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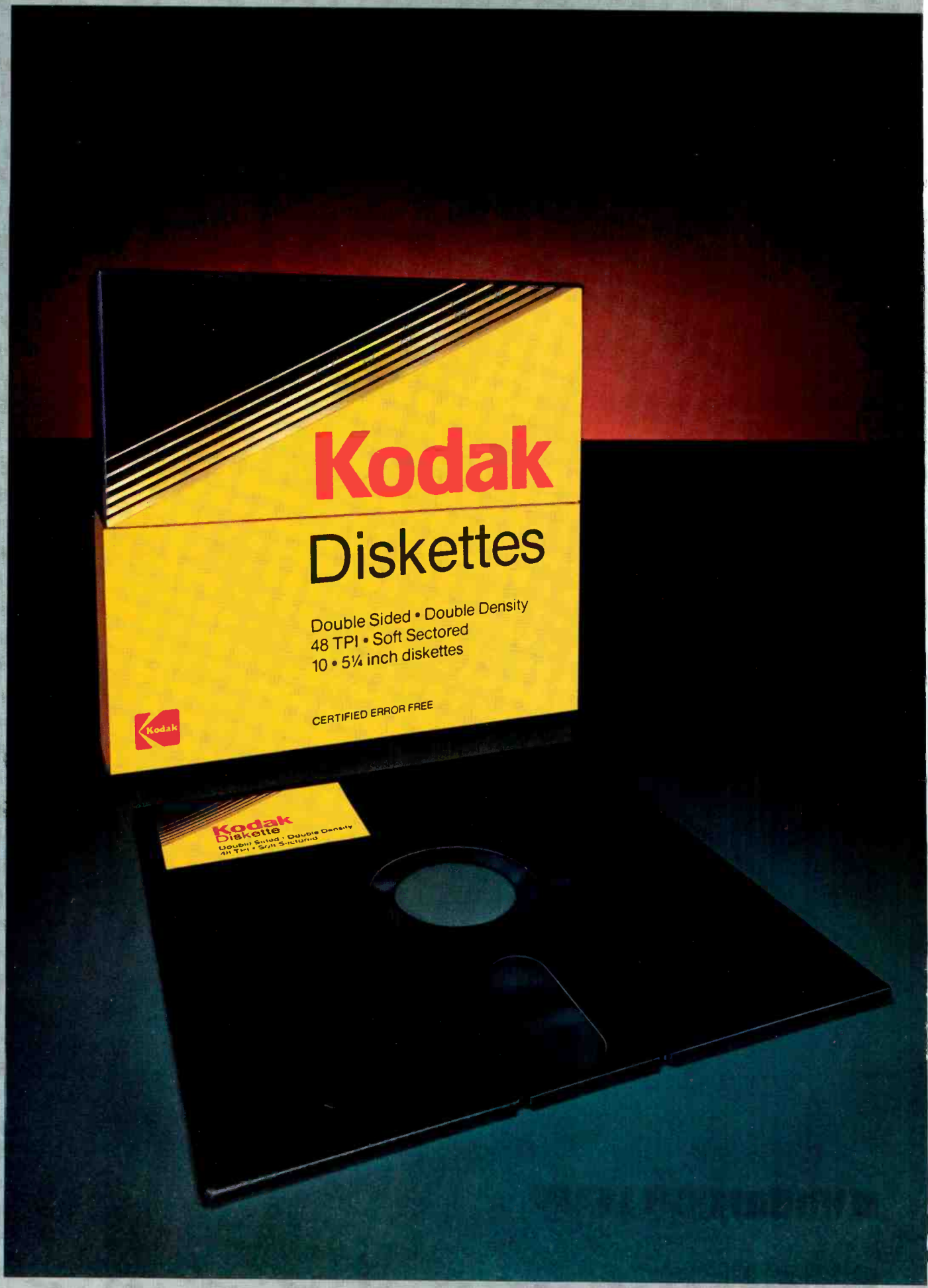

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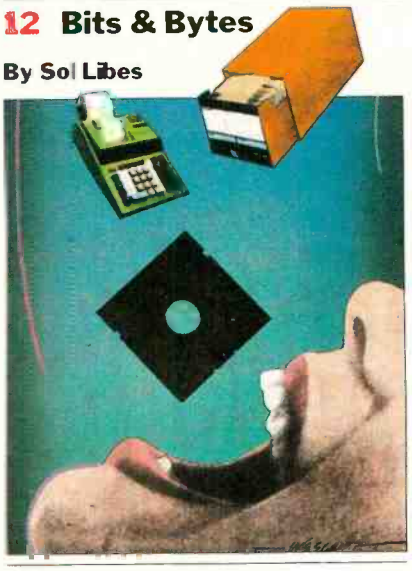

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SETH R. ALPERT

EDITORIAL

WHO NEEDS ALL THAT POWER?

MICROCOMPUTERS, as I am sure you are tired of being told, continue to get more powerful and to cost less per unit of capability. About the most publicized recent great leap forward in capacity was that provided by IBM's Personal Computer AT. This machine runs around three times as fast as its older brother, comes with up to five times as much system memory, uses floppies that store four times as much information, and can be equipped with up to four times as much hard disk storage in the basic chassis. The standard for processing power in a business micro has suddenly been changed again.

