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All About Small Accounting Computers

In the price and performance range between conventional accounting machines and full-fledged computer systems, there is a class of data processing equipment that is currently filling the needs of thousands of businesses of all types and sizes. Though these machines employ a wide variety of programming and storage techniques, they are typically characterized by purchase prices in the $5,000 to $50,000 range, modest internal processing capabilities, and a strong emphasis upon direct keyboard input and low-speed printed output.

These low-cost business data processing systems are known by numerous names: Electronic Accounting Machines, Office Computers, Electronic Billing Computers, Magnetic Record Computers, etc. To simplify matters, we have chosen to use the generic term "small accounting computers" throughout this report.

WHO MAKES THEM

The leading U.S. suppliers of small accounting computers have long been Burroughs Corporation and the National Cash Register Company. It is no coincidence that Burroughs and NCR are also the leading suppliers of conventional adding and accounting 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. No official statistics are available as to the size or distribution of this market, but it has been reliably estimated that Burroughs and NCR each command roughly a one-third share of a $900 million worldwide market for accounting machines and small accounting computers.

IBM, the dominant supplier of both larger computer systems and punched-card tabulating equipment, has not fared as well in the small accounting computer market to date. But the IBM System/3 Model 6—with its disc storage, fast printer, and optional CRT display output—is a strong recent entry at the upper end of this segment of the market. Other major suppliers of American-made small accounting computers include the Automated Business Systems Division of Litton Industries and the Friden Division of the Singer Company. Several smaller companies, including Automated Information Systems, Atron, and Clary Datacomp Systems, offer small business data processing systems based upon minicomputers with comparatively powerful internal processing capabilities.

European-made equipment is making a much greater impact upon the small accounting computer market than in any other segment of the U.S. computer market. Honeywell, Olivetti, and Philips are marketing equipment which they manufacture in France, Italy, and the Nether-

This comprehensive survey summarizes the characteristics of 30 small accounting computers from 13 suppliers. These keyboard-oriented business data processing systems, priced in the $5,000 to $50,000 range, come in a wide range of configurations and capabilities. Designed mainly for small companies, they are being productively employed in many large organizations as well.

lands, respectively. And Victor Comptometer, a leading U.S. supplier of adding machines and calculators, is marketing a line of German-made equipment that has already gained wide acceptance in Europe.

WHO NEEDS THEM

The small accounting computers are, of course, designed primarily to serve the business data processing needs of small companies. The principal sales targets are the more than 200,000 U.S. business and government organizations with between 20 and 500 employees. Smaller companies ▷

The Burroughs L 4000, like the other models of Burroughs' popular L Series accounting computers and TC Series communications terminals, features a magnetic disc memory that holds data, the user's programs, and "firmware" (microprogramming) which controls the system's arithmetic and logic operations. The 20-char/sec "ball printer" uses a print sphere similar to the IBM Selectric print element.

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▷ will usually find it difficult to justify the price tags on these machines, while larger organizations will usually need more powerful computers.

For many of these small companies, a computer—when properly selected, installed, programmed, operated, and appreciated—can lead to far smoother operations and higher profits. In addition to processing routine transactions, a computer can produce reports that give management the information it needs to achieve improved customer service, reduced inventories, tighter cost control, and increased production efficiency. But in far too many cases, especially in smaller companies, 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 inclination for such training, the next best approach is to hire an independent consulting firm to provide guidance in the selection and installation of an appropriate computer system.

Though the small accounting computers are designed mainly for use in small companies, they are also being productively used in some of the nation's largest corporations. Hardly anyone would seriously recommend the use of a dozen or more small accounting computers in place of, say, one large IBM System/360. But these low-cost systems can effectively serve large companies in a variety of specialized applications such as these:

- 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 computers perform both local data processing functions and communications control functions in company-wide data communications networks.

APPLICATIONS

In their basic configurations, most of the small accounting computers consist of a processing unit, a keyboard for data entry, and a serial (typewriter-style) printer for data output. All variable data for each transaction is entered by the operator through the on-line 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 discs, leading to greatly increased processing speeds and flexibility.

For most small accounting 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 throughput of a system will rarely exceed a few transactions per minute.

Many of the 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. But this is seldom done, probably because of the limited internal processing and storage capabilities of these machines. One leading supplier of small accounting computers states that less than 20 percent of the systems it installs are equipped with any input/output devices beyond the basic keyboard, printer, and (in some models) magnetic ledger card capabilities.

As their name implies, the small accounting computers are designed and used predominantly for applications of the accounting type. Very few of these systems are suitable for applications in the scientific, engineering, management sciences, or information storage and retrieval categories.

Within the accounting realm, billing is by far the most common application for these systems. The order entry, invoicing, and accounts receivable functions constitute the lifeblood of many small businesses, as well as the functions that require the most clerical effort to process manually. As a result, the billing application alone frequently justifies the installation of a computer. Indeed, several of the systems included in our survey are officially designated as "Billing Computers," although they are suitable for other applications as well.

Payroll is probably the next most important application for the small accounting computers, with inventory control, accounts payable, general ledger accounting, and sales analysis also ranking high on the list. In addition to these broad general classes of applications, the small accounting computers are capable of effectively handling many of the specialized data processing needs of manufacturing, wholesaling, retailing, financial, educational, government, and service organizations.

BUYING ADVICE

As with all categories of data processing equipment, the watchword in selecting a small accounting 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. ▷

