computer Interactions COMPRO-II	Datapoint Diskette 1100	Datapoint 2200	Datapoint 5500	Digital Computer Controls D-116/IRIS
DATA FORMATS					
Word length, bits	12	8	8	8	16
Digits per word	2 or 4	1	1	1	4
Characters per word	2	1	1	1	2 or 3
Operand length, words	Variable	1	1	1	1
Instruction length, words	Variable	1, 2, 3, or 4	1, 2, 3, or 4	1, 2, 3, or 4	1
INTERNAL STORAGE					
Type of storage	Core or MOS	MOS	MOS	MOS	Core
Storage capacity, words	4K-32K	16K	4K-16K	28K-64K	32K
Cycle time, microseconds/word	1.2	1.6	1.6	0.8	1.2 or 0.96
Storage usable for data	Yes	Yes	Yes	Yes	Yes
Storage usable for programs	Yes	Yes	Yes	Yes	Yes
PROCESSING					
Programming technique	Internally stored	Internally stored	Internally stored	Internally stored	Internally stored
No. of operational registers	9	14	14	16	4
Capacity of each register	1 word	8 bits	8 bits	8 bits	1 word
Add time, milliseconds/word	0.0026	0.0048	0.0048	0.0024	0.00135
KEYBOARD INPUT					
Alphanumeric (typewriter) keyboard	Standard	Standard	Standard	Standard	Standard
10-key numeric keyboard	Standard	Standard	Standard	Standard	Standard
Full accounting keyboard	No	No	No	No	No
STANDARD PRINTED OUTPUT					
Printing speed, chars/sec or lpm	125 or 600 lpm	30-660 cps (opt.)	30-660 cps (opt.)	30-660 cps (opt.)	64 or 330 cps
Carriage width, inches	80 or 132 positions	132 positions	132 positions	132 positions	132 positions
Split platen	No	No	No	No	No
Pin-feed forms handling	Standard	Standard	Standard	Standard	Standard
Friction-feed forms handling	No	Standard	Standard	Optional	No
Journal roll handling	No	No	No	No	No
MAGNETIC LEDGER CARDS	No	No	No	No	No
Data capacity, digits per card	-	-	-	-	-
Automatic card alignment	-	-	-	-	-
Automatic card feeding & stacking	-	-	-	-	-
MAGNETIC DISC I/O					
Max. on-line disc capacity, chars	Standard	Standard	Optional	Optional	Standard
Disc I/O speed, chars/sec	320,000,000	1,000,000	40,000,000	200,000,000	20,000,000
Interchangeable discs	260,000	31,000	312,500	312,500	200,000
	Yes	Yes	Yes	Yes	Yes
OTHER I/O UNITS					
Punched card input speed, cols/sec or cpm	800 cpm	400 cpm	400 cpm	400 cpm	267 cps
Punched card output speed, cols/sec or cpm	Optional	-	-	-	No
Paper tape input speed chars/sec	10-300	-	-	-	300
Paper tape output speed, chars/sec	30-60	-	-	-	75
Line printer output speed, lines/min	60-600	125 or 300	125 or 300	125 or 300	300
Magnetic tape I/O speed, chars/sec	8500-40,000	-	10,000 & 20,000	10,000 & 20,000	36,000
Communications interface	Optional	Optional	Optional	Optional	Optional
SOFTWARE/SUPPORT					
Assembler	Yes	Yes	Yes	Yes	Yes
Compilers	No	Dataform, Databus, BASIC, RPG II	Datashare, RPG II, BASIC, Dataform	RPG II, BASIC, Datashare	BASIC, FORTRAN
Application programs	Std. business applications	Std. business applications	Std. business applications	Std. business applications	No
Software separately priced	No	No	No	No	Yes
Technical help separately priced	See Comments	Yes	Yes	Yes	Yes
PRICING & AVAILABILITY					
Purchase price of basic system, \$	40,000-60,000	11,200	8,571	22,500	27,000
Monthly rental of basic system, \$	880-1,320 (5-yr. lease)	273	284	732	810 (3rd party)
Date of first U.S. delivery	1972	February 1975	May 1972	February 1975	1971
Number installed in U.S. to date	Not specified	-	6,000	-	4,000
COMMENTS					
	Technical help separately priced after "start-up"; based on DEC minicomputer	Includes diskette drive and CRT display	Includes CRT display and dual cassette drives; widely used as intelligent terminal	Includes CRT display and dual cassette drives	Full line of peripherals available; based on D-116 mini-computer

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MANUFACTURER & MODEL	DEC Datasytem 310	DEC Datasytem 320	DEC Datasytem 330	DEC Datasytem 340	DEC Datasytem 530
DATA FORMATS					
Word length, bits	12	12	12	12	16
Digits per word	2	2	2	2	4
Characters per word	2	2	2	2	2
Operand length, words	1 or 2	1 or 2	1 or 2	1 or 2	Variable
Instruction length, words	1	1	1	1	1, 2, or 3
INTERNAL STORAGE					
Type of storage	Core	Core	Core	Core	Core
Storage capacity, words	8K-32K	8K-32K	8K-32K	8K-32K	28K
Cycle time, microseconds/word	1.4	1.2	1.2	1.2	1.0
Storage usable for data	Yes	Yes	Yes	Yes	Yes
Storage usable for programs	Yes	Yes	Yes	Yes	Yes
PROCESSING					
Programming technique	Internally stored	Internally stored	Internally stored	Internally stored	Internally stored
No. of operational registers	8	8	8	8	8
Capacity of each register	1 word	1 word	1 word	1 word	1 word
Add time, milliseconds/word	0.0028	0.0026	0.0026	0.0026	0.00099
KEYBOARD INPUT					
Alphanumeric (typewriter) keyboard	Standard	Standard	Standard	Standard	Standard
10-key numeric keyboard	Standard	Standard	Standard	Standard	Standard
Full accounting keyboard	No	No	No	No	No
STANDARD PRINTED OUTPUT					
Printing speed, chars/sec or lpm	30 cps (optional)	165 cps	165 cps	165 cps	165 cps or 300 lpm
Carriage width, inches	132 positions	132 positions	132 positions	132 positions	132 positions
Split platen	No	No	No	No	No
Pin-feed forms handling	Standard	Standard	Standard	Standard	Standard
Friction-feed forms handling	No	No	No	No	No
Journal roll handling	No	No	No	No	No
MAGNETIC LEDGER CARDS					
Data capacity, digits per card	No	No	No	No	No
Automatic card alignment	-	-	-	-	-
Automatic card feeding & stacking	-	-	-	-	-
MAGNETIC DISC I/O					
Max. on-line disc capacity, chars	Standard	Optional	Optional	Standard	Standard
Disc I/O speed, chars/sec	1,240,000	13,000,000	13,000,000	13,000,000	320,000,000
Interchangeable discs	30,000	240,000	240,000	240,000	266,600
	Yes	Yes	Yes	Yes	Yes
OTHER I/O UNITS					
Punched card input speed, cols/sec or cpm	400 cpm	400 cpm	400 cpm	400 cpm	400-1600 cpm
Punched card output speed, cols/sec or cpm	-	No	No	No	No
Paper tape input speed chars/sec	-	300	300	300	300
Paper tape output speed, chars/sec	-	50	50	50	50
Line printer output speed, lines/min	300	60-245	245-1,110	245-1,110	300-1,200
Magnetic tape I/O speed, chars/sec	-	36,000	36,000	36,000	72,000
Communications interface	Optional	Optional	Optional	Optional	Optional
SOFTWARE/SUPPORT					
Assembler	No	No	No	No	Yes
Compilers	DIBOL	DIBOL, FORTRAN, BASIC	DIBOL, FORTRAN, BASIC	DIBOL, FORTRAN, BASIC	RPG II, MUMPS-II, FORTRAN IV
Application programs	No	No	No	No	No
Software separately priced	Yes	Yes	Yes	Yes	Yes
Technical help separately priced	Yes	Yes	Yes	Yes	Yes
PRICING & AVAILABILITY					
Purchase price of basic system, \$	12,000	33,865	35,965	35,265	44,025
Monthly rental of basic system, \$	-	-	-	-	-
Date of first U.S. delivery	April 1975	March 1972	March 1972	March 1972	January 1973
Number installed in U.S. to date	-	See Comments	See Comments	See Comments	See Comments
COMMENTS	Basic system includes 8K PDP-8/A, 2 diskette drives, CRT display, and keyboard	About 400 systems installed, each based upon specifically configured PDP-8/E's. Only the DDS 310 and DDS 340 are actively marketed now; however, the 320 and 330 can be obtained on an as-available basis			See Comments on following page

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MANUFACTURER & MODEL	DEC Datasytem 535	DEC Datasytem 540	DEC Datasytem 550	DEC Datasytem 560	Digital Scientific META 4/1130
DATA FORMATS					
Word length, bits	16	16	16	16	16
Digits per word	4	4	4	4	4
Characters per word	2	2	2	2	2
Operand length, words	Variable	Variable	Variable	Variable	1
Instruction length, words	1, 2, or 3	1, 2, or 3	1, 2, or 3	1, 2, or 3	1 or 2
INTERNAL STORAGE					
Type of storage	Core	Core	Core or MOS	Core or MOS	Core
Storage capacity, words	48K-64K	32K-124K	32K-124K	32K-124K	65K
Cycle time, microseconds/word	1.15	1.15	1.09	0.58	0.900
Storage usable for data	Yes	Yes	Yes	Yes	Yes
Storage usable for programs	Yes	Yes	Yes	Yes	Yes
PROCESSING					
Programming technique	Internally stored	Internally stored	Internally stored	Internally stored	Internally stored
No. of operational registers	8	8	16	16	32
Capacity of each register	1 word	1 word	1 word	1 word	1 word
Add time, milliseconds/word	0.00099	0.00099	0.00097	0.00051	0.00214
KEYBOARD INPUT					
Alphanumeric (typewriter) keyboard	Standard	Standard	Standard	Standard	Standard
10-key numeric keyboard	Standard	Standard	Standard	Standard	Optional
Full accounting keyboard	No	No	No	No	Optional
STANDARD PRINTED OUTPUT					
Printing speed, chars/sec or lpm	165 cps or 300 lpm	165 cps or 300 lpm	165 cps or 300 lpm	165 cps or 300 lpm	14.8 cps
Carriage width, inches	132 positions	132 positions	132 positions	132 positions	13.5
Split platen	No	No	No	No	No
Pin-feed forms handling	Standard	Standard	Standard	Standard	Standard
Friction-feed forms handling	No	No	No	No	Standard
Journal roll handling	No	No	No	No	No
MAGNETIC LEDGER CARDS					
Data capacity, digits per card	No	No	No	No	No
Automatic card alignment	-	-	-	-	-
Automatic feeding & stacking	-	-	-	-	-
MAGNETIC DISC I/O					
Max. on-line disc capacity, chars	Standard	Standard	Standard	Standard	Optional
Disc I/O speed, chars/sec	19,600,000	704,000,000	704,000,000	704,000,000	160,000,000
Interchangeable discs	180,000	800,000	800,000	800,000	250,000
	Yes	Yes	Yes	Yes	Yes
OTHER I/O UNITS					
Punched card input speed, cols/sec or cpm	400-1,600 cpm	400-1,600 cpm	400-1,600 cpm	400-1,600 cpm	1,000 cpm
Punched card output speed, cols/sec or cpm	-	No	No	No	160 cpm
Paper tape input speed chars/sec	300	300	300	300	400
Paper tape output speed, chars/sec	50	50	50	50	150
Line printer output speed, lines/min	300-1,200	300-1,200	300-1,200	300-1,200	300-600
Magnetic tape I/O speed, chars/sec	72,000	72,000	72,000	72,000	60,000
Communications interface	Optional	Optional	Optional	Optional	Optional
SOFTWARE/SUPPORT					
Assembler	Yes	Yes	Yes	Yes	Yes
Compilers	BASIC	RPG II, MUMPS-II, BASIC, COBOL, FORTRAN	RPG II, MUMPS-II, BASIC, COBOL, FORTRAN	RPG II, MUMPS-II, BASIC, COBOL, FORTRAN	COBOL, RPG, FORTRAN
Application programs	No	No	No	No	IBM 1130 library
Software separately priced	Yes	Yes	Yes	Yes	Yes
Technical help separately priced	Yes	Yes	Yes	Yes	Yes
PRICING & AVAILABILITY					
Purchase price of basic system, \$	54,000	60,670	71,870	71,870	21,950
Monthly rental of basic system, \$	-	-	-	-	666
Date of first U.S. delivery	October 1974	January 1973	November 1972	November 1972	January 1970
Number installed in U.S. to date	See Comments	See Comments	See Comments	See Comments	120
COMMENTS	About 500 Datasytem 500's of all models have been installed to date. Models 530, 535, and 540 are based on the DEC PDP-11/40 minicomputer, while Models 550 and 560 are based on the PDP-11/45. See Report 70C-384-05 for details				Emulates the IBM 1130 and can execute all programs written for the 1130