I happen to be one of those indivduals who is always eagerly awaiting the next quantum jump in power, be it from hardware or software, so to me this introduction of the AT was nothing but good news. My years in computing have conditioned me to believe that, for micros and mainframes alike, no matter how much power is at your fingertips, it will soon seem at best ordinary or, more likely, insufficient. People, from end users to computer professionals, just don't enjoy waiting for a computer to do its thing. Ultimately, anything less than instant response time will seem to be too slow.

Processing power has become an important issue even for home computer buyers. Industry reports indicate that recent sales of personal computers to individuals reflect a shift from machines under $500 to those $500 to $1000.

As it turns out, not everyone agrees with me on this (and, of course many other things as well). Shortly after the introduction of the AT, I found myself in a conversation with another observer of the personal computer scene who reacted by saying that it was indeed impressive, but who really needs that kind of power in a desktop computer? Clearly a more sensible attitude than that found in speed freaks like myself who can never get enough. In fact, I am embarrassed to admit that it was the first time I ever seriously considered the viewpoint my colleague was espousing.

In truth, many people have such an outlook. A good example can be found among programmers who have the Spartan view that it is somehow purer, perhaps even more macho, to work on a lean machine than a loaded one. They go so far as to argue that those who write for an 8-bit environment simply write better, more efficient, more elegant code than those who work in the 16-bit world, precisely because of the resource and memory constraints that they face. Personally, I think that is malarkey and simply misses the point. I would rather have a programmer developing software for me free to worry about its features and user interface than about cramming every ounce into 64K of RAM.

Wasteful? Perhaps, but machines like the AT will get today's jobs done faster and pave the way for the more capable software of tomorrow. How could anyone not want that? Paraphrasing one of the laws of thermodynamics, software expands to fill the hardware available. While part of that expansion may result from less efficient programming methodology, I am convinced that marketplace forces will see to it that the majority is due to expanding capabilities.

Are machines with the power of the AT unnecessary for most of today's micro users? Trying to be realistic (and I admit that is sometimes difficult), I think it is fair to say that today's personal computers pack adequate power for today's applications. For people whose needs are satisfied now, there is little realistic reason to move to more powerful machines. But as software that takes advantage of more powerful hardware becomes available, those who wish to benefit fully from personal computers will want to upgrade. And those who wish to remain competitive may have no choice.

One might well ask where all this will end. When will personal computers (or supercomputers for that matter) have enough power so that there is no need to go on developing more capable machines? My feeling is that that time is not even in sight. Electronic computing, after all, is less than 40 years old; personal computers have been around for a mere ten years. A whole new world of applications, many of which have been previewed in the pages of this magazine, is sitting on the horizon, waiting to soak up personal computer resources as they become available. Examples include image processing, local large databases stored on optical disks, and speech recognition and synthesis. As the hardware becomes sufficiently capable and affordable, such applications will become commonplace. And I am confident that a next generation of applications will be waiting in the wings, hungry for more computer power if only it were available.

Who needs all that power? All of us, that's who. ◇

PHOTO BY DONNA DAY

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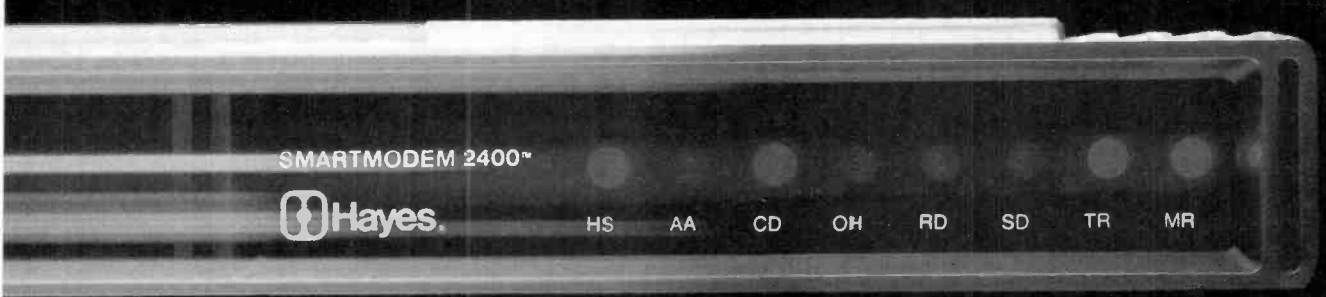

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LETTERS

Princeton Graphic SR-12 Monitor Review Correction

The December 1984 issue of COMPUTERS & ELECTRONICS contained a review of Princeton Graphic Systems' high-resolution color SR-12 Monitor and Scan Doubler. This monitor supports crisp displays of up to 690 × 480 pixels and 16 simultaneous colors. Our review was regrettably misleading on a number of points having to do with hardware and software compatibility and the additional equipment you will need to be able to make use of the SR-12. We would like to clear up an impression the review might have given, that it is difficult to take advantage of the monitor's capabilities.