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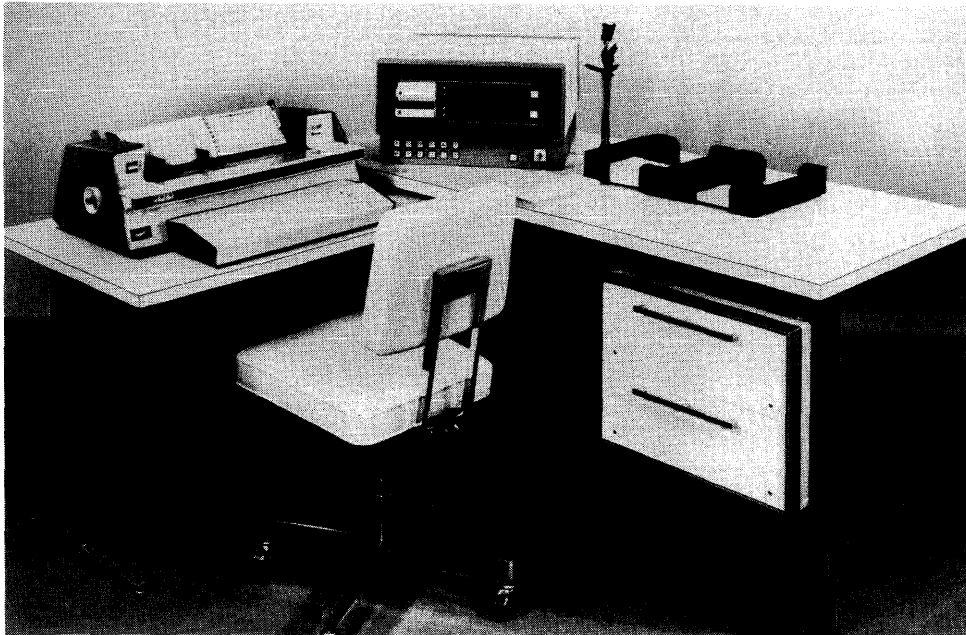
The ULTIMACC system, from Automated Information Systems, Inc., consists of a Data General NOVA minicomputer, a Litton 30-char/sec keyboard/printer, and a Tri-Data 4-tape magnetic tape cartridge unit. AIS supplies the hardware interfaces, standard software, and custom programming, and sells the system on a turnkey basis for accounting applications in small businesses.

▷ 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 knocks on its 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 contract you sign.

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

If all this sounds like too much trouble, or just plain incomprehensible, your company (like hundreds of others) could be heading for serious losses of time and money through installation of an unsuitable computer system. In that case, you need the assistance of an independent consulting firm that has no vested interest except to see that your data processing needs are fully satisfied. Dozens of qualified consulting firms stand ready to serve you, and DATAPRO 70 Feature Report 70F-050-01 provides useful guidelines for selecting and employing consulting services effectively. Though the price of outside consulting help may seem high, it's likely to represent one of the wisest EDP investments you'll ever make.

You'll find a great deal of additional useful advice in DATAPRO 70 Feature Report 70F-100-01, "How to Plan and Implement a New Computer Installation," and in the following explanations of the comparison chart entries. ▷

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▷ **THE COMPARISON CHARTS**

The characteristics of 30 small accounting computers from 13 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 November and December of 1970; their close cooperation with the Datapro Research staff in the preparation of these charts is greatly appreciated.

The comparison chart entries and their significance to potential users of small accounting 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 accounting 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.

Digits per word is the number of decimal digits that can be represented within each machine word. 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. Most systems use either six or eight bits to represent each character. Some small accounting computers are incapable of processor or storing alphanumeric information, in which case this entry is blank.

Operand length is the length of each unit of data upon which the basic internal processing operations, such 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 accounting computers store their data and their programs in separate storage units, the instruction length may be unrelated to the data word length. ▷
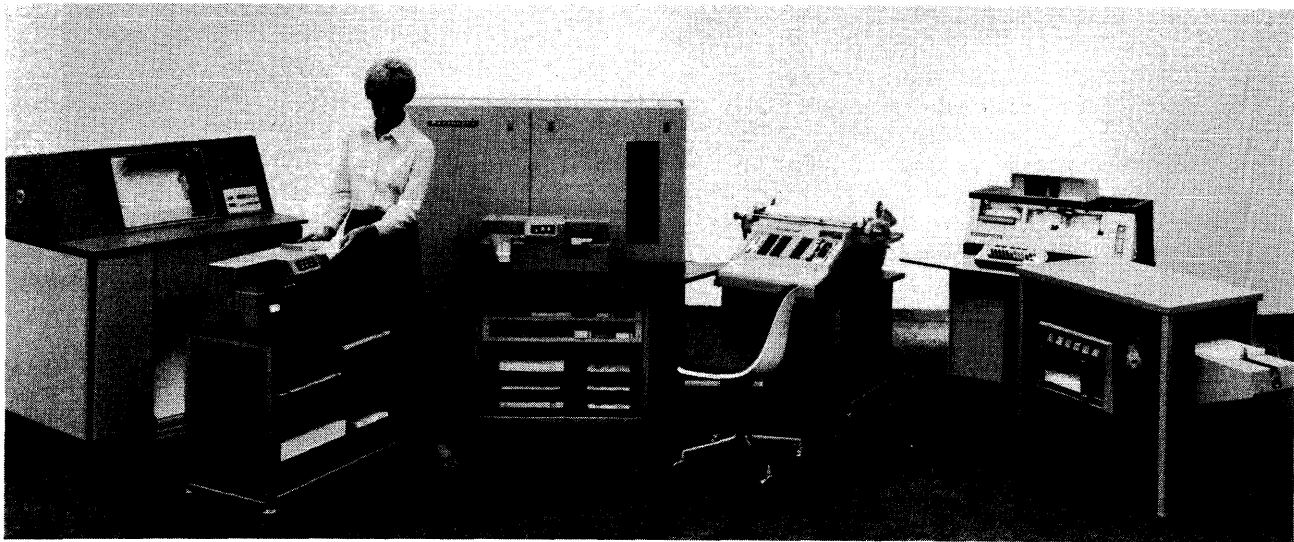
The Burroughs E 8000 is the largest model in the company's extensive and widely accepted E Series of electronic accounting systems. This "full-house" configuration includes central processor (background), control console (behind chair), automatic magnetic-striped ledger reader (at right), two card readers, card punch, and printer. Programs for the E 8000 can be written in COBOL and compiled on a Burroughs B 3500 computer system.

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▷ **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 accounting 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 accounting computers. Semiconductor storage, which is expected to gradually supersede core storage as the principal storage medium for larger computers, has yet to make its appearance on the small accounting computer scene.