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MANUFACTURER & MODEL	Fujitsu Limited FACOM V ₀	General Automation DM 120	General Automation DM 130	General Automation DM 140	GRI Business Systems System 99
DATA FORMATS					
Word length, bits	32	16	16	16	16
Digits per word	8	4	4	4	4 + sign
Characters per word	4	2	2	2	2
Operand length, words	1-6 bytes	1	1	1	1
Instruction length, words	1 or 2	1 or 2	1 or 2	1 or 2	1 or 2
INTERNAL STORAGE					
Type of storage	MOS	Core	Core	Core	Core
Storage capacity, words	16K-36K bytes	8K	32K	64K	16K-32K
Cycle time, microseconds/word	0.4/byte	0.9	0.9	0.9	1.76
Storage usable for data	Yes	Yes	Yes	Yes	Yes
Storage usable for programs	Yes	Yes	Yes	Yes	Yes
PROCESSING					
Programming technique	Internally stored	Internally stored	Internally stored	Internally stored	Internally stored
No. of operational registers	16	16	16	16	18
Capacity of each register	16 bits	1 word	1 word	1 word	16 bits
Add time, milliseconds/word	0.050	0.0009	0.0009	0.0009	0.00176
KEYBOARD INPUT					
Alphanumeric (typewriter) keyboard	Standard	Standard	Standard	Standard	Standard
10-key numeric keyboard	Standard	Standard	Standard	Standard	Standard
Full accounting keyboard	No	No	No	No	No
STANDARD PRINTED OUTPUT					
Printing speed, chars/sec or lpm	30 cps	165-2,200 cps	165-2,200 cps	165-2,200 cps	165-330 cps
Carriage width, inches	16 (141 pos.)	-	-	-	13.2
Split platen	Optional	No	No	No	No
Pin-feed forms handling	Standard	Standard	Standard	Standard	Standard
Friction-feed forms handling	Optional	Optional	Optional	Optional	No
Journal roll handling	No	No	No	No	No
MAGNETIC LEDGER CARDS					
Data capacity, digits per card	No	No	No	No	No
Automatic card alignment	-	-	-	-	-
Automatic card feeding & stacking	-	-	-	-	-
MAGNETIC DISC I/O					
Max. on-line capacity, chars	Standard	No	Standard	Standard	Standard
Disc I/O speed, chars/sec	19,600,000	-	200,000,000	200,000,000	42,400,000
Interchangeable discs	Yes	-	Yes	Yes	300,000
OTHER I/O UNITS					
Punched card input speed, cols/sec or cpm	100 cpm	1,000 cpm	1,000 cpm	1,000 cpm	480 cps
Punched card output speed, cols/sec or cpm	100 cpm	-	-	47 cps	192 cps
Paper tape input speed chars/sec	300	-	-	400	-
Paper tape output speed, chars/sec	50	-	-	75	-
Line printer output speed, lines/min	170	60-1,000	60-1,000	60-1,000	200-600
Magnetic tape I/O speed, chars/sec	21,600	-	-	10,000-60,000	160,000 max.
Communications interface	Optional	Standard	Standard	Standard	Standard
SOFTWARE/SUPPORT					
Assembler	Yes	No	Yes	Yes	Yes
Compilers	COBOL, FORTRAN, TASKFORCE	No	FORTTRAN IV	FORTTRAN IV	Interactive RPG II
Application programs	CAPSEL	No	Inventory, A/R, job costing	Inventory, A/R, job costing	Std. business applications
Software separately priced	Yes	No	Yes	No	Some
Technical help separately priced	Yes	Yes	Yes	Yes	Yes
PRICING & AVAILABILITY					
Purchase price of basic system, \$	Not specified	25,000	37,000	49,000	42,470
Monthly rental of basic system, \$	Not specified	-	-	-	-
Date of first U.S. delivery	Not specified	Late 1974	Late 1974	Late 1974	December 1972
Number installed in U.S. to date	Not specified	Not specified	Not specified	Not specified	Not specified
COMMENTS					
	Rack-mountable; peripherals include diskette, CRT display, OCR, and OMR	Remote job entry (RJE) terminal based upon GA's SPC-16/65 minicomputer	Free-standing data management system based upon GA's SPC-16/65 minicomputer	Handles concurrent batch and real-time processing and up to 32 terminals; based upon GA's SPC-16/65 minicomputer	Based on GRI 99/50 minicomputer; price includes multi-user operating system

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MANUFACTURER & MODEL	Hewlett-Packard M/210	Hewlett-Packard M/230	Hewlett-Packard M/260	Hewlett-Packard M/280	Hewlett-Packard 2000F
DATA FORMATS					
Word length, bits	16	16	16	16	16
Digits per word	4	4	4	4	4
Characters per word	2	2	2	2	2
Operand length, words	1	1	1	1	1
Instruction length, words	1	1	1	1	1
INTERNAL STORAGE					
Type of storage	MOS	MOS	MOS	MOS	MOS
Storage capacity, words	32K	32K	32K	32K	64K (dual proc.)
Cycle time, microseconds/word	0.650	0.650	0.650	0.650	0.650
Storage usable for data	Yes	Yes	Yes	Yes	Yes
Storage usable for programs	Yes	Yes	Yes	Yes	Yes
PROCESSING					
Programming technique	Internally stored	Internally stored	Internally stored	Internally stored	Internally stored
No. of operational registers	2	2	2	2	2
Capacity of each register	1 word	1 word	1 word	1 word	1 word
Add time, milliseconds/word	0.00194	0.00194	0.00194	0.00194	0.00194
KEYBOARD INPUT					
Alphanumeric (typewriter) keyboard	Standard	Standard	Standard	Standard	Standard
10-key numeric keyboard	Optional	Optional	Optional	Optional	Optional
Full accounting keyboard	No	No	No	No	No
STANDARD PRINTED OUTPUT					
Printing speed, chars/sec or lpm	600 lpm max.	600 lpm max.	600 lpm max.	600 lpm max.	1,250 lpm max.
Carriage width, inches	132 positions	132 positions	132 positions	132 positions	132 positions
Split platen	No	No	No	No	No
Pin-feed forms handling	Optional	Optional	Standard	Standard	Standard
Friction-feed forms handling	Standard	Optional	Optional	Optional	Optional
Journal roll handling	No	No	No	No	No
MAGNETIC LEDGER CARDS					
Data capacity, digits per card	No	No	No	No	No
Automatic card alignment	-	-	-	-	-
Automatic card feeding & stacking	-	-	-	-	-
MAGNETIC DISC I/O					
Standard	Standard	Standard	Standard	Standard	Standard
Max. on-line disc capacity, chars	93,000,000	93,000,000	93,000,000	93,000,000	188,000,000
Disc I/O speed, chars/sec	617,000	617,000	617,000	617,000	617,000
Interchangeable discs	Yes	Yes	Yes	Yes	Yes
OTHER I/O UNITS					
Punched card input speed, cols/sec or cpm	300-600 cpm	300-600 cpm	300-600 cpm	300-600 cpm	-
Punched card output speed, cols/sec or cpm	45-75 cpm	45-75 cpm	45-75 cpm	45-75 cpm	-
Paper tape input speed chars/sec	500	500	500	500	30
Paper tape output speed, chars/sec	75	75	75	75	30
Line printer output speed, lines/min	-	-	-	-	-
Magnetic tape I/O speed, chars/sec	72,000 max.	72,000 max.	72,000 max.	72,000 max.	72,000 max.
Communications interface	Optional	Optional	Optional	Optional	No
SOFTWARE/SUPPORT					
Assembler	2-pass	2-pass	2-pass	2-pass	No
Compilers	FORTRAN, ALGOL	FORTRAN, ALGOL	FORTRAN, ALGOL	FORTRAN, ALGOL	BASIC
Application programs	Order entry & invoicing	-	Order entry & invoicing	Order entry & invoicing	ADMIN/2000
Software separately priced	Partially	Partially	Partially	Partially	Partially
Technical help separately priced	Partially	Partially	Partially	Partially	Partially
PRICING & AVAILABILITY					
Purchase price of basic system,	29,790	48,950	50,500	70,235	63,500
Monthly rental of basic system,	775 (5-yr. lease excl. maint.)	1,273 (5-yr. lease excl. maint.)	1,313 (5-yr. lease excl. maint.)	1,826 (5-yr. lease excl. maint.)	1,651 (5-yr. lease excl. maint.)
Date of first U.S. delivery	May 1974	May 1974	May 1974	Not specified	Not specified
Number installed in U.S. to date	Not specified	Not specified	Not specified	Not specified	Not specified
COMMENTS					
		Basic system includes multiplexor & supports up to 16 terminals using multitasking software	Includes IMAGE data base mgmt. software	Basic system includes ON-TOP order entry & invoicing appl'ns. software for multi-terminal on-line interaction	Handles up to 32 concurrent user terminals in time-sharing environment; dual-processor system

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MANUFACTURER & MODEL	Hewlett-Packard 2000G Access Data System	Hewlett-Packard 21 MX	Hewlett-Packard 2100	Hewlett-Packard 3000CX	Honeywell Model 58
DATA FORMATS Word length, bits Digits per word Characters per word Operand length, words Instruction length, words	16 4 2 1 1	16 2 2 Variable Variable	16 2 2 Variable Variable	16 4 2 1-3 words Variable	8-bit byte 1 or 2/byte 1/byte 1 to 10 bytes 1 to 8 bytes
INTERNAL STORAGE Type of storage Storage capacity, words Cycle time, microseconds/word Storage usable for data Storage usable for programs	MOS 64K (dual proc.) 0.650 Yes Yes	MOS 4K-1 million 0.650 Yes Yes	Core 4K-32K 0.980 Yes Yes	Core 32K-64K 0.980 Yes Yes	Core 5K or 10K bytes 1.2 Yes Yes
PROCESSING Programming technique No. of operational registers Capacity of each register Add time, milliseconds/word	Internally stored 2 1 word 0.00194	Internally stored 21 1 word 0.00194	Internally stored 15 1 word 0.00196	Internally stored 36 1 word 0.0007	Internally stored 100 5 bytes 0.12/9 digits
KEYBOARD INPUT Alphanumeric (typewriter) keyboard 10-key numeric keyboard Full accounting keyboard	Standard Optional No	Optional CRT Optional CRT No	Optional CRT Optional CRT No	Standard Optional No	Standard Standard No
STANDARD PRINTED OUTPUT Printing speed, chars/sec or lpm Carriage width, inches Split platen Pin-feed forms handling Friction-feed forms handling Journal roll handling	1,250 lpm max. 132 positions No Standard Optional No	200-1,800 lpm 132 positions Optional Optional Optional No	200-1,800 lpm 132 positions Optional Optional Optional No	200-1,800 lpm 132 positions No Standard Optional No	100 to 650 lpm 16 No Standard No No
MAGNETIC LEDGER CARDS Data capacity, digits per card Automatic card alignment Automatic card feeding & stacking	No — — —	No — — —	No — — —	No — — —	No — — —
MAGNETIC DISC I/O Max. on-line disc capacity, chars Disc I/O speed, chars/sec Interchangeable discs	Standard 188,000,000 617,000 Yes	Optional 100,000,000 312,000 Yes	Optional 100,000,000 312,000 Yes	Standard 400,000,000 485,000 No	Optional 23,000,000 156,250 Yes
OTHER I/O UNITS Punched card input speed, cols/sec or cpm Punched card output speed, cols/sec or cpm Paper tape input speed, chars/sec Paper tape output speed, chars/sec Line printer output speed, lines/min Magnetic tape I/O speed, chars/sec Communications interface	300-600 cpm — 500 75 — 72,000 Optional	800 cpm 60 cpm 500 75 — 72,000 Optional	800 cpm 60 cpm 500 75 — 72,000 Optional	1,600 cpm 60 cpm 500 75 — 72,000 Standard	240-720 cps 40 cps — — 100 to 650 — Optional
SOFTWARE/SUPPORT Assembler Compilers Application programs Software separately priced Technical help separately priced	No BASIC ADMIN/2000 Partially Partially	Yes BASIC, FORTRAN, ALGOL IMAGE DBM Yes Yes	Yes BASIC, FORTRAN, ALGOL IMAGE DBM Yes Yes	Yes BASIC, FORTRAN, COBOL, RPG, SPL IMAGE DBM & many others Yes Yes	No MiniCOBOL, COBOL Std. business applications Partially Partially
PRICING & AVAILABILITY Purchase price of basic system, \$ Monthly rental of basic system, \$ Date of first U.S. delivery Number installed in U.S. to date	63,500 1,651 (5-yr. lease excl. maint.) Not specified Not specified	8,950 — September 1974 1,000	12,865 — Not specified 7,000	99,500 — November 1972 100	37,900-63,320 1,015-1,440 Oct. 1970 Not specified
COMMENTS	Handles up to 32 concurrent user terminals and HASP RJE workstations; dual-processor system	Price shown is for 16K central processor only	Price shown is for 16K central processor only	Virtual-memory system designed for concurrent batch and multi- terminal processing	Processor is no longer sold, but peripherals are still available to users