The monitor itself is noninterlaced and needs compatible video output. Two approaches can be taken to obtain the required video output. First, PGS's Scan Doubler board can be added to a configuration including any IBM-compatible color graphics card. The Quadcolor boards mentioned in the review will work, as will many other products. The Quadcolor II board is good but not optimal for such a configuration, as the review stated. Using the Scan Doubler with an IBM-compatible color card maintains IBM software compatibility, but requires an extra slot and limits software addressability to the IBM standard 640 × 200 pixels.

A second approach would be to use a high-performance graphics board such as the Sigma Designs Color 400 or the Tseng Labs Colorpak Plus. Because such boards have built-in scan doubling capability, they can be used with the SR-12 without the PGS Scan Doubler. In addition to saving a slot, such boards also support addressability of 640 × 400, thus producing an even sharper display (which is particularly important for text) than a Scan Doubler based configuration.

We regret any confusion that our review may have caused.—*Ed.*

The Bernoulli Box

I must take exception to a statement in the article "3M Stretches the Capacity of Floppy Disks" in your August issue, in which the author said that a compliant-medium equivalent of the hard disk didn't exist until 3M's development of stretched-surface media. IOMEGA has had such a disk drive on the market for over two years. These drives, available in both 5¼" (5M bytes) and 8" (10M bytes) versions employ the Bernoulli effect to stabilize the spinning disk with respect to the head.

Every virtue of the stretched-surface disk is possessed by the Bernoulli disk, but the physical laws of moving air described by Bernoulli are used to stabilize the compliant medium rather than a plastic frame. Thus high-density plug-in cartridge disks are obtained without the fragility and expense characteristic of hard disk cartridges.

We are currently marketing a drive subsystem for the IBM PC known as the "Bernoulli Box," which contains two 10M-byte replaceable cartridge drives in a PC look-alike cabinet. The drives are also used by other manufacturers who offer IOMEGA-based drive systems for minicomputers, dedicated word processing systems, and S-100 and Apple micros.

—GARY CROWELL
IOMEGA Corp.
Ogden, UT

Languages and Letters

The comments by Reid Neubert regarding the ease of reading various type fonts in your Letters column of November were very interesting. He is certainly correct about the recognition of words as *gestalts* formed by the grouped letters.

I learned to read German in black letter type and can read it about three times as fast as when the German is printed in roman. On the other hand, I read Swedish much more rapidly in roman. I read Yiddish also, but slowly because of the lack of distinctiveness in the Hebrew characters. Arabic scripts, especially Pharsee, share this fault.

The problem is also noticeable in modern Chinese and Japanese characters with uniform-width strokes. Characters learned in the old-style square method are very hard to recognize in the new style. I suspect even those who are native to the language have their problems too.

—BILLY R. POGUE
Thatcher, AZ

Errata

In the list of Manufacturers of "Real World Interfaces" in the Novermber issue, the address for Lawson Labs should by Columbia Falls, MT 59912. The telephone number for Imaging Technology should be 617-938-8444.

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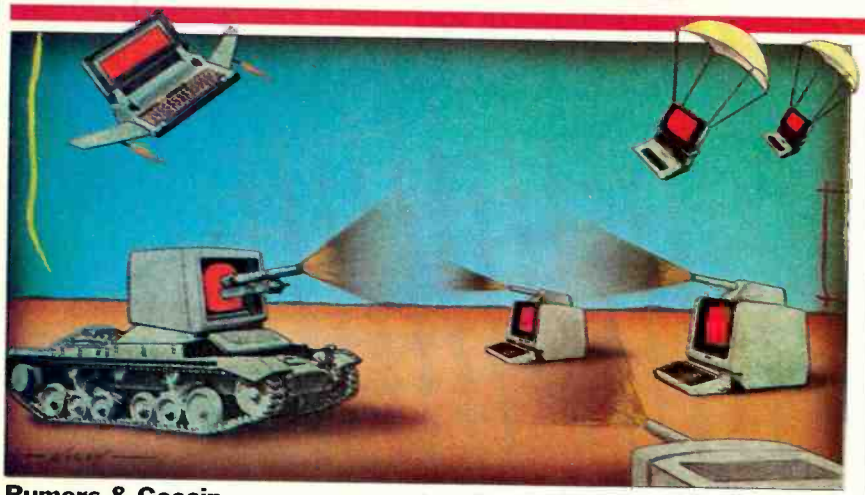


ILLUSTRATIONS BY CARL WESLEY

Rumors & Gossip

▶ The Commodore-Atari price war is expected to escalate. Atari may drop the 800XL price to close to $100, in which case Commodore is expected to sell the C-64 for just a few dollars more. The new Commodore Plus/4 machine, introduced in October with a list price of $299, is already being discounted for under $230 and the C-64 had pre-Christmas discounts to as low as $185. The 800XL reportedly has 3% of the home market, compared to the 64's 32%. Commodore may sell its new 68000 machine (purchased from Amiga) in Europe by the end of next month and introduce it formally in the U.S. at the June Consumer Electronics Show. Some industry pundits are calling this machine "Mac with color." Meanwhile Atari is rumored to be negotiating with Mindset and at least one other company to acquire comparable graphics capabilities. Apple seems to be working hard to develop its color version of the Mac.