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 oper-

ands 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 accounting 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 ranks 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 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 refused to specify the storage cycle times of their machines—and DATAPRO 70 believes every prospective ▷
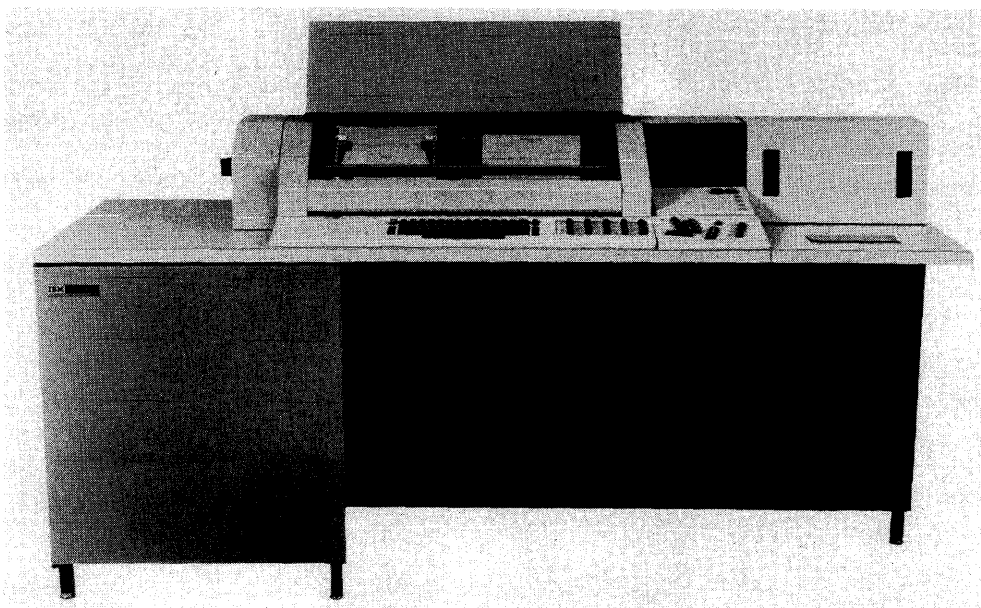
The IBM 6430, unlike the older members of the IBM 6400 Series, is controlled by an internally stored program. The 6430 has three separate core storage areas capable of holding 160 or 320 instructions, 64 numeric data words, and 96 alphanumeric characters, respectively. The Selectric-style printer has 220 print positions and flexible forms-handling capabilities.

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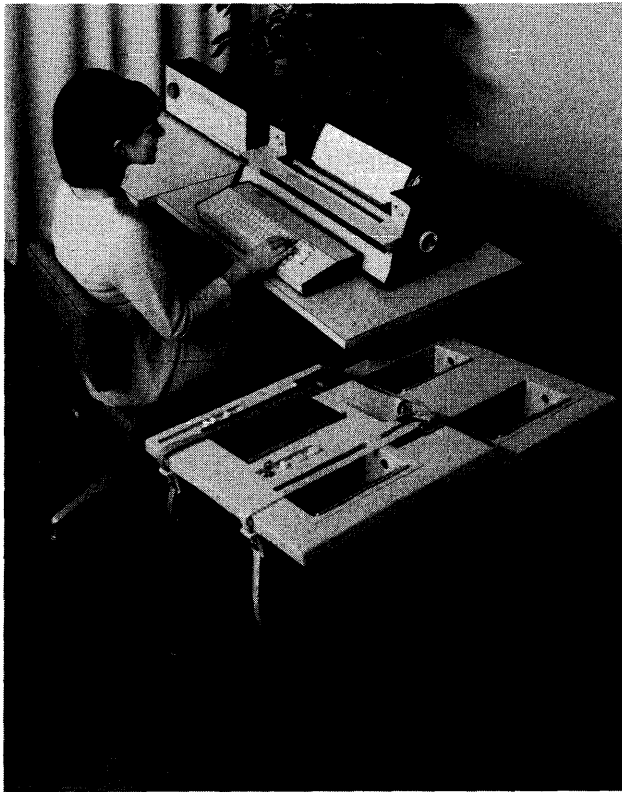
The Litton EBS/1231 has a 2048-word magnetic drum memory that stores both instructions and data. The 35-char/sec wheel-type printer features three independent form feeds. The Distributape Console (foreground) handles both reading and punching of edge-punched cards or paper tape at 50 characters per second.

buyer has a right to know all the basic specifications of every computer, even in cases where the data's relevance is questionable.

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 number 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 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 accounting computers, however, are *externally programmed.* The instructions which comprise 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 frequently 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 accounting 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 ▷

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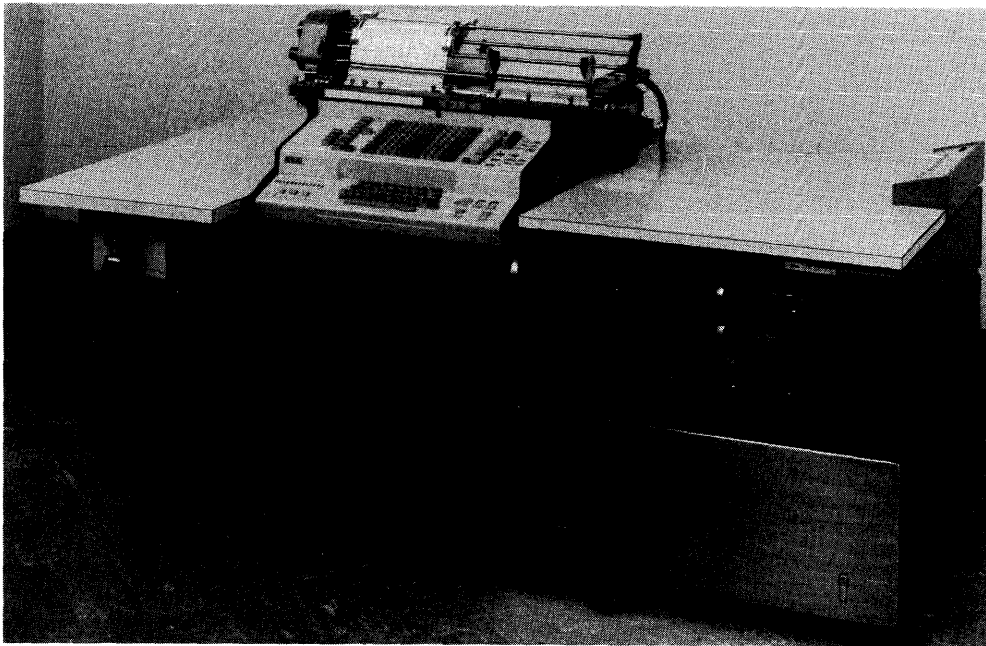
The widely used NCR 400 retains the full numeric keyboard that is familiar to most accounting machine operators. Instructions are read from a Mylar tape loop, and a disc memory holds up to 200 words of data. The optional 486-1 Magnetic Ledger Reader, at right, provides high-speed input of data previously recorded on magnetic-striped ledger cards.