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MANUFACTURER & MODEL	Honeywell Model 61/58	Honeywell Model 61/60	Honeywell Model 62/60	IBM System/3 Model 6	IBM System/3 Model 8
DATA FORMATS Word length, bits Digits per word Characters per word Operand length, words Instruction length, words	8-bit byte 1 or 2/byte 1/byte 1 to 10 bytes 1 to 8 bytes	8-bit byte 1 or 2/byte 1/byte 1 to 10 bytes 1 to 8 bytes	8-bit byte 1 or 2/byte 1/byte 1, 2, or 3 bytes 2, 4, 6, or 8 bytes	8-bit byte 1 per byte 1 per byte 1-16 digits 4-6 bytes	8-bit byte 1 per byte 1 per byte 1-16 digits 4-6 bytes
INTERNAL STORAGE Type of storage Storage capacity, words Cycle time, microseconds/word Storage usable for data Storage usable for programs	Core/MOS 5K or 10K bytes 1.2 Yes Yes	Core/MOS 10K bytes 1.2 Yes Yes	MOS 65K-131K bytes 1.0/2 bytes Yes Yes	Core 8K to 16K 1.52 Yes Yes	MOSFET 16K-65K 1.52 Yes Yes
PROCESSING Programming technique No. of operational registers Capacity of each register Add time, milliseconds/word	Internally stored 100 5 bytes 0.12/9 digits	Internally stored 100 5 bytes 0.12/9 digits	Internally stored 24 4 bytes 0.039	Internally stored — — 0.024 (5 digits)	Internally stored — — 0.024 (5 digits)
KEYBOARD INPUT Alphanumeric (typewriter) keyboard 10-key numeric keyboard Full accounting keyboard	Standard Standard No	Standard Standard No	Standard Standard No	Standard Standard No	Standard Standard No
STANDARD PRINTED OUTPUT Printing speed, chars/sec or lpm Carriage width, inches Split platen Pin-feed forms handling Friction-feed forms handling Journal roll handling	100-650 lpm 16 No Standard No No	300-650 lpm 16 No Standard No No	30 cps — No Standard No No	85 cps 13.2 or 22 Optional Standard No No	100-300 lpm 132 positions No Standard No No
MAGNETIC LEDGER CARDS Data capacity, digits per card Automatic card alignment Automatic card feeding & stacking	No — — —	No — — —	No — — —	No — — —	No — — —
MAGNETIC DISC I/O Max. on-line disc capacity, chars Disc I/O speed, chars/sec Interchangeable discs	Standard 92,000,000 312,500 Yes	Standard 92,000,000 312,500 Yes	Standard 116,800,000 312,500 Yes	Standard 9,800,000 199,000 Yes	Standard 9,800,000 312,000 Yes
OTHER I/O UNITS Punched card input speed, cols/sec or cpm Punched card output speed, cols/sec or cpm Paper tape input speed chars/sec Paper tape output speed, chars/sec Line printer output speed, lines/min Magnetic tape I/O speed, chars/sec Communications interface	240-720 cps 40 cps — — 100 to 650 — Optional	240-720 cps 40 cps — — 100 to 650 — Optional	800-1,400 cpm 66-133 cpm — — 400-600 — Standard	20 cpm 20 cpm No No No No Optional	— — — — 100-300 — Optional
SOFTWARE/SUPPORT Assembler Compilers Application programs Software separately priced Technical help separately priced	No COBOL, MiniCOBOL Std. business applications Yes Yes	No COBOL, Mini- COBOL, BASIC Std. business applications Yes Yes	No RPG, COBOL Std. business applications Yes Yes	No BASIC, RPG II Std. business applications Yes Yes	No RPG II, FORTRAN, COBOL Many available Yes Yes
PRICING & AVAILABILITY Purchase price of basic system, \$ Monthly rental of basic system, \$ Date of first U.S. delivery Number installed in U.S. to date	68,350 1,469 November 1974 Not specified	131,480 3,149 2nd qtr. 1975 Not specified	183,310 4,211 November 1974 Not specified	47,830 1,078 December 1970 Over 5,000	62,525 1,599 June 1975 —
COMMENTS	Multiworkstation model permits up to 4 on-line term- inals; see Report 70C-480-14 for details	Front-End Processor permits up to 8 on-line term- inals; see Report 70C-480-14 for details	See Report 70C-480-13 for for details	Offers optional CRT display out- put; see Report 70C-491-21 for details	Diskette- oriented system; see Report 70C-491-21 for details

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MANUFACTURER & MODEL	IBM System/3 Model 10	IBM System/3 Model 15	IBM System/32	IBM System/360 Model 20	IBM 1130
DATA FORMATS Word length, bits Digits per word Characters per word Operand length, words Instruction length, words	8-bit byte 1 per byte 1 per byte 1-16 digits 4-6 bytes	8-bit byte 1 per byte 1 per byte 1-16 digits 4-6 bytes	8-bit byte 1 per byte 1 per byte 1-16 digits 3-6 bytes	8 2 1 1-16 2, 4, 6	16 2 2 1 or 2 1 or 2
INTERNAL STORAGE Type of storage Storage capacity, words Cycle time, microseconds/word Storage usable for data Storage usable for programs	Core 8K-49K 1.52 Yes Yes	MOSFET 49K-131K 1.52 Yes Yes	MOSFET 16K-32K 0.6 Yes Yes	Core 4K-32K 1.0-3.6 Yes Yes	Core 4K-32K 2.2 or 3.6 Yes Yes
PROCESSING Programming technique No. of operational registers Capacity of each register Add time, milliseconds/word	Internally stored — — 0.024 (5 digits)	Internally stored — — 0.024 (5 digits)	Internally stored — — 0.150 (5 digits)	Internally stored 8 — 0.209 (5 digits)	Internally stored 3 1 word 0.0049 or 0.0080
KEYBOARD INPUT Alphanumeric (typewriter) keyboard 10-key numeric keyboard Full accounting keyboard	Optional No No	CRT console No No	Standard Standard No	Standard No No	Standard — —
STANDARD PRINTED OUTPUT Printing speed, chars/sec or lpm Carriage width, inches Split platen Pin-feed forms handling Friction-feed forms handling Journal roll handling	100-1100 lpm 96-132 position No Standard No No	465-1100 lpm 132 positions No Standard No No	40 cps-155 lpm 132 positions No Standard No No	15.5 cps — No Standard Standard No	15.5 cps — — Standard — —
MAGNETIC LEDGER CARDS Data capacity, digits per card Automatic card alignment Automatic card feeding & stacking	No — — —	No — — —	No — — —	No — — —	No — — —
MAGNETIC DISC I/O Max. on-line disc capacity, chars. Disc I/O speed, chars/sec Interchangeable discs	Standard 40,960,000 312,000 Yes	Standard 164,170,000 885,000 Yes	Standard 9,169,920 889,000 Yes (diskette); also fixed disc	Optional 21,600,000 156,000 Yes	Standard 2,560,000 156,000 Yes
OTHER I/O UNITS Punched card input speed, cols/sec or cpm Punched card output speed, cols/sec or cpm Paper tape input speed chars/sec Paper tape output speed, chars/sec Line printer output speed, lines/min Magnetic tape I/O speed, chars/sec Communications interface	1,000 cpm max. 120 cpm max. No No 1100 max. 80,000 max. Optional	1,000 cpm max. 120 cpm max. No No 1100 max. 80,000 max. Optional	— — — — — — Optional	1,000 cpm 500 cpm No No 1100 60,000 Optional	600 cpm 120 cpm 60 14.8 600 RPQ only RPQ only
SOFTWARE/SUPPORT Assembler Compilers Application programs Software separately priced Technical help separately priced	No RPG, COBOL, FORTRAN IV Many available Yes Yes	No RPG, COBOL, FORTRAN IV Many available Yes Yes	No RPG II Available for 5 industries, with more to come Yes Yes	Yes PL/1, RPG Many available Some Yes	Yes RPG, FORTRAN, COBOL Many available Some Yes
PRICING & AVAILABILITY Purchase price of basic system, \$ Monthly rental of basic system, \$ Date of first U.S. delivery Number installed in U.S. to date	45,690 1,092 January 1970 Over 15,000	142,640 3,555 November 1973 Not specified	33,100 809 March 1975 —	50,200 1,380 November 1964 About 15,000	30,700 705 February 1965 About 5,500
COMMENTS	Disk-based, batch-oriented system; see Report 70C-491-21 for details	Provides multi-programming support; see Report 70C-491-21 for details	Features processor, memory, key-board, CRT, printer, diskette, and fixed disk drive in one desk-size cabinet; see Report 70C-491-25 for details	Generally superseded in current IBM product line by System/3; see Report 70C-491-02 for details	Designed for scientific computing but widely used for small-scale business data processing; see Report 70C-491-11 for details