AT&T, we hear, is not happy with Digital Research's slow progress in porting Unix System V to the 80286 microprocessor and may finish the project in-house. . . . Apple is expected to announce shortly several networking products for the Macintosh that will allow business users to connect the machine to several different IBM systems, including those using the SNA LU 6.2 protocol and DCA/DIA. Apple is afraid that if it doesn't offer some IBM compatibility, it will be locked out of the business market.

Sinclair seems to be developing a new microprocessor chip with parallel processing and RAM on board that won't be introduced for at least 4 years. And we have been told Atari is investigating potential sales of home PBXs.

Texas Instruments is setting a new precedent in the personal computer field by offering a 5-year warranty and a 24-hr. customer support line. Since most PC makers still offer 90-day warranties, TI's move will put additional pressures on sellers. We wonder whether TI, like the auto makers, will return to 90-day warranties if, or when, business improves.

Informal Blurbs & Morsels

▶ IBM, introducing its PC in August 1981, caught the industry by surprise. About a year passed before the first clones appeared. Not so with the AT, which was introduced in August 1984. AT-clone prototypes were already shown at the COMDEX show in November, and companies are expected to start shipping production units shortly. A few dealers are already offering discounts on the new AT even though IBM is still allocating shipments. The AT is reported to have garnered 9% of retail dollar sales in September, the first month it became available. That portion is even higher than what the Apple Mac captured in its first month. It is estimated that IBM sold 60,000 ATs by the end of last year.

Before long IBM will most likely introduce a tape backup system for the AT and a new operating system that is a subset of the VM operating system used on their larger computers. And there are rumors that IBM is working on a plug-in card for the AT that will allow the AT to emulate a System 36.

Industry prognosticators generally feel that IBM's recent price cuts for the PC, XT, and Portable are an attempt to clear inventory prior to the introduction of upgraded versions of the PC, XT and a lap portable. The last round of price cuts in June together with increased production had a devastating effect on the clones, and these new products should have an even greater impact. IBM is known to have already contracted with Toshiba and Alps for 1.8 million microfloppy drives (at $60 each) and with Verbatim for a half-million 3½" drives a month, which probably means that the new products might be out as soon as this month. Rumors are that the new desktop PC will have better ergonomics and will set a new, low, price standard for an entry-level system due to streamlined manufacturing and a greatly reduced parts count. The lap unit is also expected to contain 128K of bubble memory for file storage. IBM is believed to have contracted with Hi-Comp, which already makes a PC bubble card, for 500,000 bubble subassemblies for possible use in the lap unit.

IBM is understood to be developing a line of laser printers at its Boulder facility.

According to International Resource Development, a market research outfit, IBM is currently shipping about 10,000 ATs, about 25,000 PC*jr*s, about 35,000 XTs and about 50,000 PCs every month.

There have been accusations that IBM is dumping PCs by forcing dealers to purchase more units than they are able to sell. The result is that these dealers turn around and unload their excess inventories to unauthorized resellers (the "grey market"). Dealers carrying the IBM PC are coming under even greater pressures as they find that their biggest competitor in selling IBM systems is IBM itself. It has been estimated that 60% of all PC/XT machines are now sold directly by IBM. IBM is currently offering discounts to multisystem buyers of 30–37% and even more on large orders. Dealers find that they usually cannot compete with IBM on multisystem sales and are left with selling the meager and expensive single systems.

In Japan IBM has introduced a special version of the PC*jr* called the JX. The unit is being made for IBM by Matsushita and sells for $676 to $1378. The unit uses 3½" floppies and has a high-resolution graphics option of 720 × 512 pixels. Could this be a prelude of things to come from IBM in the U.S.? IBM is also known to be taking a serious look at the Microsoft MSX operating system, which is very popular in Japan

for low-cost home computers. It looks like IBM is seriously entering this mass-merchandiser market.

It is estimated that software now accounts for 10% of IBM's business. Last year IBM sold about $4 billion worth of software, which is probably more than all the other software vendors put together! IBM's software sales, increasing at about 40% a year, should account for one-third of its business within 10 years. Rises in software prices have been offsetting declining hardware prices.

Apple Juice

▶ Analysts estimate that Apple shipped about 300,000 Macintosh computers last year, quite a respectable number for the first year of sales. Sales, however, leveled off toward the end of the year and fell far short of the 1 million PC/XT machines IBM shipped last year. Of course Apple is taking pains to protect its dealers and so far has limited its direct system sales to end users (as IBM is doing; see above). Expected shortly is a 20M-byte hard disk for the Mac. Apple is also known to be developing a lap version of the Mac.

Further, it appears that the fat Mac, with 512K of memory, has had a serious impact on sales of Lisa 2s. Apple is known to be developing a more powerful Mac, based on the Motorola 68020, that will probably replace the Lisa.

Meanwhile Apple's upgraded version of the II with 8/16-bit CPU capability and memory addressing of 16M bytes is expected out late this year and should extend the life of the Apple II even further. A more distant possibility is enhanced color graphics for the II, as Apple seeks to meet the challenge expected from Commodore/Amiga. Apple reports that by the end of last year it had sold over 2 million Apple IIs.