▷ 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 accounting 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.

Printed Output

Printed documents and reports represent the principal form—and frequently the only form—of output from most small accounting 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 7 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 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. ▷

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▷ *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 accounting 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 accounting 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 may of the advantages of both traditional visible records and machine-readable media such as punched cards or magnetic tape. Their principal 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 capability 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 accounting 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.

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. ▷

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▷ **Other I/O Units**

Many of the small accounting 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 all 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 Feature Report 70F-370-01, "How to Select 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.

Line printers can be added to some small accounting 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 accounting 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 preparation of other programs. It enables the programmer to ▷

The Olivetti Auditronic 770 stores both programs and data on magnetic tape cartridges. The basic cartridge holds up to 36,960 characters, and an optional "supplementary memory" stores an additional 57,750 characters. An internal data memory holds 841 characters. Forms-handling facilities are unusually flexible.

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▷ 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—yet compilers are available for only a few of the small accounting computers. The reason is that compilation is an intricate process that requires more storage space and processing power than most of these systems provide. Even where compilers are offered, they frequently include only restricted subsets of the standard programming languages and/or require the use of a larger computer to perform the compilation process.

Application programs. Some 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 nearly every case. 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
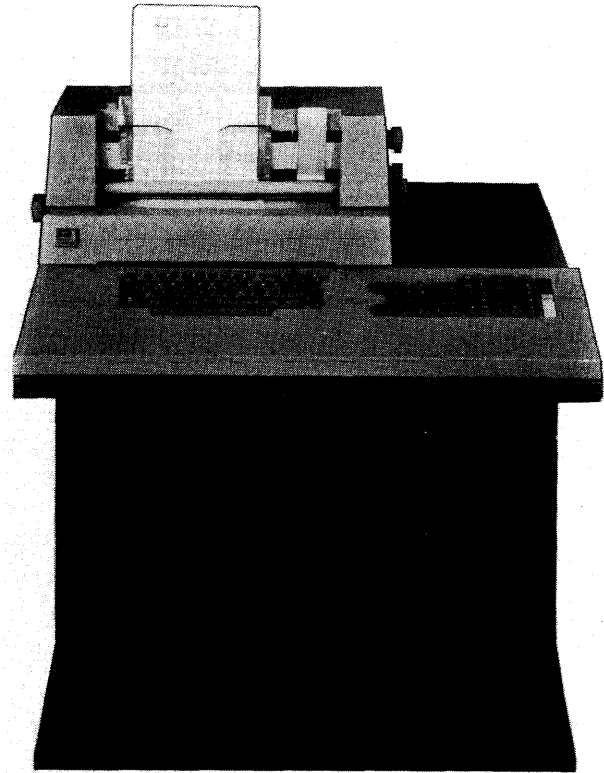
The Victor 820/10 Computer Billing System is one of numerous models in the Series 800, manufactured by Nixdorf in West Germany and sold and serviced by Victor Comptometer in the United States. The Series 800 machines feature both core and "rod cell" storage, plus microprogrammed logic. The unit shown here is equipped with an optional front feed that facilitates the insertion of individual forms.

bill for a typical small accounting 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 all independent consulting firm). In fact, the manufacturer does *all* the programming for the great majority of small accounting 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 ▷

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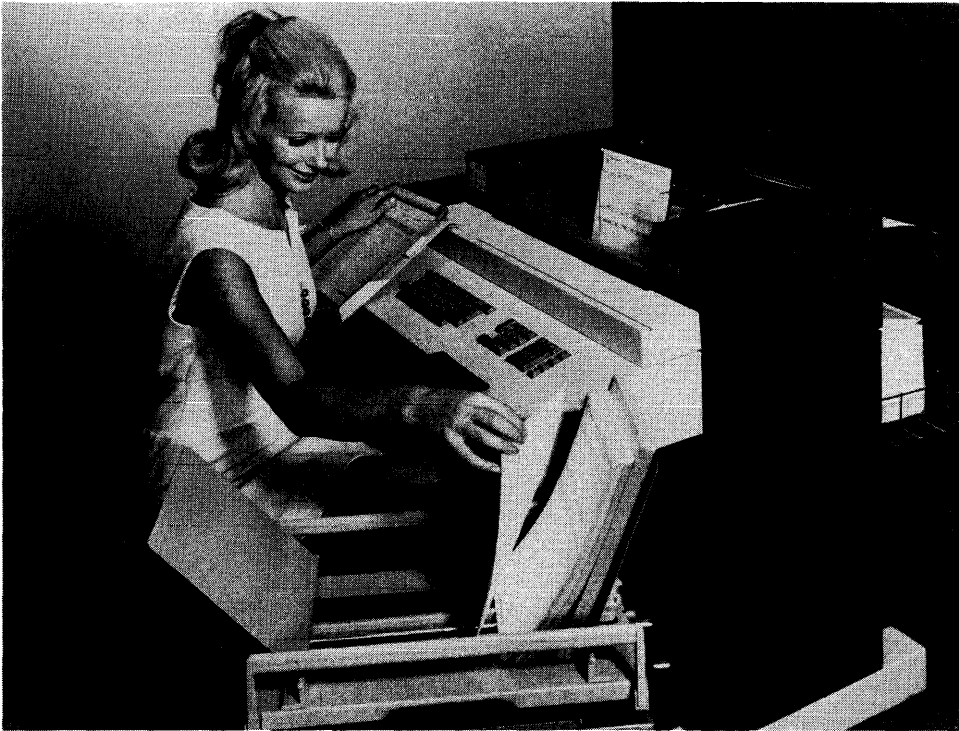
The Philips P-350 Series Office Computers feature 400 to 1200 15-digit words of core storage for both programs and data. The larger models can accommodate as many as 16 peripheral devices, up to 4 of which can operate simultaneously. Though the P-350 Series is a recent arrival on the U.S. market, several thousand systems have already been sold in Europe.

▷ 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.

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 December 1, 1970. 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 and addresses of the 13 suppliers whose products are summarized in the comparison charts that follow.

Automated Information Systems, Inc., 1064 River Road, Edgewater, New Jersey 07020.

Atron Corporation, 1256 Trapp Road, St. Paul, Minnesota 55118.

Burroughs Corporation, 6071 Second Avenue, Detroit, Michigan 48232.