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MANUFACTURER & MODEL	International Computers Ltd. ICL 2903	International Computing Co. System 95/99	Jacquard Systems J100	Linolex Desktop Processor	Martin, Wolfe Mesa II 5000 Series
DATA FORMATS					
Word length, bits	24	16	16	8	16
Digits per word	6 or 7	4	2	2	4
Characters per word	4	2	2	1	2
Operand length, words	1 word	Variable	1	1-256	1
Instruction length, words	1 word	Variable	1	1-4	1
INTERNAL STORAGE					
Type of storage	MOS	Core	Core	MOS	Core
Storage capacity, words	16K-48K	16-32K	128K	8K-32K	24K-32K bytes
Cycle time, microseconds/word	1.14	1.0	1.5	1.0	1.2 per 2 bytes
Storage usable for data	Yes	Yes	Yes	Yes	Yes
Storage usable for programs	Yes	Yes	Yes	Yes	Yes
PROCESSING					
Programming technique	Internally stored	Internally stored	Internally stored	Internally stored	Internally stored
No. of operational registers	—	4	3	Variable	4
Capacity of each register	—	16 bits	16	Variable	1 word
Add time, milliseconds/word	0.033	0.00135	0.1	0.020	0.00135
KEYBOARD INPUT					
Alphanumeric (typewriter) keyboard	Standard	Standard	Standard	Standard	Standard
10-key numeric keyboard	No	Standard	Optional	Standard	Standard
Full accounting keyboard	No	No	Optional	No	No
STANDARD PRINTED OUTPUT					
Printing speed, chars/sec or lpm	300 lpm	100-330 cps	160 cps	30-530 cps	125-200 lpm
Carriage width, inches	132 positions	8" std, 132 pos. opt.	15	—	132 positions
Split platen	No	No	Optional	No	No
Pin-fed forms handling	Standard	Yes	Optional	Optional	Standard
Friction-feed forms handling	No	No	Standard	Optional	No
Journal roll handling	No	No	Optional	No	No
MAGNETIC LEDGER CARDS					
Data capacity, digits per card	No	No	No	No	No
Automatic card alignment	—	—	—	—	—
Automatic card feeding & stacking	—	—	—	—	—
MAGNETIC DISC I/O					
Max. on-line disc capacity, chars	Standard 269,400,000	Optional 4,588,000	Optional 24,000,000	Optional 1,000,000	Standard 48,000,000
Disc I/O speed, chars/sec	416,000	180,000	1,000,000	10,000	190,000
Interchangeable discs	Yes	Yes	Yes	Yes	Yes
OTHER I/O UNITS					
Punched card input speed, cols/sec or cpm	300 cpm	No	300 cpm	533 cps	No
Punched card output speed, cols/sec or cpm	100 cpm	No	80 cpm	130 cps	No
Paper tape input speed chars/sec	1,000	No	300	No	No
Paper tape output speed, chars/sec	110	63.5 (opt.)	60	No	No
Line printer output speed, lines/min	300-1,350	No	1,200	240	—
Magnetic tape I/O speed, chars/sec	80,000	No	120,000	10,000	36,000
Communications interface	Standard	Optional	Optional	Optional	Optional
SOFTWARE/SUPPORT					
Assembler	No	Yes	Yes	Yes	Yes
Compilers	COBOL, ALGOL, FORTRAN, RPG II	FORTRAN	BASIC	BASIC	RPG, FORMS
Applications programs	Many available	A/R, order entry, invoicing	AR/AGE	Std. business, data entry	Many available
Software separately priced	Yes	Yes	Yes	Yes	Partially
Technical help separately priced	No	Yes	Yes	No	Partially
PRICING & AVAILABILITY					
Purchase price of basic system, \$	Not specified	25,700	13,500	12,900	39,000
Monthly rental of basic system, \$	Approx. \$2,100	874 (3-year lease)	—	374 (1-year lease)	Third party
Date of first U.S. delivery	Late 1974	October 1972	December 1974	July 1972	June 1973
Number installed in U.S. to date	Not specified	5	Not specified	500	10
COMMENTS					
	Basic system includes 16K-word CPU, 10MB disc unit, 300-lpm printer, 300-cpm card reader, & 3 CRT terminals	Based on Data General Nova minicomputers; basic system includes CRT display and printer	8-line communications multiplexor avail.; \$4,000 additional charge for software	Basic system includes 3 tape drives, 1600-character CRT, and keyboard	

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MANUFACTURER & MODEL	Martin, Wolfe Mesa II 7000 Series	Micro Computer Machines MCM 70 AVS	Microdata REALITY	Microline MMCS	Mini-Computer Systems MICOS
DATA FORMATS					
Word length, bits	16	8	16	16	16
Digits per word	4	2 per byte	2	4	2
Characters per word	2	1 per byte	2	2	2
Operand length, words	1	1 byte	½, 1, 2, or 3	1	Variable
Instruction length, words	1	1 byte	½, 1, 2, or 3	1	Variable
INTERNAL STORAGE					
Type of storage	Core	MOS	Core	Core	Core
Storage capacity, words	24K-65K bytes	4K-8K bytes	32K	16K-64K	32K
Cycle time, microseconds/word	1.0 per 2 bytes	1	2.0	0.980	1.0
Storage usable for data	Yes	Yes	Yes	Yes	Yes
Storage usable for programs	Yes	Yes	Yes	Yes	Yes
PROCESSING					
Programming technique	Internally stored	Internally stored	Internally stored	Internally stored	Internally stored
No. of operational registers	4	Not specified	34	6	4
Capacity of each register	1 word	Not specified	8 bits	16 bits	16 bits
Add time, milliseconds/word	0.001	Not specified	—	0.0019	0.00135
KEYBOARD INPUT					
Alphanumeric (typewriter) keyboard	Standard	Standard	Standard	Standard	Standard
10-key numeric keyboard	Standard	Optional	Standard	Standard	Optional
Full accounting keyboard	No	No	No	Standard	No
STANDARD PRINTED OUTPUT					
Printing speed, chars/sec or lpm	200-2,000 lpm	30 cps	300 lpm	10, 30, or 165 cps	330 cps
Carriage width, inches	132 positions	132 positions	132 positions	15	132 positions
Split platen	No	No	No	No	No
Pin-feed forms handling	Standard	Yes	Standard	Standard	Yes
Friction-feed forms handling	No	No	No	No	No
Journal roll handling	No	No	No	No	No
MAGNETIC LEDGER CARDS					
Data capacity, digits per card	No	No	No	No	No
Automatic card alignment	—	—	—	—	—
Automatic card feeding & stacking	—	—	—	—	—
MAGNETIC DISC I/O					
Max. on-line disc capacity, chars	Standard	No	Standard	Standard	Standard
Disc I/O speed, chars/sec	120,000,000	—	40,000,000	80,000,000	400,000,000
Interchangeable discs	304,000	—	1,562,000	312,000	312,000
	Yes	—	No	Yes	Yes
OTHER I/O UNITS					
Punched card input speed, cols/sec or cpm	No	RPO only	—	330 cps	533 cps
Punched card output speed, cols/sec or cpm	No	RPO only	—	No	RPO
Paper tape input speed chars/sec	No	—	—	500 (optional)	—
Paper tape output speed, chars/sec	No	—	—	75	100
Line printer output speed, lines/min	—	—	300	100-1,200	300 or 600
Magnetic tape I/O speed, chars/sec	36,000	700 (cassette)	20,000	20,000	37,500
Communications interface	Optional	Optional	Standard	Optional	Optional
SOFTWARE/SUPPORT					
Assembler	Yes	No	Yes	Yes	Yes
Compilers	RPG, FORMS	APL	ENGLISH, RPG II	Commercial FORTRAN	BASIC
Application programs	Many available	—	—	Manufacturing	See Comments
Software separately priced	Partially	Partially	No	Yes	Yes
Technical help separately priced	Partially	Partially	Yes	Yes	Yes
PRICING & AVAILABILITY					
Purchase price of basic system, \$	53,000	6,500	50,000 (approx.)	39,000	49,500
Monthly rental of basic system, \$	Third party	—	Quoted by authorized dealer	—	1,250 (5-year lease)
Date of first U.S. delivery	June 1973	December 1973	November 1973	October 1972	December 1971
Number installed in U.S. to date	Over 50	Not specified	75	Not specified	Over 100
COMMENTS					
		Magnetic tape cassette drive, power failure protection, & I/O interface are standard	Virtual storage system oriented toward data base management; can handle more than 32 on-line users	Designed for terminal-oriented manufacturing & inventory mgmt. applications	System includes hardware, MICOS operating system, plus about 10 utilities; over 50 industry applications are available

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MANUFACTURER & MODEL	Nixdorf 820/110	Nixdorf 820/123	Nixdorf 820/125	Nixdorf 820/135	Nixdorf 840/110
DATA FORMATS					
Word length, bits	12	12	12	12	12
Digits per word	1, 2, 3	1, 2, 3	1, 2, 3	1, 2, 3	1, 2, 3
Characters per word	1, 2	1, 2	1, 2	1, 2	1, 2
Operand length, words	1	1	1	1	1
Instruction length, words	1-4	1-4	1-4	1-4	1-4
INTERNAL STORAGE					
Type of storage	Core	Core	Core	Core	Core
Storage capacity, words	4K-16K	4K-8K	2K-16K	4K-16K	4K-16K
Cycle time, microseconds/word	2.0	2.0	2.0	2.0	2.0
Storage usable for data	Yes	Yes	Yes	Yes	Yes
Storage usable for programs	Yes	Yes	Yes	Yes	Yes
PROCESSING					
Programming technique	Internally stored	Internally stored	Internally stored	Internally stored	Internally stored
No. of operational registers	15	15	15	15	15
Capacity of each register	Varies	Varies	Varies	Varies	Varies
Add time, milliseconds/word	3.2	3.2	3.2	3.2	3.2
KEYBOARD INPUT					
Alphanumeric (typewriter) keyboard	Standard	Standard	Standard	Standard	Standard
10-key numeric keyboard	Standard	Standard	Standard	Standard	Standard
Full accounting keyboard	No	No	No	No	No
STANDARD PRINTED OUTPUT					
Printing speed, chars/sec or lpm	15 cps	15 cps	15 cps	15 cps	50 cps
Carriage width, inches	13.5	13.5	13.5	13.5	17.4
Split platen	No	No	No	No	No
Pin-feed forms handling	Optional	Optional	Optional	Optional	Standard
Friction-feed forms handling	Optional	Optional	Optional	Optional	No
Journal roll handling	No	No	No	No	No
MAGNETIC LEDGER CARDS					
Data capacity, digits per card	No	Standard	Standard	No	No
Automatic card alignment	—	1, 212/side	1, 212/side	—	—
Automatic card feeding & stacking	—	Standard	Standard	—	—
	—	Optional	Optional	—	—
MAGNETIC DISC I/O					
Max. on-line disc capacity, chars	No	No	No	Standard	No
Disc I/O speed, chars/sec	—	—	—	2,800,000	—
Interchangeable discs	—	—	—	144,000	—
	—	—	—	Yes	—
OTHER I/O UNITS					
Punched card input speed, cols/sec or cpm	200 cps	200 cps	200 cps	200 cps	200 cps
Punched card output speed, cols/sec or cpm	19 or 50 cps	19 or 50 cps	19 or 50 cps	19 or 50 cps	19 or 50 cps
Paper tape input speed, chars/sec	200	200	200	200	200
Paper tape output speed, chars/sec	25	25	25	25	25
Line printer output speed, lines/min	60-200	60-200	60-200	60-200	60-200
Magnetic tape I/O speed, chars/sec	420 (cassette)	420 (cassette)	420 (cassette)	420 (cassette)	420 (cassette)
Communications interface	Optional	Optional	Optional	No	No
SOFTWARE/SUPPORT					
Assembler	No	No	No	No	No
Compilers	BOSS	BOSS	BOSS	BOSS	BOSS
Application programs	Many available	Many available	Many available	Many available	Many available
Software separately priced	Yes	Yes	Yes	Yes	Yes
Technical help separately priced	Yes	Yes	Yes	Yes	Yes
PRICING & AVAILABILITY					
Purchase price of basic system, \$	16,890	18,490	18,990	35,000	20,890
Monthly rental of basic system, \$	—	—	—	—	—
Date of first U.S. delivery	1969	1970	1969	1973	November 1973
Number installed in U.S. to date	See Comments	See Comments	See Comments	See Comments	—
COMMENTS	The Nixdorf systems are manufactured in West Germany; over 35,000 systems have been installed to date, mainly in Europe, with about 2,500 in the United States.				