Apple has also stepped up its advertising efforts to $200 million for the year, double what it spent in 1983 and 1984.

The Integrated Software Glut

▶ VisiCorp announced the first "integrated software environment" called Visi On in November 1982. And Quarterdeck soon followed, with its Desq system. Now, according to Datapro Research, there are at least 102 integrated products available. Lotus (Symphony), Software Publishing (PFS), Ashton-Tate (Framework) and Peachtree lead the integrated market. IBM is promising to begin shipping its Topview integrating environment this quarter. Meanwhile Microsoft has pushed back release of Windows from June 1984, to November 1984, and now to June 1985. The published specs for Windows appear much more powerful than those of Topview or of any of the other integrated or integrating packages introduced so far.

There are increasing signs that "integrated environments" may be a product in search of a market. Visi On never got off the ground and Quarterdeck is reorganizing. And many users are complaining that integrating many applications makes the product slow and too hard to use and learn. Lotus's older and less comprehensive 1-2-3 appears now to be selling better than its more elaborate Symphony.

It will still be a few more months before we know if users really want such a high degree of integration. Most personal computer users run only one or two (at the most three) applications on their systems—for example, a spreadsheet or word processor—and still fewer need concurrency beyond a print spooler.

OROM—The Next Hardware Breakthrough?

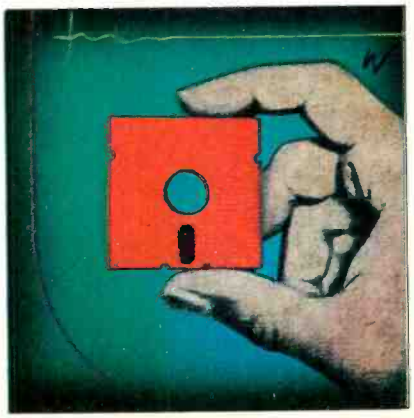
▶ IBM is known to be seriously evaluating the use of OROM (Optical Read-Only Memory) disks for use with its PCs. Speculation is that IBM will introduce an OROM drive option before the end of the year. Based on the technology used in audio and video laser disks, OROMs are expected to revolutionize the distribution of commercial software.

The disks are expected to be well under 4″ in size and fit into drives that are significantly smaller than current half-height drives. IBM is known to be evaluating systems with disks as small as 2″ in diameter that can store 40M bytes. It is considering systems made by 3M Co. for media-mastering drives from Matsushita Electric as well as from several other vendors. Industry experts predict that premastered optical disks could cost less than $3 in quantity and the drives should be made for well under $150.

While other companies are sitting and watching, IBM is known to be soliciting bids for OROM systems that can access 40M to 500M bytes at Winchester speeds with drive costs comparable to floppies. The likelihood is that IBM will be the first company to introduce such a system for desktop computers, although Apple and AT&T are also known to be seriously investigating OROMs for their desktop systems.

OROMs would be the ideal mass-delivery method of proprietary system software. For example, instead of Lotus, with six floppy disks, there would be only one OROM disk. Furthermore, the disk is read-only and far more difficult to copy. OROMs are even more advantageous for integrated software packages and database applications where the database is provided by the software supplier, and IBM is the largest supplier of software for desktop machines. Additional research is being conducted into the manufacture of optical disks with both read-only and read-write.

At the Japan Electronics Show, in October, prototype re-recordable optical disk systems were demonstrated by Hitachi, Sanyo and Sony. Sony, creator of the 3½″ drive, showed 3½″ erasable 50M-byte optomagnetic disks. They can read and write both digital and analog data on the same disk. Thus, in addition to program and data, the vendor could supply documentation with full color graphics. ◇