Clary Datacomp Systems, Inc., 404 Junipero Serra Drive, San Gabriel, California 91776. ▷

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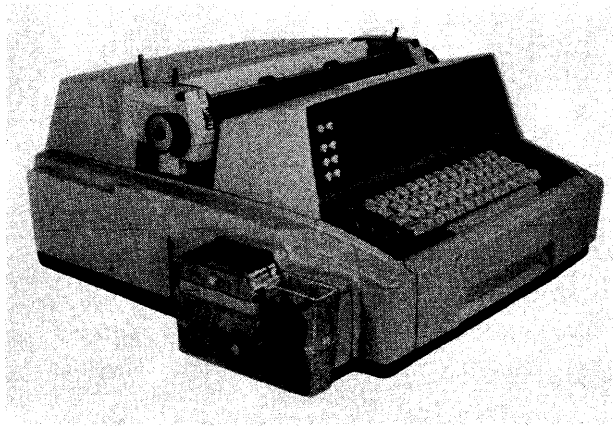
The 5005 Computyper Billing Machine, from the Friden Division of Singer Company, is a low-priced, ultra-compact unit that stores programs of up to 406 instructions in a delay-line memory. The programs are loaded from snap-on punched tape cartridges. Data storage capacity is limited to five 12-digit words.

▷ Honeywell Information Systems, Inc., 200 Smith Street, Waltham, Massachusetts 02154.

International Business Machines Corporation, Data Processing Division, 112 East Post Road, White Plains, New York 10601.

Litton Industries, Inc., Automated Business Systems Division, 600 Washington Avenue, Carlstadt, New Jersey 07072.

The National Cash Register Company, Main and K Streets, Dayton, Ohio 45409.

Olivetti Underwood Corporation, 1 Park Avenue, New York, New York 10016.

Philips Business Systems, Inc. (a subsidiary of North American Philips Corporation), 100 East 42nd Street, New York, New York 10017.

The Singer Company, Friden Division, 2350 Washington Avenue, San Leandro, California 94577.

TAB Products Company, 2690 Hanover Street, Palo Alto, California 94304.

Victor Comptometer Corporation, Computer Division, 3900 North Rockwell Street, Chicago, Illinois 60618. ☐

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MANUFACTURER & MODEL	Automated Information Systems ULTIMACC	Atron 501 Datamanager	Burroughs Series E 3000	Burroughs Series E 4000	Burroughs Series E 8000
DATA FORMATS					
Word length, bits	16	8-bit byte	—	—	—
Digits per word	2 or 4	1 per byte	12 + sign	12 + sign	12 + sign
Characters per word	2	1 per byte	—	6	6
Operand length, words	Variable	1 to 256 bytes	1	1	1
Instruction length, words	Variable	1 to 5 bytes	—	3 Instr./word	3 Instr./word
INTERNAL STORAGE					
Type of storage	Core	Core	Core	Core	Core
Storage capacity, words	4K to 32K	4K to 32K bytes	100 max.	200 max.	400
Cycle time, microseconds/word	2.6	2.0	545,000	12	12
Storage usable for data	Yes	Yes	Yes	Yes	Yes
Storage usable for programs	Yes	Yes	No	Yes	Yes
PROCESSING					
Programming technique	Internally stored	Internally stored	Control panel	Internally stored	Internally stored
No. of operational registers	4 accumulators	Variable	—	—	—
Capacity of each register	1 word	Variable	—	—	—
Add time, milliseconds/word	0.0059	0.006/byte	545	1.596	1.596
KEYBOARD INPUT					
Alphanumeric (typewriter) keyboard	Standard	Optional	Standard	Optional	Standard
10-key numeric keyboard	Standard	No	No	No	No
Full accounting keyboard	No	No	Standard	Standard	Standard
PRINTED OUTPUT					
Printing speed, chars/sec	30	14.8	7	7	7
Carriage width, inches	17	15.5	22	22	22
Split platen	Standard	No	Optional	Standard	Standard
Pin-feed forms handling	Standard	Standard	No	Optional	Optional
Friction-feed forms handling	Standard	Optional	Standard	Standard	Standard
Journal roll handling	Standard	No	Standard	Standard	Standard
MAGNETIC LEDGER CARDS	No	No	Optional	Optional	Standard
Data capacity, digits per card	—	—	52	120 or 240	240
Automatic card alignment	—	—	Optional	Optional	Standard
Automatic card feeding & stacking	—	—	Optional	Optional	Optional
MAGNETIC DISC I/O	Optional	Optional	No	No	No
Max. on-line disc capacity, chars	10,000,000	20,000,000	—	—	—
Disc I/O speed, chars/sec	400,000	196,000	—	—	—
Interchangeable discs	Yes	Optional	—	—	—
OTHER I/O UNITS					
Punched card input speed, cols/sec	Optional	300	No	132	264
Punched card output speed, cols/sec	130	13	22	22	22
Paper tape input speed, chars/sec	300	10	No	No	No
Paper tape output speed, chars/sec	100	10	25	25	25
Line printer output speed, lines/min	200 to 300	135	No	No	165
Magnetic tape I/O speed, chars/sec	1900	20,000	No	No	No
Communications interface	Optional	Optional	No	No	No
SOFTWARE & SUPPORT					
Assembler	Yes	Yes	No	No	Yes
Compilers	No	No	No	No	Yes
Application programs	Std. business applications	Communications control only	—	Std. business applications	Std. business applications
Software separately priced	Some	No	No	Yes	Yes
Technical help separately priced	Optional	Yes	No	Yes	Yes
PRICING & AVAILABILITY					
Purchase price of basic system	$42,500	$19,350	$8,500-14,000	$17,000-26,500	$18,000-30,000
Monthly rental of basic system	$975 (5-year lease)	$775	$390-445	$425-665	$500-750
Date of first U.S. delivery	Jan. 1971	Sept. 1969	1967	1967	1970
Number installed in U.S. to date	3 by Feb. 1971	150	1,850	3,500	900
COMMENTS	4-tape magnetic tape cartridge unit is principal I/O and file medium. Leases available for up to 7 years.	Basic system price includes 4K bytes, card reader, and IBM Selectric as printer.	Provides 30 50, 80, or 100 words of core storage.	External "Program Control Center" complements stored program by controlling print format, etc	COBOL programs can be compiled on a Burroughs B 3500 computer system.