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MANUFACTURER & MODEL	Monroe 200	NCR Century 50 & Century 50 Mod 1	NCR Century 100	NCR Century 101	NCR 299-100
DATA FORMATS					
Word length, bits	16	8	8	8	64
Digits per word	12 or 15	1 or 2	1 or 2	1 or 2	16
Characters per word	None	1	1	1	8
Operand length, words	15	1-256	1-256	1-256	1
Instruction length, words	14 bits	4-8	4-8	4-8	1
INTERNAL STORAGE					
Type of storage	MOS shift register	Thin-film	Thin-film	Core	Core
Storage capacity, words	8 words	16K-32K	16K-32K	16K-64K	8K bits
Cycle time, microseconds/word	600	0.8	0.8	1.2	7 per bit
Storage usable for data	Yes	Yes	Yes	Yes	Yes
Storage usable for programs	No	Yes	Yes	Yes	Yes
PROCESSING					
Programming technique	Internally stored	Internally stored	Internally stored	Internally stored	Internally stored
No. of operational registers	10 and 18	63	63	63	7
Capacity of each register	12 or 15	1-word	1-word	1-word	64 bits
Add time, milliseconds/word	0.6	0.0590	0.0590	0.0288	220
KEYBOARD INPUT					
Alphanumeric (typewriter) keyboard	Standard	Optional unit	Optional unit	Optional unit	Standard
10-key numeric keyboard	No	No	No	No	Standard
Full accounting keyboard	No	No	No	No	No
STANDARD PRINTED OUTPUT					
Printing speed, chars/sec or lpm	18 cps	125 or 200 lpm	450/900 lpm	300 lpm	15 cps
Carriage width, inches	13	132 char.	132 char.	132 char.	24
Split platen	No	No	No	No	Standard
Pin-feed forms handling	Optional	Standard	Standard	Standard	Optional
Friction-feed forms handling	Standard	No	No	No	Standard
Journal roll handling	Standard	No	No	No	Standard
MAGNETIC LEDGER CARDS					
Data capacity, digits per card	No	No	No	No	No
Automatic card alignment	—	—	—	—	—
Automatic card feeding & stacking	—	—	—	—	—
MAGNETIC DISC I/O					
Max. on-line disc capacity, chars	No	Standard	Standard	Standard	No
Disc I/O speed, chars/sec	—	113,000,000	113,000,000	240,000,000	—
Interchangeable discs	—	108,000	108,000	315,000	—
	—	Yes	Yes	Yes	—
OTHER I/O UNITS					
Punched card input speed, cols/sec or cpm	No	300-1,200 cpm	300-1,200 cpm	300-1,200 cpm	No
Punched card output speed, cols/sec or cpm	—	100-294 cpm	100-460 cpm	100-460 cpm	—
Paper tape input speed chars/sec	—	1,000	1,000-1,500	1,000-1,500	—
Paper tape output speed, chars/sec	—	200	200	200	—
Line printer output speed, lines/min	—	125-900	450-3,000	300-3,000	—
Magnetic tape I/O speed, chars/sec	—	40,000 max.	80,000 max.	240,000 max.	—
Communications interface	—	Optional	Optional	Optional	—
SOFTWARE/SUPPORT					
Assembler	No	Yes	Yes	Yes	No
Compilers	No	COBOL, BASIC, FORTRAN, RPG	COBOL, BASIC, FORTRAN, RPG	COBOL, BASIC, FORTRAN, RPG	No
Application programs	Billing/posting	Many available	Many available	Many available	Many available
Software separately priced	No	Some	Some	Some	Yes
Technical help separately priced	No	Some	Some	Some	Yes
PRICING & AVAILABILITY					
Purchase price of basic system, \$	4,395	1,350 or 1,670	71,500	80,520	7,250
Monthly rental of basic system, \$ (1-year lease)	413	47,000 or 55,850	2,550	2,190	—
Date of first U.S. delivery	November 1972	February 1971	September 1968	April 1972	October 1973
Number installed in U.S. to date	1,500	Over 600	Over 2,000	Over 50	Over 1,000
COMMENTS	Designed for billing and invoicing applications & posting to ledger cards	These are the three smallest models in an upward-compatible family of eight models. All offer a wide range of peripheral equipment and software. The Century 50 Mod 1, introduced in April 1974, is distinguished from the original Century 50 only by a slower basic printer (125 vs. 200 lpm) and lower price (\$47,000 vs. \$55,850)			Features novel optical program entry technique; core memory holds up to 63 program statements and 50 totals

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MANUFACTURER & MODEL	NCR 299-200	NCR 395	NCR 399	NCR 400	NCR Century 8200
DATA FORMATS					
Word length, bits	64	—	4-2048	—	8
Digits per word	16	14	1-16	13	1
Characters per word	8	—	1-256	—	1
Operand length, words	1	1	1-256	1	—
Instruction length, words	1	—	6-12 digits	—	4 or 8 bytes
INTERNAL STORAGE					
Type of storage	Core	Disc	Core	Disc	Core
Storage capacity, words	16K	20-200	16K bytes	40-200	32K-48K bytes
Cycle time, microseconds/word	7 per bit	Not specified	1.2	Not specified	1.2
Storage usable for data	Yes	Yes	Yes	Yes	Yes
Storage usable for programs	Yes	No	Yes	No	Yes
PROCESSING					
Programming technique	Internally stored	Control panel, front bar	Internally stored	Mylar tape, front bar	Internally stored
No. of operational registers	8	—	—	—	—
Capacity of each register	64 bits	—	—	—	—
Add time, milliseconds/word	220	Not specified	2.2	Not specified	Not specified
KEYBOARD INPUT					
Alphanumeric (typewriter) keyboard	Standard	Standard	Standard	Standard	On CRT display
10-key numeric keyboard	Standard	No	Standard	No	No
Full accounting keyboard	No	Standard	Optional	Standard	No
STANDARD PRINTED OUTPUT					
Printing speed, chars/sec or lpm	15 cps	150 cycles/min.	20 cps	150 cycles/min.	125 lpm
Carriage width, inches	24	26	22.1	26 inches	132 positions
Split platen	Standard	Standard	Standard	Standard	No
Pin-feed forms handling	Optional	Optional	Optional	Optional	Standard
Friction-feed forms handling	Standard	Standard	Standard	Standard	No
Journal roll handling	Standard	Standard	Standard	Standard	No
MAGNETIC LEDGER CARDS					
Data capacity, digits per card	No	No	Optional	Optional	No
Automatic card alignment	—	—	354-1500	260	—
Automatic card feeding & stacking	—	—	Optional	Standard	—
MAGNETIC DISC I/O					
Max. on-line disc capacity, chars	No	No	Standard	No	Standard
Disc I/O speed, chars/sec	—	—	9,860,000	—	19,600,000
Interchangeable discs	—	—	312,000	—	—
	—	—	Yes	—	Yes
OTHER I/O UNITS					
Punched card input speed, cols/sec or cpm	No	133 cps	300 cpm	133 cps	300 cpm
Punched card output speed, cols/sec or cpm	—	25 cps	13-26 cpm	25 cps	—
Paper tape input speed, chars/sec	—	—	125	—	—
Paper tape output speed, chars/sec	—	30	75	30	—
Line printer output speed, lines/min	—	—	125, 200, 200	—	125, 200, 300
Magnetic tape I/O speed, chars/sec	Cassette	—	750 (cassette)	—	—
Communications interface	Optional	—	Optional	—	1 to 4 local CRT displays
SOFTWARE/SUPPORT					
Assembler	No	No	Yes	Yes	No
Compilers	No	No	No	No	No
Application programs	Many available	Many available	Many available	Many available	SPIRIT, A/R, A/P, payroll, gen. ledger
Software separately priced	Yes	Yes	Yes	Yes	No
Technical help separately priced	Yes	Yes	Yes	Yes	Yes
PRICING & AVAILABILITY					
Purchase price of basic system, \$	9,300	9,900	14,000	10,900	39,750
Monthly rental of basic system, \$	310	330	420	365	1,285
Date of first U.S. delivery	January 1975	Not specified	October 1972	1967	March 1975
Number installed in U.S. to date	—	Not specified	Not specified	4,500	—
COMMENTS	Features novel optical program entry technique and optional cassette I/O; core memory holds up to 126 program steps and 100 totals	Features standard typewriter keyboard plus full accounting keyboard; no longer in production	Tape cassette is used to store both application and control programs, mutually exclusive with cartridge disk	External program tape may be in either loop or strip form; no longer in production	Features SPIRIT software for order entry, inventory, and A/R; emulates Century 101 at 40-50% of 101 speed

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MANUFACTURER & MODEL	Nixdorf 840/123	Nixdorf 840/125	Nixdorf 840/135	Olivetti Auditronic 730	Olivetti P203
DATA FORMATS					
Word length, bits	12	12	12	84	Variable
Digits per word	1, 2, 3	1, 2, 3	1, 2, 3	14	15 or 30
Characters pwr word	1, 2	1, 2	1, 2	—	—
Operand length, words	1	1	1	14	½ char.
Instruction length, words	1-4	1-4	1-4	1	1 char.
INTERNAL STORAGE					
Type of storage	Core	Core	Core	Core	Delay line
Storage capacity, words	4K-8K	2K-16K	4K-16K	30 14-digit words	10 32-digit words
Cycle time, microseconds/word	2.0	2.0	2.0	24 per digit	Not specified
Storage usable for data	Yes	Yes	Yes	Yes	Yes
Storage usable for programs	Yes	Yes	Yes	No	Yes
PROCESSING					
Programming technique	Internally stored	Internally stored	Internally stored	Stored on mag. tape cartridged	Internally stored (see Comments)
No. of operational registers	15	15	15	30	3
Capacity of each register	Varies	Varies	Varies	14 digits each	30 digits
Add time, milliseconds/word	3.2	3.2	3.2	4.4	80
KEYBOARD INPUT					
Alphanumeric (typewriter) keyboard	Standard	Standard	Standard	Standard	Standard
10-key numeric keyboard	Standard	Standard	Standard	Standard	Standard
Full accounting keyboard	No	No	No	No	No
STANDARD PRINTED OUTPUT					
Printing speed, chars/sec or lpm	50 cps	50 cps	50 cps	15 cps	15 cps
Carriage width, inches	17.4	17.4	17.4	27.5	18
Split platen	No	No	No	Standard	Optional
Pin-feed forms handling	Standard	Standard	Standard	Standard	Optional
Friction-feed forms handling	No	No	No	Standard	Standard
Journal roll handling	No	No	No	Standard	Standard
MAGNETIC LEDGER CARDS					
Data capacity, digits per card	Standard	Standard	No	Optional	No
Automatic card alignment	1, 212/side	1, 212/side	—	50 chars/side	—
Automatic card feeding & stacking	Standard	Standard	—	Standard	—
	Optional	Optional	—	No	—
MAGNETIC DISC I/O					
Max. on-line disc capacity, chars	No	No	Standard	No	No
Disc I/O speed, chars/sec	—	—	2,800,000	—	—
Interchangeable discs	—	—	144,000	—	—
	—	—	Yes	—	—
OTHER I/O UNITS					
Punched card input speed, cols/sec or cpm	200 cps	200 cps	200 cps	No	No
Punched card output speed, cols/sec or cpm	19 or 50 cps	19 or 50 cps	19 or 50 cps	No	No
Paper tape input speed chars/sec	200	200	200	50	No
Paper tape output speed, chars/sec	25	25	25	15-50	40
Line printer output speed, lines/min	60-200	60-200	60-200	No	No
Magnetic tape I/O speed, chars/sec	420 (cassette)	420 (cassette)	420 (cassette)	Cartridge only	No
Communications interface	Optional	Optional	No	No	No
SOFTWARE/SUPPORT					
Assembler	No	No	No	No	No
Compilers	BOSS	BOSS	BOSS	BOSS	BOSS
Application programs	Many available	Many available	Many available	Std. business applications	Std. business applications
Software separately priced	Yes	Yes	Yes	Yes	Yes
Technical help separately priced	Yes	Yes	Yes	Yes	Yes
PRICING & AVAILABILITY					
Purchase price of basic system, \$	22,490	22,990	40,000	6,000	3,295
Monthly rental of basic system, \$	—	—	—	Leasing avail.	Leasing avail.
Date of first U.S. delivery	November 1973	November 1973	November 1973	Oct. 1971	April 1968
Number installed in U.S. to date	—	—	—	Over 250	Over 2,500
COMMENTS	The Nixdorf systems are manufactured in West Germany; over 35,000 systems have been installed to date, mainly in Europe, with about 2,500 in the United States.			Each mag. tape cartridge can contain 1280 instructions; over 50 applications available	Programs may contain up to 160 instructions & are loaded from magnetic cards; over 140 programs available