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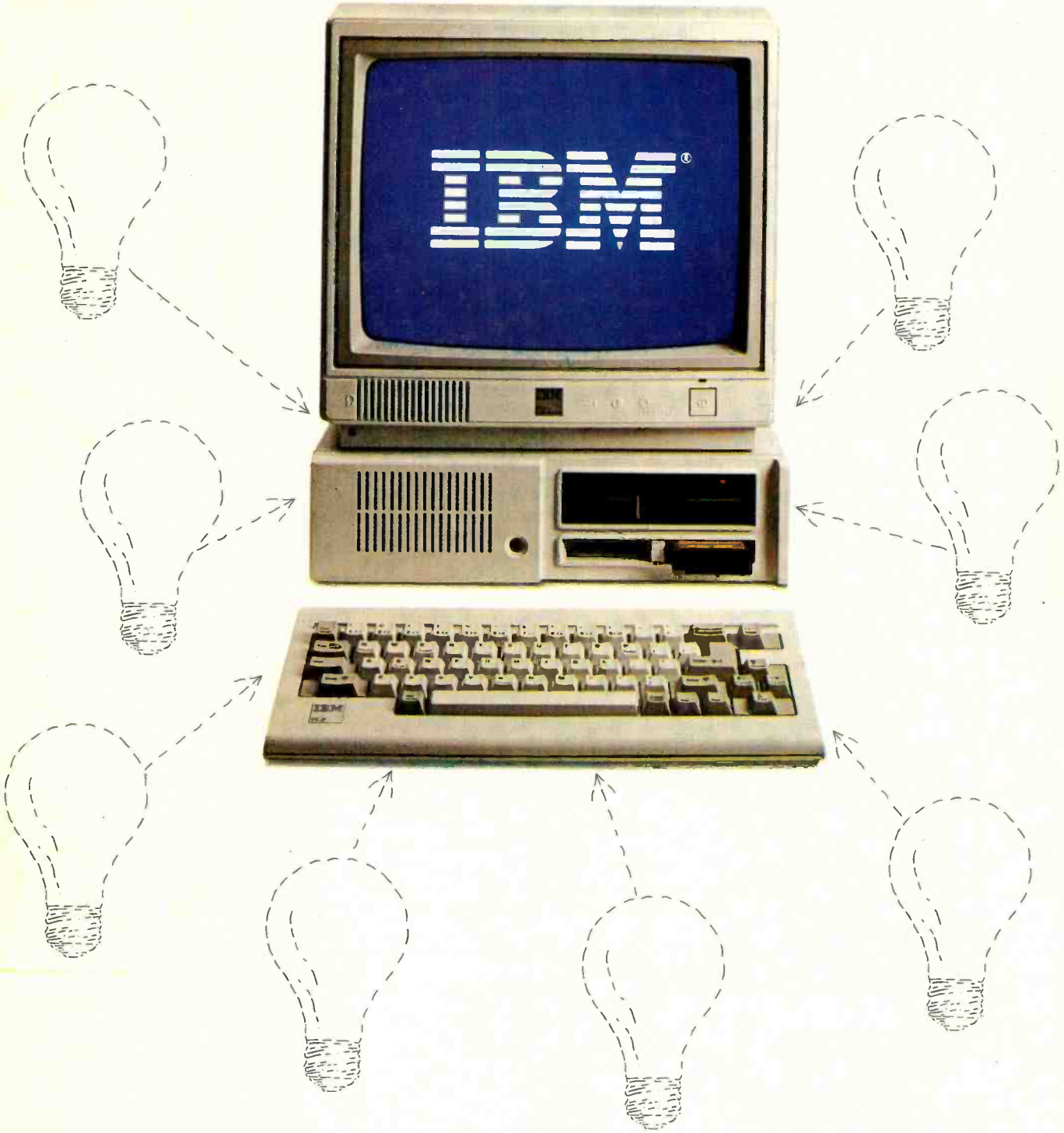

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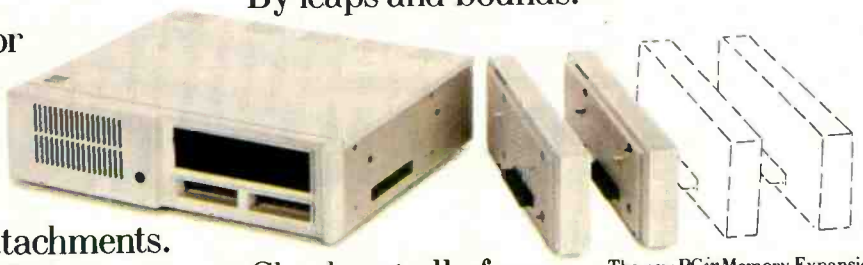

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LES SOLOMON ON COMPUTER HARDWARE

HI THERE, CAN WE COMMUNICATE?

THE title of this column paraphrases the line Joan Rivers uses to start her programs. She wants to talk; I want to communicate about a "high-level" computer language.

Like so many others, I came into the microcomputer world speaking only BASIC—a high-level language that uses simple words in English (or any other vernacular that has a BASIC) to make the computer do its thing. Since I could read and write English, BASIC programs that I wrote and/or borrowed ran without error. And with slight adjustments from one BASIC dialect to another, BASIC programs copied from books and magazines also ran.

What made life so pleasant was that since much software was written using relatively simple and easily understood English words and grammar, I could read and follow these programs (even if I didn't quite understand them).

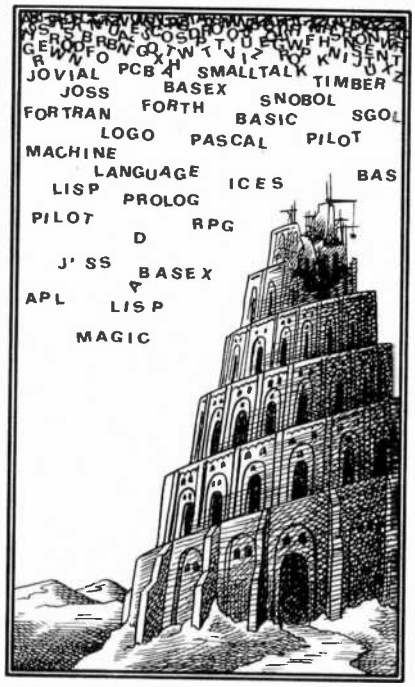
During the past several years, a number of specialized computer languages have come into use. I started to keep track of these languages, but stopped my list at almost 200! Then one day, I (for one) started to experience the same problem that occurred to the people who tried to build the Tower of Babel.