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MANUFACTURER & MODEL	Burroughs L 2000 & L 3000	Burroughs L 4000	Burroughs L 5000	Clary Datacomp 404	Honeywell GE-55
DATA FORMATS					
Word length, bits	64	64	64	16	8-bit byte
Digits per word	16	16	16	4	1 or 2/byte
Characters per word	8	8	8	2	1/byte
Operand length, words	1	1	1	1 to 4	1 to 10 bytes
Instruction length, words	4 instr./word	4 instr./word	4 instr./word	1 or 2	1 to 8 bytes
INTERNAL STORAGE					
Type of storage	Disc	Disc	Disc	Core	Core
Storage capacity, words	1280	1280	1280	4K to 65K	5K or 10K bytes
Cycle time, microseconds/word	See Comments	See Comments	See Comments	2.0	7.9
Storage usable for data	Yes	Yes	Yes	Yes	Yes
Storage usable for progams	Yes	Yes	Yes	Yes	Yes
PROCESSING					
Programming technique	Internally stored	Internally stored	Internally stored	Internally stored	Internally stored
No. of operational registers	—	—	—	4	100
Capacity of each register	—	—	—	1 word	5 bytes
Add time, milliseconds/word	40	40	40	0.09/15 digits	2.0/9 digits
KEYBOARD INPUT					
Alphanumeric (typewriter) keyboard	Standard	Standard	Standard	Standard	Standard
10-key numeric keyboard	Standard	Standard	Standard	Optional	Standard
Full accounting keyboard	No	No	No	No	No
PRINTED OUTPUT					
Printing speed, chars/sec	20	20	20	15 to 165	100 or 200 lpm
Carriage width, inches	15	26	26	15	16
Split platen	Standard	Standard	Standard	Optional	No
Pin-feed forms handling	Standard	Standard	Standard	Standard	Standard
Friction-feed forms handling	Standard	Standard	Standard	Optional	No
Journal roll handling	Standard	Standard	Standard	Optional	No
MAGNETIC LEDGER CARDS	No	No	Standard	Optional	No
Data capacity, digits per card	—	—	349	720 or 2160	—
Automatic card alignment	—	—	Standard	Standard	—
Automatic card feeding & stacking	—	—	Standard	Standard	—
MAGNETIC DISC I/O	No	No	No	Optional	No
Max. on-line disc capacity, chars	—	—	—	30,000,000	—
Disc I/O speed, chars/sec	—	—	—	200,000	—
Interchangeable discs	—	—	—	Yes	—
OTHER I/O UNITS					
Punched card input speed, cols/sec	133	133	133	400	200
Punched card output speed, cols/sec	22	22	22	80	40
Paper tape input speed, chars/sec	40	40	40	500	No
Paper tape output speed, chars/sec	40	40	40	80	No
Line printer output speed, lines/min	No	No	No	600	100 or 200
Magnetic tape I/O speed, chars/sec	No	No	No	72,000	No
Communications interface	Optional	Optional	No	Optional	Optional
SOFTWARE & SUPPORT					
Assembler	Yes	Yes	Yes	Yes	Yes
Compilers	COBOL	COBOL	COBOL	COBOL, BASIC	GECOL
Application programs	Many available	Many available	Many available	Accounting, MIS	Std. business applications
Software separately priced	Yes	Yes	Yes	Some	No
Technical help separately priced	Yes	Yes	Yes	Some	No
PRICING & AVAILABILITY					
Purchase price of basic system	$8,490	$10,490	$19,900	$19,950	$38,690
Monthly rental of basic system	$215	$360	$495	$575 (5-year lease)	$990
Date of first U.S. delivery	Feb. 1969	May 1970	Oct. 1970	Jan. 1970	Jan. 1969
Number installed in U.S. to date	Over 2000	Over 200	Over 25	Not specified	Not specified
COMMENTS	Disc memory has 32 tracks, each served by a fixed read/write head, and 5-millisecond average access time. L 3000 accommodates front-inserted forms, while L 2000 does not. L 2000 with communications interface becomes TC 500, described in Report 70D-112-01.			Magnetic Card Unit reads and writes at up to 3000 chars/sec.	For details, see DATAPRO 70 Report 70C-450-02.

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MANUFACTURER & MODEL	Honeywell GE-58	IBM 6405	IBM 6420	IBM 6430	IBM System/3 Model 6
DATA FORMATS					
Word length, bits	8-bit byte	—	—	—	8 per byte
Digits per word	1 or 2/byte	10 + sign	10 + sign	10 + sign	1 per byte
Characters per word	1/byte	—	Variable	Variable	1 per byte
Operand length, words	1 to 10 bytes	1	1	1	1-16 digits
Instruction length, words	1 to 8 bytes	—	—	6 digits	4-6 bytes
INTERNAL STORAGE					
Type of storage	Core	Core	Core	Core	Core
Storage capacity, words	5K or 10K bytes	20 to 120	20 to 40	See Comments	8K to 16K bytes
Cycle time, microseconds/word	1.2	Not specified	Not specified	Not specified	1.52
Storage usable for data	Yes	Yes	Yes	Yes	Yes
Storage usable for programs	Yes	No	No	Yes	Yes
PROCESSING					
Programming technique	Internally stored	Plugboard; 60 to 190 program steps	Plugboard; 100 to 190 program steps	Stored; 160 or 320 instructions	Stored
No. of operational registers	100	—	—	—	—
Capacity of each register	5 bytes	—	—	—	—
Add time, milliseconds/word	0.12/9 digits	4.32	4.32	4.32	0.026 (5 digits)
KEYBOARD INPUT					
Alphanumeric (typewriter) keyboard	Standard	Standard	Standard	Standard	Standard
10-key numeric keybard	Standard	Standard	Standard	Standard	Standard
Full accounting keyboard	No	No	No	No	No
PRINTED OUTPUT					
Printing speed, chars/sec	100 or 200 lpm	15.5	15.5	15.5	85
Carriage width, inches	16	22	22	22	13.2 or 22
Split platen	No	Standard	Standard	Standard	Optional
Pin-feed forms handling	Standard	Standard	Standard	Standard	Standard
Friction-feed forms handling	No	Standard	Standard	Standard	Optional
Journal roll handling	No	No	No	No	No
MAGNETIC LEDGER CARDS	No	No	Optional	No	No
Data capacity, digits per card	—	—	191 characters	—	—
Automatic card alignment	—	—	Yes	—	—
Automatic card feeding & stacking	—	—	Optional	—	—
MAGNETIC DISC I/O	Optional	No	No	No	Standard
Max. on-line disc capacity, chars	4.6 million	—	—	—	9.8 million
Disc I/O speed, chars/sec	156,250	—	—	—	199,000
Interchangeable discs	Yes	—	—	—	Yes
OTHER I/O UNITS					
Punched card input speed, cols/sec	133 or 267	15	15	15	20
Punched card output speed, cols/sec	40	15	15	15	20
Paper tape input speed, chars/sec	No	15	15	No	No
Paper tape output speed, chars/sec	No	15	15	No	No
Line printer output speed, lines/min	100 or 200	No	No	No	No
Magnetic tape I/O speed, chars/sec	No	No	No	No	No
Communications interface	Optional	No	No	No	Optional
SOFTWARE & SUPPORT					
Assembler	Yes	No	No	No	No
Compilers	MiniCOBOL	No	No	No	BASIC, RPG II
Application programs	Std. business applications	No	No	No	None to date
Software separately priced	No	—	—	—	Yes
Technical help separately priced	Some	Yes	Yes	Yes	Yes
PRICING & AVAILABILITY					
Purchase price of basic system	$35,490	$10,430	$17,655	$15,315	$46,450
Monthly rental of basic system	$910	$333	$532	$435	$975
Date of first U.S. delivery	Oct. 1970	1965	1964	1967	Dec. 1970
Number installed in U.S. to date	Not specified	Not specified	Not specified	Not specified	Not specified
COMMENTS	For details DATAPRO 70 Report 70C-450-02.	Has from 4 to 24 selectors and 20 command keys.	Basic storage of 20-40 numeric words is augmented by special alpha and ledger storage.	Three separate storage areas hold 64 numeric words, 96 alpha chars., and 160 or 320 instructions.	For details, see DATAPRO 70 Report 70C-491-21. Offers optional CRT display output.