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MANUFACTURER & MODEL	Olivetti P603	Olivetti A5 Model 10	Olivetti A5 Model 20	Olivetti A5 Model 30	Olivetti A7 Model 80
DATA FORMATS					
Word length, bits	Variable	64	64	64	8
Digits per word	1-30	15 + sign	15 + sign	15 + sign	2 per byte
Characters per word	1-30	8	8	8	1 per byte
Operand length, words	½ char.	8 bits	8 bits	8 bits	1-3 bytes
Instruction length, words	1 char.	4 inst./word	4 inst./word	4 inst./word	1-2 bytes
INTERNAL STORAGE					
Type of storage	Delay line	MOS	MOS	MOS	MOS
Storage capacity, words	16 32-digit words*	0.5K-2K	1K-2K	1K-2K	16K-48K
Cycle time, microseconds/word	Not specified	1.5	1.5	1.5	0.9
Storage usable for data	Yes	Yes	Yes	Yes	Yes
Storage usable for programs	Yes	Yes	Yes	Yes	Yes
PROCESSING					
Programming technique	Internally stored	Internally stored	Internally stored	Internally stored	Internally stored
No. of operational registers	3	47	111-239	111-239	—
Capacity of each register	30 digits	1 word	1 word	1 word	—
Add time, milliseconds/word	Not specified	10	10	10	0.0061
KEYBOARD INPUT					
Alphanumeric (typewriter) keyboard	Standard	Standard	Standard	Standard	Standard
10-key numeric keyboard	Standard	Standard	Standard	Standard	Standard
Full accounting keyboard	No	No	No	No	No
STANDARD PRINTED OUTPUT					
Printing speed, chars/sec or lpm	15 cps	16 cps	16 cps	16 cps	40 cps
Carriage width, inches	18	18	18	18	26
Split platen	Optional	Standard	Standard	Standard	Standard
Pin-feed forms handling	Optional	Optional	Optional	Optional	Standard
Friction-feed forms handling	Standard	Standard	Standard	Standard	Standard
Journal roll handling	Standard	Standard	Standard	Standard	Standard
MAGNETIC LEDGER CARDS	No	No	No	Planned	Optional
Data capacity, digits per card	—	—	—	—	1,024
Automatic card alignment	—	—	—	—	Standard
Automatic card feeding & stacking	—	—	—	—	—
MAGNETIC DISC I/O	No	No	No	Planned	Standard
Max. on-line disc capacity, chars	—	—	—	—	512,000
Disc I/O speed, chars/sec	—	—	—	—	290,000
Interchangeable discs	—	—	—	Planned	Yes
OTHER I/O UNITS					
Punched card input speed, cols/sec or cpm	No	No	No	No	400 cpm
Punched card output speed, cols/sec or cpm	No	No	No	No	320 cpm
Paper tape input speed chars/sec	20	No	No	No	Yes
Paper tape output speed, chars/sec	20	20	20	20	Yes
Line printer output speed, lines/min	No	No	No	165 cps (serial)	120-1,200
Magnetic tape I/O speed, chars/sec	1,000	1,000 (cassette)	1,000 (cassette)	1,000 (cassette)	1,000 (cassette)
Communications interface	No	Optional	Optional	Optional	Optional
SOFTWARE/SUPPORT					
Assembler	No	Yes	Yes	Yes	Yes
Compilers	No	APCO	APCO	APCO	PL/1
Application programs	Std. business applications	Many available	Many available	Many available	Many available
Software separately priced	Yes	Yes	Yes	Yes	Yes
Technical help separately priced	Yes	Yes	Yes	Yes	Yes
PRICING & AVAILABILITY					
Purchase price of basic system, \$	6,990	4,750	6,325	7,925	9,600-25,000
Monthly rental of basic system, \$	Leasing avail.	240 (3-yr. lease)	256 (3-yr. lease)	320 (3-yr. lease)	240-626
Date of first U.S. delivery	July 1972	February 1975	February 1975	February 1975	March 1975
Number installed in U.S. to date	Over 1,000	—	—	—	—
COMMENTS	Programs loaded from magnetic cards can hold 384 instructions; over 100 applications available *Storage expandable to 3,854 words	Magnetic cards can be used for external storage of programs and for data input and output; each card holds 128 instructions, 256 characters, or 512 digits			See Comments for A7 models on next page

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MANUFACTURER & MODEL	Olivetti A7 Model 85	Olivetti A7 Model 90	Philips P-351	Philips P-352	Philips P-354
DATA FORMATS Word length, bits Digits per word Characters per word Operand length, words Instruction length, words	8 2 per byte 1 per byte 1-3 bytes 1-2 bytes	8 2 per byte 1 per byte 1-3 bytes 1-2 bytes	64 15 + sign 8 1 1	64 15 + sign 8 1 1	64 15 + sign 8 1 1
INTERNAL STORAGE Type of storage Storage capacity, words Cycle time, microseconds/word Storage usable for data Storage usable for programs	MOS 16K-48K 0.9 Yes Yes	MOS 16K-48K 0.9 Yes Yes	Core 400 3.5 Yes Yes	Core 400-1200 3.5 Yes Yes	Core 600-1200 3.5 Yes Yes
PROCESSING Programming technique No. of operational registers Capacity of each register Add time, milliseconds/word	Internally stored — — 0.0061	Internally stored — — 0.0061	Internally stored — — 1.5	Internally stored — — 1.5	Internally stored — — 1.5
KEYBOARD INPUT Alphanumeric (typewriter) keyboard 10-key numeric keyboard Full accounting keyboard	Standard Standard No	Standard Standard No	Standard Standard No	Standard Standard No	Standard Standard No
STANDARD PRINTED OUTPUT Printing speed, chars/sec or lpm Carriage width, inches Split platen Pin-feed forms handling Friction-feed forms handling Journal roll handling	40 cps 26 Standard Standard Standard Standard	40 cps 26 Standard Standard Standard Standard	40 cps 18 Standard Standard Standard Optional	40 cps 18 Standard Standard Standard Optional	40 cps 18 Standard Standard Standard Optional
MAGNETIC LEDGER CARDS Data capacity, digits per card Automatic card alignment Automatic card feeding & stacking	Optional 1,024 Standard —	Optional 1,024 Standard —	No — — —	No — — —	Standard 672/stripe Standard Yes
MAGNETIC DISC I/O Max. on-line disc capacity, chars Disc I/O speed, chars/sec Interchangeable discs	Standard 672,000 290,000 Yes	Standard 20,272,000 316,000 Yes	No — — —	Standard 4,600,000 Not specified Yes	Standard 4,600,000 Not specified Yes
OTHER I/O UNITS Punched card input speed, cols/sec or cpm Punched card output speed, cols/sec or cpm Paper tape input speed, chars/sec Paper tape output speed, chars/sec Line printer output speed, lines/min Magnetic tape I/O speed, chars/sec Communications interface	400 cpm 320 cpm Yes Yes 120-1,200 1,000 (cassette) Optional	400 cpm 320 cpm Yes Yes 120-1,200 1,000 (cassette) Optional	No 50 cps 50 50 No No No	280 cpm 50 cps 50 50 55 Tape cassette Optional	280 cpm 50 cps 50 50 55 Tape cassette Optional
SOFTWARE/SUPPORT Assembler Compilers	Yes PL/1	Yes PL/1	No No	Yes No	Yes No
Application programs Software separately priced Technical help separately priced	Many available Yes Yes	Many available Yes Yes	Over 200 available Yes Yes	Over 200 available Yes Yes	Over 200 available Yes Yes
PRICING & AVAILABILITY Purchase price of basic system, \$ Monthly rental of basic system, \$ Date of first U.S. delivery Number installed in U.S. to date	10,950-35,000 274-876 March 1975 —	11,750-49,000 294-1,377 March 1975 —	8,840 185 June 1970 Not specified	15,000 — June 1970 Not specified	15,500 — January 1972 See Comments
COMMENTS	Models 85 & 90 utilize a fixed disk as 160K auxiliary memory (virtual storage); all models of A7 have a 256-byte mag. card capability and a visual display console unit; multiprogramming is standard		Uses core storage for both instructions and data; upward compatible with larger Philips systems	See Comments on next page	See Comments on next page

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MANUFACTURER & MODEL	Philips P-356	Philips P-358	Philips P-359	Qantel System 800	Qantel System 900
DATA FORMATS					
Word length, bits	64	64	64	8	8
Digits per word	15 + sign	15 + sign	15 + sign	1 or 2	1 or 2
Characters per word	8	8	8	1	1
Operand length, words	1	1	1	1	1
Instruction length, words	1	1	1	2-5	2-5
INTERNAL STORAGE					
Type of storage	Core	Core	Core	MOS	MOS
Storage capacity, words	400-1200	600-1200	800-1200	4K	4K
Cycle time, microseconds/word	3.5	3.5	3.5	1.5	1.5
Storage usable for data	Yes	Yes	Yes	Yes	Yes
Storage usable for programs	Yes	Yes	Yes	Yes	Yes
PROCESSING					
Programming technique	Internally stored	Internally stored	Internally stored	Internally stored	Internally stored
No. of operational registers	—	—	—	1	1
Capacity of each register	—	—	—	16 words	16 words
Add time, milliseconds/word	1.5	1.5	1.5	0.128 (5 digits)	0.128 (5 digits)
KEYBOARD INPUT					
Alphanumeric (typewriter) keyboard	Standard	Standard	Standard	Standard	Standard
10-key numeric keyboard	Standard	Standard	Standard	Standard	Standard
Full accounting keyboard	No	No	No	No	No
STANDARD PRINTED OUTPUT					
Printing speed, chars/sec or lpm	40 cps	40 cps	40 cps	45 cps	45 cps
Carriage width, inches	29	29	29	15.5	15.5
Split platen	Standard	Standard	Standard	No	No
Pin-feed forms handling	Standard	Standard	Standard	Optional	Optional
Friction-feed forms handling	Standard	Standard	Standard	Standard	Standard
Journal roll handling	Optional	Optional	Optional	No	No
MAGNETIC LEDGER CARDS					
Data capacity, digits per card	No	Standard	Standard	No	No
Automatic card alignment	—	672/stripe	1,344/stripe	—	—
Automatic card feeding & stacking	—	Standard	Standard	—	—
	—	Yes	Yes	—	—
MAGNETIC DISC I/O					
Max. on-line disc capacity, chars	Standard	Standard	Standard	Standard	Standard
Disc I/O speed, chars/sec	4,600,000	4,600,000	4,600,000	12,000,000	12,000,000
Interchangeable discs	Not specified	Not specified	Not specified	666,000	666,000
	Yes	Yes	Yes	Yes	Yes
OTHER I/O UNITS					
Punched card input speed, cols/sec or cpm	280 cpm	280 cpm	280 cpm	500 cpm	500 cpm
Punched card output speed, cols/sec or cpm	50 cps	50 cps	50 cps	—	—
Paper tape input speed chars/sec	50	50	50	50	50
Paper tape output speed, chars/sec	50	50	50	50	50
Line printer output speed, lines/min	55	55	55	60-300	60-300
Magnetic tape I/O speed, chars/sec	Tape cassette	Tape cassette	Tape cassette	60,000	60,000
Communications interface	Optional	Optional	Optional	Optional	Optional
SOFTWARE/SUPPORT					
Assembler	Yes	Yes	Yes	Yes	Yes
Compilers	No	No	No	QIC	QIC
Application programs	Over 200 available	Over 200 available	Over 200 available	SOLUTION	SOLUTION
Software separately priced	Yes	Yes	Yes	Yes	Yes
Technical help separately priced	Yes	Yes	Yes	Yes	Yes
PRICING & AVAILABILITY					
Purchase price of basic system, \$	22,000	20,000	23,000	19,500	24,900
Monthly rental of basic system, \$	—	—	—	—	—
Date of first U.S. delivery	June 1972	May 1971	May 1971	March 1975	March 1975
Number installed in U.S. to date	See Comments	See Comments	See Comments	—	—
COMMENTS	Can control up to 16 I/O units, up to 4 of which can operate simultaneously. Can be equipped with 1 or 2 front forms feeds, journal roll feed, and continuous forms feed. P-358 and P-359 can have dual continuous forms feed. A mosaic line printer and an automatic magnetic ledger reader were added to the line in 1972. Magnetic tape cassette, extended core memory, and disks were added in 1973. Over 18,000 installed worldwide; over 1,200 in U.S.			Includes 6 million bytes disc storage, 45-cps printing terminal	Includes 6 million bytes disc storage, 45-cps auxiliary character printer, & video terminal