These "high-level" languages used what appeared to be English words, yet were not quite English, and used them in a complex syntax that I could not follow.

Moreover, software written in one of these "advanced" languages could not communicate with any other. They might as well have come from different and unrelated cultures. Not only couldn't they understand each other, but I couldn't understand what was going on.

When I tried to figure it out, I found that each language had a cult following that appeared ready to die rather than switch. When I asked the software sages about their particular languages, I was told that (fill in the name of the language) represented "mankind's greatest gift to software development." And, if I dared question this "truth," then I was not a true believer, and would be doomed to vaporization.

I started to read books and magazine articles about these improved and efficient languages. However, no sooner did



I start to get a handle on one language, when along came another whose gurus promised it to be "the one and true language."

At the same time it seemed that each new language got further and further away from easily understandable English. One, called APL, is so advanced that it doesn't even use language symbols as we know them on this planet, and can be read only by crew members of a passing UFO. (Don't write threatening letters, I know how powerful APL is, but I misplaced my intergalactic code book.)

I understand that BASIC (at least the interpreter) is slow and poorly constructed for most of the heavy work that a computer is designed for. Yes, I am aware of its memory requirements. Yes, I am aware that structure is important. I know that some languages can perform certain tasks with fantastic speed. I am not a software Luddite. I believe that both hardware and software are improving almost on a weekly basis.

Now to my gripe, which, simply, concerns the almost total lack of human interface in these advanced languages.

I am not against any new language. All I ask is why can't the syntax be written so that an English-speaking person can follow it? Would it hurt anyone, if easily understood English words and structure were used? At least most of us could follow the reasoning of the program flow. Maybe we would even get to like, and use, the language.

One relatively easy solution would be to create two versions of a computer language. The first would be the actual language for use by adherents. The second (introductory?) version would have on-screen relatively easy-to-understand English commands, while the machine would perform the requested operations in the "real" language.

After all, compiled BASIC works that way. Maybe a little time will be wasted during the "interpretation," but, at least, a new user will be able to understand the new language without having to spend a lot of time trying to figure out whether it was useful. Then, someone who liked the simplified, English-command version would feel much better about going through the period of "learning the lingo" with an eye towards graduating to the full-blown language.

Disk Cache

In conventional operation, when the computer requests data from the disk, only the requested data are retrieved. Since it takes a finite amount of time to search the disk for the particular track and sector containing the requested data—the drive must be started and brought up to speed and the head must be properly positioned—it would not take very many requests to "burn up" quite a bit of time.

Because the next piece of information required is likely to be on the same disk track as the preceding, and because it takes the same amount of time to download an entire disk track as it does for a few sectors, a disk cache memory can be useful.

However, when each track section of the cache memory is full and another request for data is made, a built-in special algorithm selects which portion of the cache memory will be purged so that the requested data can be stored in its place. Thus the data in the cache are continuously updated. ◇

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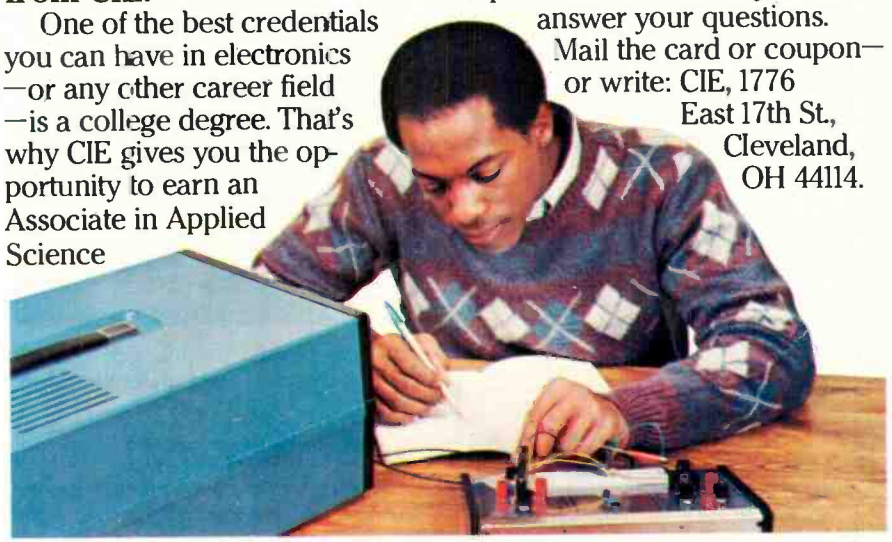

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FORREST M. MIMS III

THE COMPUTER SCIENTIST

PSYCHOLOGICAL TESTING

MANY tests have been devised to measure virtually every conceivable physical and mental ability possessed by human subjects. They include tests of visual acuity using an eye chart, tests of intelligence and tests of coordination, like games, especially the electronic variety.

I've long been interested in using electronic circuitry to measure the responses of animal and human subjects to various situations and stimuli. When I was a development engineer at the Laser Division of the Air Force Weapons Laboratory, one of my assignments was to assist in a highly sophisticated experiment wherein trained rhesus monkeys responded to symbols flashed on a screen. Depending upon the shape of the symbol, which was called the stimulus, the animals pulled one of two levers. For each correct response, a food pellet was automatically dropped into a cup in front of the monkey.