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EBS Series SAC

MANUFACTURER & MODEL	Litton EBS/1210	Litton EBS/1231	Litton EBS/1241	NCR 395	NCR 400
DATA FORMATS					
Word length, bits	36	40	40	—	—
Digits per word	10	10	10	14	13
Characters per word	—	5	5	—	—
Operand length, words	1	1	1	1	1
Instruction length, owrds	1	1	1	—	—
INTERNAL STORAGE					
Type of storage	Drum	Drum	Drum	Disc	Disc
Storage capacity, words	375	2048	4096	20 to 200	40 to 200
Cycle time, microseconds/word	17,100	5000	5000	Not specified	Not specified
Storage usable for data	Yes	Yes	Yes	Yes	Yes
Storage usable for programs	Yes	Yes	Yes	No	No
PROCESSING					
Programming technique	Internally stored	Internally stored	Internally sotred	Control panel, front bar	Mylar tape, front bar
No. of operational registers	—	—	—	—	—
Capacity of each register	—	—	—	—	—
Add time, milliseconds/word	Not specified	25	Not specified	Not specified	Not specified
KEYBOARD INPUT					
Alphanumeric (typewriter) keyboard	Standard	Standard	Standard	Standard	Standard
10-key numeric keyboard	No	Standard	Standard	No	No
Full accounting keyboard	No	No	No	Standard	Standard
PRINTED OUTPUT					
Printing speed, chars/sec	10	35	35	150 cycles/min.	150 cycles/min.
Carriage width, inches	70 positions	190 positions	190 positions	26 inches	26 inches
Split platen	No	Standard	Standard	Standard	Standard
Pin-feed forms handling	Standard	Standard	Standard	Optional	Optional
Friction-feed forms handling	No	Standard	Standard	Standard	Standard
Journal roll handling	No	Standard	Standard	Standard	Standard
MAGNETIC LEDGER CARDS	No	No	No	No	Optional
Data capacity, digits per card	—	—	—	—	260
Automatic card alignment	—	—	—	—	Standard
Automatic card feeding & stacking	—	—	—	—	Optional
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	No	No	No	133	133
Punched card output speed, cols/sec	No	No	No	25	25
Paper tape input speed, chars/sec	30	50	50	No	No
Paper tape output speed, chars/sec	10	50	50	30	30
Line printer output speed, lines/min	No	No	No	No	No
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	No	Yes
Compilers	No	No	No	No	No
Application programs	Over 40 avail.	Over 40 avail.	Over 40 avail.	Many available	Many available
Software separately priced	Some	Some	Some	Yes	Yes
Technical help separately priced	Not specified	Not specified	Not specified	Yes	Yes
PRICING & AVAILABILTIY					
Purchase price of basic system	$7,950	$19,760	$22,760	$9,900	$13,900
Monthly rental of basic system	—	—	—	$355	$425
Date of first U.S. delivery	Not specified	June 1968	Oct. 1970	1964	1967
Number installed in U.S. to date	Not specified	Not specified	Not specified	Not specified	4500
COMMENTS	System price includes 1 custom and 2 packaged programs; additional software is separately priced. Mnemonic Interpretive Language facilitates programming. EBS/1231 and 1241 read and punch edge-punched cards and paper tape at 50 chars/sec.			Features standard typewriter keyboard plus full accounting keyboard.	External program tape may be in either loop or strip form.