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MANUFACTURER & MODEL	Qantel System 1100, System 1200	Q1/LMC	RPG Data Systems RPG 310-1	RPG Data Systems RPG 310-2	RPG Data Systems RPG 310-3
DATA FORMATS Word length, bits Digits per word Characters per word Operand length, words Instruction length, words	8 1 or 2 1 1 2-5	8 2 1 1-255 1-3	8-bit byte 1 per byte 1 per byte Variable Variable	8-bit byte 1 per byte 1 per byte Variable Variable	8-bit byte 1 per byte 1 per byte Variable Variable
INTERNAL STORAGE Type of storage Storage capacity, words Cycle time, microseconds/word Storage usable for data Storage usable for programs	MOS 4K-32K 1.5 Yes Yes	MOS 4-64K 2 Yes Yes	Core/ROM 24K-64K 1.1 Yes Yes	Core/ROM 24K-64K 1.1 Yes Yes	Core/ROM 24K-64K 1.1 Yes Yes
PROCESSING Programming technique No. of operational registers Capacity of each register Add time, milliseconds/word	Internally stored — — 0.128 (5 digits)	Internally stored 8 8-16 bits 0.002	Internally stored 5 16/8 Not specified	Internally stored 10 16/8 Not specified	Internally stored 5 16/8 Not specified
KEYBOARD INPUT Alphanumeric (typewriter) keyboard 10-key numeric keyboard Full accounting keyboard	Standard Standard No	Standard Standard Standard	Standard Standard No	Standard Standard No	Standard Standard No
STANDARD PRINTED OUTPUT Printing speed, chars/sec or lpm Carriage width, inches Split platen Pin-feed forms handling Friction-feed forms handling Journal roll handling	165 cps 132 char. No Standard No No	45 cps 13 Yes Optional Standard No	165 to 1650 cps 132 char. No Standard No No	165 to 1650 cps 132 char. No Standard No No	165 to 1650 cps 132 char. No Standard No No
MAGNETIC LEDGER CARDS Data capacity, digits per card Automatic card alignment Automatic card feeding & stacking	No — — —	No — — —	No — — —	No — — —	No — — —
MAGNETIC DISC I/O Max. on-line disc capacity, chars Disc I/O speed, chars/sec Interchangeable discs	Standard 120,000,000 666,000 Yes	Standard 40,000,000 30,000 Yes	Standard 40,000,000 190,000 Yes	Standard 40,000,000 190,000 Yes	Standard 40,000,000 190,000 Yes
OTHER I/O UNITS Punched card input speed, cols/sec or cpm Punched card output speed, cols/sec or cpm Paper tape input speed, chars/sec Paper tape output speed, chars/sec Line printer output speed, lines/min Magnetic tape I/O speed, chars/sec Communications interface	500 cpm — 50 50 100-1,800 60,000 Optional	— — — — 600 — Optional	800 cps 96 cps 300 30-75 60-600 36,000-72,000 Optional	800 cps 96 cps 300 30-75 60-600 36,000-72,000 Optional	800 cps 96 cps 300 30-75 60-600 36,000-72,000 Optional
SOFTWARE/SUPPORT Assembler Compilers Application programs Software separately priced Technical help separately priced	Yes QIC Std. business applications Yes Yes	Yes PL/1 Several No Yes	Yes RPG II Several Yes Partially	Yes RPG II Several Yes Partially	Yes RPG II Several Yes Partially
PRICING & AVAILABILITY Purchase price of basic system, \$ Monthly rental of basic system, \$ Date of first U.S. delivery Number installed in U.S. to date	30,975/32,445 912/958 (66-mo. lease) April 1970 Over 250	14,750 — September 1973 100	33,500 — April 1973	65,000 — January 1974	35,000 — June 1974
COMMENTS	Both systems based on Answer hardware; 1100 supports 2 term- inals; 1200 sup- ports 6 terminals; all Qantel systems are upward- compatible		Single-CPU system	Dual-CPU system; shared data	RJE system for use with remote IBM 360/370 HASP or CDC 6000 EXPORT/ IMPORT

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MANUFACTURER & MODEL	Scidata Series 4	Scidata Series 5	Scidata Series 6	Singer 5005 Computer
DATA FORMATS Word length, bits Digits per word Characters per word Operand length, words Instruction length, words	12 — 2 3 bits 1	12 — 2 3 bits 1	16 — 2 6 bits 4 or 10 bits	48 12 — 1 7 bits/instr.
INTERNAL STORAGE Type of storage Storage capacity, words Cycle time, microseconds/word Storage usable for data Storage usable for programs	Core 16K 2.0 Yes Yes	Core 32K 2.0 Yes Yes	Core 64K 1.3 Yes Yes	Delay line 5 Not specified Yes See Comments
PROCESSING Programming technique No. of operational registers Capacity of each register Add time, milliseconds/word	Internally stored 16 12 bits 0.0026	Internally stored 16 12 bits 0.0026	Internally stored 8 16 bits 0.0023	Internally stored 3 12 digits 11.0
KEYBOARD INPUT Alphanumeric (typewriter) keyboard 10-key numeric keyboard Full accounting keyboard	Standard Standard Optional	Standard Standard Optional	Standard Standard Optional	Standard Optional No
STANDARD PRINTED OUTPUT Printing speed, chars/sec or lpm Carriage width, inches Split platen Pin-feed forms handling Friction-feed forms handling Journal roll handling	1,320 cps 132 char. No Standard No No	1,320 cps 132 char. No Standard No No	1,320 cps 132 char. No Standard No No	12 cps 16 or 20 Optional Optional Standard No
MAGNETIC LEDGER CARDS Data capacity, digits per card Automatic card alignment Automatic card feeding & stacking	No — — —	No — — —	No — — —	No — — —
MAGNETIC DISC I/O Max. on-line disc capacity, chars Disc I/O speed, chars/sec Interchangeable discs	Standard 13,200,000 — Yes	Standard 13,200,000 — Yes	Standard 13,200,000 — Yes	No — — —
OTHER I/O UNITS Punched card input speed, cols/sec or cpm Punched card output speed, cols/sec or cpm Paper tape input speed, chars/sec Paper tape output speed, chars/sec Line printer output speed, lines/min Magnetic tape I/O speed, chars/sec Communications interface	800 cps 67 cps — — 600 32,000 Optional	800 cps 67 cps — — 600 32,000 Optional	800 cps 67 cps — — 600 32,000 Optional	No No 70 (cartridge) 20 No No No
SOFTWARE/SUPPORT Assembler Compilers Application programs Software separately priced Technical help separately priced	Yes No — Yes Yes	Yes No — Yes Yes	Yes No — Yes Yes	No No Some Yes Yes
PRICING & AVAILABILITY Purchase price of basic system, \$ Monthly rental of basic system, \$ Date of first U.S. delivery Number installed in U.S. to date	45,000 — 1970 22	65,000 — 1970 70	90,000 — 1972 3	4,995 135 (5-yr. lease) March 1968 2,500
COMMENTS				Separate delay line memory holds 406 instructions. Programs are loaded from snap-on punched tape cartridges

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MANUFACTURER & MODEL	Singer System Ten, 110 Series	Singer System Ten, 210 Series	Singer System Ten, 310 Series	Singer System Ten, 410 Series	Sweda Int'l. Litton 1220-1, 1220-2
DATA FORMATS					
Word length, bits	6	6	6	6	40
Digits per word	1	1	1	1	12
Characters per word	1	1	1	1	5
Operand length, words	1-10 chars.	1-10 chars.	1-10 chars.	1-10 chars.	4 per word
Instruction length, words	10 chars.	10 chars.	10 chars.	10 chars.	4 per word
INTERNAL STORAGE					
Type of storage	Core	Core	Core	Core	Drum
Storage capacity, words	20K-40K	20K-160K	20K-160K	20K-160K	2,046
Cycle time, microseconds/word	3.3	3.3	3.3	3.3	2,550
Storage usable for data	Yes	Yes	Yes	Yes	Yes
Storage usable for programs	Yes	Yes	Yes	Yes	Yes
PROCESSING					
Programming technique	Internally stored	Internally stored	Internally stored	Internally stored	Internally stored
No. of operational registers	3 to 60	3 to 60	3 to 60	3 to 60	128
Capacity of each register	18 digits	18 digits	18 digits	18 digits	12 digits
Add time, milliseconds/word	0.180 (5 digits)	0.180 (5 digits)	0.180 (5 digits)	0.180 (5 digits)	14
KEYBOARD INPUT					
Alphanumeric (typewriter) keyboard	Standard plus CRT	Optional CRT	Optional CRT	Standard plus CRT	Standard
10-key numeric keyboard	On CRT	On CRT	On CRT	On CRT	Standard
Full accounting keyboard	No	No	No	No	No
STANDARD PRINTED OUTPUT					
Printing speed, chars/sec or lpm	25 or 30 cps	25 or 30 cps	25 or 30 cps	25 or 30 cps	35 cps
Carriage width, inches	17	13 or 17	13 or 17	13 or 17	190 positions
Split platen	No	No	No	No	Standard
Pin-feed forms handling	Standard	Standard	Standard	Standard	Standard
Friction-feed forms handling	No	Optional	Optional	No	Standard
Journal roll handling	No	No	No	No	Standard
MAGNETIC LEDGER CARDS					
Data capacity, digits per card	No	No	No	No	No
Automatic card alignment	-	-	-	-	-
Automatic card feeding & stacking	-	-	-	-	-
MAGNETIC DISC I/O					
Max. on-line disc capacity, chars	Standard	Standard	Optional	Standard	No
Disc I/O speed, chars/sec	20,000,000	160,000,000	160,000,000	160,000,000	-
Interchangeable discs	299,166	299,166	299,166	299,166	-
	Yes	Yes	Yes	Yes	-
OTHER I/O UNITS					
Punched card input speed, cols/sec or cpm	No	1,000 cpm max.	1,000 cpm max.	1,000 cpm max.	No
Punched card output speed, cols/sec or cpm	No	300 cpm max.	300 cpm max.	300 cpm max.	No
Paper tape input speed chars/sec	No	275	275	275	50
Paper tape output speed, chars/sec	No	150	150	150	50
Line printer output speed, lines/min	450	600	600	600	55
Magnetic tape I/O speed, chars/sec	No	20,000	20,000	20,000	No
Communications interface	No	Optional	Optional	Optional	No
SOFTWARE/SUPPORT					
Assembler	Yes	Yes	Yes	Yes	See Comments
Compilers	RPG II	RPG II, BASIC	RPG II, BASIC	RPG II, BASIC	No
Application programs	See Comments	See Comments	See Comments	See Comments	Over 40 available
Software separately priced	Yes	Yes	Yes	Yes	Yes
Technical help separately priced	No	No	No	No	No
PRICING & AVAILABILITY					
Purchase price of basic system, \$	25,000	46,050	15,320	64,754	14,900
Monthly rental of basic system, \$	-	1,624	568	2,273	395
Date of first U.S. delivery	June 1973	June 1970	June 1973	June 1971	1970
Number installed in U.S. to date	250	2,500	150	250	See Comments
COMMENTS	All models are upward-compatible and feature novel hardware-level multi-programming capability. Applications software includes Client Accounting System for public accountants, Factory Information Control System, and packages for general accounting, hospitals, schools, construction, project control, etc.; 410 Series can be used in terminal-oriented POS and factory information systems				See Comments on next page