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P-350 Series

MANUFACTURER & MODEL	Olivetti Auditronic 770	Olivetti P203	Philips P-351	Philips P-352	Philips P-353
DATA FORMATS					
Word length, bits	Variable	—	64	64	64
Digits per word	Variable	15 or 30	15 + sign	15 + sign	15 + sign
Characters per word	Variable	—	8	8	8
Operand length, words	Variable	15 or 30 digits	1	1	1
Instruction length, words	Variable	1 digit/instr.	1	1	1
INTERNAL STORAGE					
Type of storage	Mag. tape cartr.	Registers	Core	Core	Core
Storage capacity, words	95,000 chars.	7 30-digit words	400	400 to 1200	400 to 1200
Cycle time, microseconds/word	Not specified	Not specified	3.5	3.5	3.5
Storage usable for data	Yes	Yes	Yes	Yes	Yes
Storage usable for programs	Yes	Yes	Yes	Yes	Yes
PROCESSING					
Programming technique	Stored on mag. tape cartridges	Internally stored (see Comments)	Internally stored	Internally stored	Internally stored
No. of operational registors	4	3	—	—	—
Capacity of each register	134 chars. total	30 digits each	—	—	—
Add time, milliseconds/word	30	80	1.5	1.5	1.5
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
PRINTED OUTPUT					
Printing speed, chars/sec	15	14	40	40	40
Carriage width, inches	27.5	18	18	18	18
Split platen	Standard	Optional	Standard	Standard	Standard
Pin-feed forms handling	Standard	No	Standard	Standard	Standard
Friction-feed forms handling	Standard	Standard	Standard	Standard	Standard
Journal roll handling	Standard	Standard	Optional	Optional	Optional
MAGNETIC LEDGER CARDS	Optional	No	No	No	Standard
Data capacity, digits per card	300 chars/side	—	—	—	128/side
Automatic card alignment	Standard	—	—	—	Standard
Automatic card feeding & stacking	No	—	—	—	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	133	No	No	373	373
Punched card output speed, cols/sec	20	No	50	50	50
Paper tape input speed, chars/sec	50	No	No	50	50
Paper tape output speed, chars/sec	50	40	50	50	50
Line printer output speed, lines/min	No	No	No	No	No
Magnetic tape I/O speed, chars/sec	Not specified	No	No	No	No
Communications interface	Optional	No	No	Optional	Optional
SOFTWARE & SUPPORT					
Assembler	No	No	No	Yes	Yes
Compilers	Yes (generators)	No	No	No	No
Application programs	Std. business applications	Std. business applications	Over 15 avail.	Over 15 avail.	Over 15 avail.
Software separately priced	Yes	Yes	Yes	Yes	Yes
Technical help separately priced	Yes	Yes	Yes	Yes	Yes
PRICING & AVAILABILITY					
Purchase price of basic system	$12,150	$6,250	$8,395	$10,990	$14,990
Monthly rental of basic system	$350	$193	$185	$242	$330
Date of first U.S. delivery	June 1970	Spring 1968	June 1970	June 1970	June 1970
Number installed in U.S. to date	22	Not specified	Not specified	Not specified	Not specified
COMMENTS	1 or 2 mag. tape cartridges hold both instructions and data. Also has 841 characters of internal data memory.	Programs may contain up to 160 instructions and are loaded from magnetic cards.	Uses core storage for both instructions and data. Upward compatible with P-352 and P-353.	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.	

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TAB Prod Co.   *800 Series Inc*

MANUFACTURER & MODEL	Singer (Friden Div.) 5005 Computyper	TAB 130	Victor 820/10	Victor 820/21	Victor 820/30
DATA FORMATS					
Word length, bits	48	8-bit byte	64 & 18	64 & 18	64 & 18
Digits per word	12	1 per byte	16 & 4	16 & 4	16 & 4
Characters per word	—	1 per byte	8 & 3	8 & 3	8 & 3
Operand length, words	1	Variable	1	1	1
Instruction length, words	7 bits/instr.	1 to 5 bytes	18 bits/instr.	18 bits/instr.	18 bits/instr.
INTERNAL STORAGE					
Type of storage	Delay line	Core	Core & rod cell	Core & rod cell	Core & rod cell
Storage capacity, words	5	4K to 32K bytes	6560 max.	17,408 max.	17,408 max.
Cycle time, microseconds/word	Not specified	1.0	2.0	2.0	2.0
Storage usable for data	Yes	Yes	Yes	Yes	Yes
Storage usable for programs	See Comments	Yes	Yes	Yes	Yes
PROCESSING					
Programming technique	Internally stored	Internally stored	Internally stored	Internally stored	Internally stored
No. of operational registers	3	16	15	15	15
Capacity of each register	12 digits	16 bits	Varies	Varies	Varies
Add time, milliseconds/word	11	0.006/byte	7.2	7.2	7.2
KEYBOARD INPUT					
Alphanumeric (typewriter) keyboard	Standard	Standard	Standard	Standard	Standard
10-key numeric keyboard	Optional	Optional	Standard	Standard	Standard
Full accounting keyboard	No	No	No	No	No
PRINTED OUTPUT					
Printing speed, chars/sec	12	15	15	15	15
Carriage width, inches	16 or 20	15	13.5	13.5	13.5
Split platen	Optional	Optional	No	No	Standard
Pin-feed forms handling	Optional	Standard	Optional	Optional	Optional
Friction-feed forms handling	Standard	Standard	Standard	Standard	Standard
Journal roll handling	No	Standard	No	No	No
MAGNETIC LEDGER CARDS	No	No	No	No	Standard
Data capacity, digits per card	—	—	—	—	1024
Automatic card alignment	—	—	—	—	Standard
Automatic card feeding & stacking	—	—	—	—	No
MAGNETIC DISC I/O	No	Optional	No	No	No
Max. on-line disc capacity, chars	—	4,000,000	—	—	—
Disc I/O speed, chars/sec	—	Not specified	—	—	—
Interchangeable discs	—	Yes	—	—	—
OTHER I/O UNITS					
Punched card input speed, cols/sec	No	400	200	200	200
Punched card output speed, cols/sec	No	No	50	50	50
Paper tape input speed, chars/sec	70 (cartridge)	No	200	200	200
Paper tape output speed, chars/sec	17	No	25	25	25
Line printer output speed, lines/min	No	300 or 600	No	No	No
Magnetic tape I/O speed, chars/sec	No	Not specified	No	No	No
Communications interface	No	Optional	No	No	Optional
SOFTWARE & SUPPORT					
Assembler	No	Yes	Yes	Yes	Yes
Compilers	No	No	No	No	No
Application programs	No	No	Many available	Many available	Many available
Software separately priced	No	No	Yes	Yes	Yes
Technical help separately priced	No	No	Yes	Yes	Yes
PRICING & AVAILABILITY					
Purchase price of basic system	$4,995	$24,500	$8,990	$11,990	$21,490
Monthly rental of basic system	$165	—	—	—	—
Date of first U.S. delivery	March 1968	Dec. 1969	Jan. 1969	Jan. 1969	Jan. 1969
Number installed in U.S. to date	1500	Over 25	See Comments	See Comments	See Comments
COMMENTS	Separate delay line memory holds 406 instructions. Programs are loaded from snap-on punched tape cartridges.	Manufactured by Eldorado Electrodata Corp. Includes 3 mag. tape cassette drives.	Other models available, at prices as low as $5,990. Contain 16 to 1024 64-bit words of core storage, up to 16,384 18-bit words of rod cell program storage, plus microprograms. Manufactured by Nixdorf in West Germany. Total of approx. 200 installed in U.S. and over 10,000 in all.		

     JANUARY 1971