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MANUFACTURER & MODEL	Sweda Int'l. Litton 1221-1, 1221-2	Sweda Int'l. Litton 1231	Sweda Int'l. Litton 1241	Sweda Int'l. Litton 1251	Sweda Int'l. Litton 1281
DATA FORMATS					
Word length, bits	40	40	40	40	40
Digits per word	12	12	12	12	12
Characters per word	5	5	5	5	5
Operand length, words	4 per word	4 per word	4 per word	4 per word	4 per word
Instruction length, words	4 per word	4 per word	4 per word	4 per word	4 per word
INTERNAL STORAGE					
Type of storage	Drum	Drum	Drum	Drum	Drum
Storage capacity, words	2,046	2,046	4,096	20,480	4,096
Cycle time, microseconds/word	2,550	2,550	2,550	2,550	2,550
Storage usable for data	Yes	Yes	Yes	Yes	Yes
Storage usable for programs	Yes	Yes	Yes	Yes	Yes
PROCESSING					
Programming technique	Internally stored	Internally stored	Internally stored	Internally stored	Internally stored
No. of operational registers	256	500	2,000	18,000	2,000
Capacity of each register	12 digits	12 digits	12 digits	12 digits	12 digits
Add time, milliseconds/word	14	14	14	14	14
KEYBOARD INPUT					
Alphanumeric (typewriter) keyboard	Standard	Standard	Standard	Standard	Standard
10-key numeric keyboard	Standard	Standard	Standard	Standard	Standard
Full accounting keyboard	No	No	No	No	No
STANDARD PRINTED OUTPUT					
Printing speed, chars/sec or lpm	35 cps	35 cps	35 cps	35 cps	35 cps
Carriage width, inches	190 positions	190 positions	190 positions	190 positions	190 positions
Split platen	Standard	Standard	Standard	Standard	Standard
Pin-feed forms handling	Standard	Standard	Standard	Standard	Standard
Friction-feed forms handling	Standard	Standard	Standard	Standard	Standard
Journal roll handling	Standard	Standard	Standard	Standard	Standard
MAGNETIC LEDGER CARDS	No	No	No	No	Standard
Data capacity, digits per card	—	—	—	—	1199
Automatic card alignment	—	—	—	—	No
Automatic card feeding & stacking	—	—	—	—	No
MAGNETIC DISC I/O	No	No	No	No	No
Max. on-line disc capacity, chars	—	—	—	—	—
Disc I/O speed, chars/sec	—	—	—	—	—
Interchangeable discs	—	—	—	—	—
OTHER I/O UNITS					
Punched card input speed, cols/sec or cpm	No	No	80 cps	80 cps	80 cps
Punched card output speed, cols/sec or cpm	No	No	No	No	No
Paper tape input speed chars/sec	50	50	50	50	50
Paper tape output speed, chars/sec	50	50	50	50	50
Line printer output speed, lines/min	55	55	55	55	55
Magnetic tape I/O speed, chars/sec	No	No	No	No	No
Communications interface	No	No	No	No	No
SOFTWARE/SUPPORT					
Assembler	See Comments	See Comments	See Comments	See Comments	See Comments
Compilers	No	No	No	No	No
Application programs	Over 40 available	Over 40 available	Over 40 available	Over 40 available	Over 40 available
Software separately priced	Yes	Yes	Yes	Yes	Yes
Technical help separately priced	No	No	No	No	No
PRICING & AVAILABILITY					
Purchase price of basic system, \$	16,150	19,760	22,760	26,900	22,960
Monthly rental of basic system, \$	428	524	615	745	625
Date of first U.S. delivery	1970	1968	October 1970	March 1973	September 1971
Number installed in U.S. to date	See Comments	See Comments	See Comments	See Comments	See Comments
COMMENTS	Over 3,500 of the Litton 1200 and 1300 systems have been installed. Mnemonic Interpretive language facilitates programming. All models can read and punch tape and edge-punched cards at 50 characters/second.				

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MANUFACTURER & MODEL	Sweda Int'l. Litton 1300	Synectics, Inc. System 1/300	Ultimacc	Ultimacc Model XP	Ultimacc Super Disc
DATA FORMATS					
Word length, bits	8	16	16	16	16
Digits per word	2	4	4	4	4
Characters per word	1	2	2 or 3	2 or 3	2 or 3
Operand length, words	Variable	1	Variable	Variable	Variable
Instruction length, words	2-6 bytes	1	Variable	Variable	Variable
INTERNAL STORAGE					
Type of storage	Core	Core	Core	Core	Core
Storage capacity, words	8K-40K	8K	16K-32K	16K-128K	16K-128K
Cycle time, microseconds/word	0.7	1.2	1.2	0.8	0.8
Storage usable for data	Yes	Yes	Yes	Yes	Yes
Storage usable for programs	Yes	Yes	Yes	Yes	Yes
PROCESSING					
Programming technique	Internally stored	Internally stored	Internally stored	Internally stored	Internally stored
No. of operational registers	16	4	4	4	4
Capacity of each register	16 bits	1 word	1 word	1	1
Add time, milliseconds/word	0.71	0.00135	0.00135	0.001	0.001
KEYBOARD INPUT					
Alphanumeric (typewriter) keyboard	Standard	Standard	Standard	Standard	Standard
10-key numeric keyboard	Standard	Optional	Standard	Standard	Standard
Full accounting keyboard	No	No	No	No	No
STANDARD PRINTED OUTPUT					
Printing speed, chars/sec or lpm	140 cps	15 cps	300 lpm	300 lpm	300 lpm
Carriage width, inches	132 positions	9.75	136 positions	136 positions	136 positions
Split platen	No	No	No	No	No
Pin-feed forms handling	Optional	Standard	Standard	Standard	Standard
Friction-feed forms handling	No	Standard	No	No	No
Journal roll handling	No	Optional	No	No	No
MAGNETIC LEDGER CARDS	No	No	No	No	No
Data capacity, digits per card	-	-	-	-	-
Automatic card alignment	-	-	-	-	-
Automatic card feeding & stacking	-	-	-	-	-
MAGNETIC DISC I/O	No	Standard	Standard	Standard	Standard
Max. on-line disc capacity, chars	-	5,000,000	40,000,000	40,000,000	160,000,000
Disc I/O speed, chars/sec	-	200,000	245,000	245,000	670,000
Interchangeable discs	-	Yes	Yes	Yes	Yes
OTHER I/O UNITS					
Punched card input speed, cols/sec or cpm	No	267 cps	267 cps	267 cps	267 cps
Punched card output speed, cols/sec or cpm	No	No	No	No	No
Paper tape input speed chars/sec	No	10-300	300	300	300
Paper tape output speed, chars/sec	No	75	100	100	100
Line printer output speed, lines/min	No	60-500	300	600	600
Magnetic tape I/O speed, chars/sec	1,250 (cassette)	Optional	36,000	36,000	36,000
Communications interface	No	Optional	Optional	Optional	Optional
SOFTWARE/SUPPORT					
Assembler	Yes	No	Yes	Yes	Yes
Compilers	No	No	BASIC, FORTRAN	BASIC, FORTRAN	BASIC, FORTRAN
Application programs	Client accounting, A/R, A/P, payroll	Many available	See Comments	See Comments	See Comments
Software separately priced	Yes	No	No	No	No
Technical help separately priced	No	Conversion—Yes	No	No	No
PRICING & AVAILABILITY					
Purchase price of basic system, \$	20,250	35,000-40,000	60,000	75,000-150,000	100,000-300,000
Monthly rental of basic system, \$	-	895-950 (5-yr. lease)	1,320 (5-yr. lease)	1,650-3,300 (5-yr. lease)	2,200-6,600 (5-yr. lease)
Date of first U.S. delivery	4th qtr. 1974	October 1973	August 1971	January 1975	October 1975
Number installed in U.S. to date	Not specified	2	85	5	-
COMMENTS	Basic system includes processor, dual cassette drives, 140-cps printer and keyboard; CRT display & third cassette are opt.	TTY or CRT input; system is designed for wholesale distribution	Based on Data General 1200 and 830 minicomputers. Basic disc storage capacity is 10 million bytes. On-line inventory control system, bill of material processing, production control, material requirements planning, order entry, invoicing, A/R, A/P, sales analysis, general ledger, and payroll applications. Turnkey prices include programming and support, multiprogrammed video display and keyboard input. Capable of supporting up to 16 I/O devices.		

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MANUFACTURER & MODEL	UNIVAC 9200	UNIVAC 9300	Xerox 530
DATA FORMATS			
Word length, bits	8-bit byte	8-bit byte	16
Digits per word	2	2	4
Characters per word	1	1	2
Operand length, words	1-2 bytes	1-2 bytes	1 or 2
Instruction length, words	4-6 bytes	4-6 bytes	1
INTERNAL STORAGE			
Type of storage	Plated wire	Plated wire	Core
Storage capacity, words	8K-16K bytes	8K-32K bytes	8K-64K
Cycle time, microseconds/word	1.2 per byte	0.6 per byte	0.8
Storage usable for data	Yes	Yes	Yes
Storage usable for programs	Yes	Yes	Yes
PROCESSING			
Programming technique	Internally stored	Internally stored	Internally stored
No. of operational registers	8	8	8
Capacity of each register	16 bits	16 bits	16 bits
Add time, milliseconds/word	0.103 (5 digits)	0.052 (5 digits)	0.00192
KEYBOARD INPUT			
Alphanumeric (typewriter) keyboard	Optional	Optional	Optional
10-key numeric keyboard	Optional	Optional	Optional
Full accounting keyboard	No	No	No
STANDARD PRINTED OUTPUT			
Printing speed, chars/sec or lpm	250/300 lpm	600 lpm	10 cps
Carriage width, inches	120 or 132 positions	120 or 132 positions	12
Split platen	No	No	No
Pin-feed forms handling	No	No	Optional
Friction-feed forms handling	No	No	Standard
Journal roll handling	No	No	No
MAGNETIC LEDGER CARDS	No	No	No
Data capacity, digits per card	-	-	-
Automatic card alignment	-	-	-
Automatic card feeding & stacking	-	-	-
MAGNETIC DISC I/O	Optional	Optional	Optional
Max. on-line disc capacity, chars	233,400,000	233,400,000	200,000,000
Disc I/O speed, chars/sec	312,000	312,000	312,000
Interchangeable discs	Yes	Yes	Yes
OTHER I/O UNITS			
Punched card input speed, cols/sec or cpm	400-1,000 cpm	600-1,000 cpm	265-2,000 cps
Punched card output speed, cols/sec or cpm	75-250 cpm	75-250 cpm	130 cps
Paper tape input speed chars/sec	300	300	300
Paper tape output speed, chars/sec	110	110	120
Line printer output speed, lines/min	250-2,000	600-2,000	350-1,250
Magnetic tape I/O speed, chars/sec	68,320 max.	68,320 max.	30,000-60,000
Communications interface	Optional	Optional	Optional
SOFTWARE/SUPPORT			
Assembler	Yes	Yes	Yes
Compilers	COBOL, FORTRAN, RPG	COBOL, FORTRAN, RPG	COBOL, FORTRAN, RPG II
Application programs	Many available	Many available	Many available
Software separately priced	No	No	No
Technical help separately priced	No	No	No
PRICING & AVAILABILITY			
Purchase price of basic system, \$	48,336	102,864	20,000-48,700
Monthly rental of basic system, \$	1,007	2,143	798-1,700
Date of first U.S. delivery	June 1967	June 1967	August 1973
Number installed in U.S. to date	See Comments	See Comments	Not specified
COMMENTS	Available in a wide range of card, magnetic tape, and disc-oriented configurations. Larger, upward-compatible systems are available. Approximately 4,100 systems were delivered. See Report 70C-877-01 for details		Designed for multi-use application, performing real-time, communications, and batch jobs concurrently in business and scientific environments. Can serve in network systems with most other computers