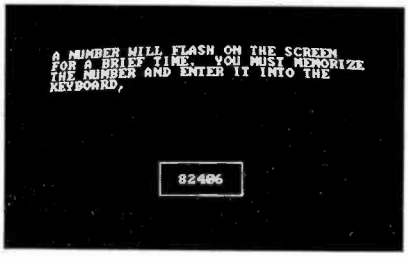
The expensive, transistorized equipment required to monitor the performance of the hard-working monkeys filled part of an equipment rack stationed next to the animals' restraint chair. After personal computers became available a few years later, I sometimes thought how convenient it would have been had such equipment been available for the monkey experiment. Not only could tests be quickly reprogrammed or modified, the stimulus could be presented by means of the computer's monitor screen.

Today anyone with access to a personal computer can design many kinds of psychological and physiological tests for both serious applications and recreation. I have designed several such tests and they are the subject of the remainder of this column. Though the programs are listed in PC*jr* BASIC, they can be modified for most other machines, particularly those that use some form of Microsoft BASIC.

LISTING 1. MEMORY TEST

```
10 'MEMORY TEST
20 'COPYRIGHT 1985 BY
   FORREST M. MIMS III
30 KEY OFF:CLS
40 SCREEN 1,0:COLOR 1
50 PRINT "A NUMBER WILL
   FLASH ON THE SCREEN"
60 PRINT "FOR A BRIEF TIME.
   YOU MUST MEMORIZE"
70 PRINT "THE NUMBER AND
   ENTER IT INTO THE"
80 PRINT "KEYBOARD."
85 LINE (103,87)-(175,111),,B
90 FOR N=1 TO 1000:NEXT N
100 RANDOMIZE TIMER
110 R=INT(RND*(100000 #+1))
120 LOCATE 13,15:PRINT R
130 FOR Z=1 TO 312:NEXT Z
140 CLS
150 INPUT "ENTER THE NUMBER
   NOW:",N
155 PRINT " "
160 IF R=N THEN PRINT
   "CORRECT." ELSE PRINT
   "INCORRECT."
165 PRINT " "
170 GOTO 50
```

Fig. 1. Screen display during the Memory Test program.



Memory Test

Several devices have been invented to prevent an intoxicated person from starting an automobile. One of these devices incorporates a display that briefly presents the driver with a random number. The driver must then correctly enter the number into a keyboard within a given time interval for the car to start. If an incorrect number is entered or if the allotted time expires, the test is repeated. After three failures, the device automatically deactivates itself for several minutes or more.

Personal computers are ideally suited for this kind of memory test. Indeed, the internal cassette tape recorder control relay of a portable machine, such as the TRS-80 Model 100, could easily be connected in series with the ignition switch of a car.

Listing 1 shows one way to implement a memory test in PC*jr* BASIC. In operation, a random number having up to six digits is flashed on the computer screen for a very brief interval. The screen then asks the user to enter the same number. The display notifies the user whether or not the entered number matches the one previously displayed and then recycles for another trial.

The program is straightforward and can be easily adapted for other computers. Lines 50–85 print instructions for the test on the monitor and draw a rectangle in the center of the screen. After a fixed delay with a duration determined by line 90, a random number between 0 and 100,000 is generated.

In PC*jr* BASIC, the RANDOMIZE TIMER statement in line 100 automatically reseeds the random number generator so that a new sequence of random numbers is produced each time the program is run. Line 120 prints the random number

LISTING 2. AUDIO-VISUAL REACTION TIME TESTS

```
10 'AUDIO-VISUAL REACTION TIME
   TEST
20 'COPYRIGHT 1985 BY FORREST M.
   MIMS III
30 KEY OFF:CLS
40 SCREEN 1,0:COLOR 1
50 PRINT "STIMULUS SELECTION."
60 INPUT "PRESS V FOR VISUAL OR
   A FOR AUDIO:",S$
70 CLS:T=0
80 RANDOMIZE TIMER
90 R=INT(RND*(1000+200))
100 FOR D=0 TO R
110 IF INKEY$=" "THEN 120 ELSE 240
120 NEXT D
130 IF S$="A" OR S$="a" THEN BEEP
140 IF S$="V" OR S$="v" THEN 150
   ELSE 160
150 LOCATE 12,20:PRINT "X"
160 T=T+1
170 IF INKEY$="P" THEN 180 ELSE
   160
180 N=N+1:Q=Q+T:AV=Q/N
190 PRINT T:PRINT " "
200 LOCATE 20,1: PRINT "AVERAGE
   =";AV
210 PRINT "PRESS P FOR ANOTHER
   TEST."
220 IF INKEY$ < > "P" THEN 220 ELSE
   70
230 END
240 BEEP:PRINT "IMPROPER
   RESPONSE!"
250 GOTO 210
```

inside the rectangle previously drawn on the screen as shown in Fig. 1.

Line 130 is a timer loop that determines how long the number is displayed in the box. When run on a PC*jr*, this loop requires about 0.0016 second per cycle. Therefore, the 312 cycles specified in line 130 provide a delay of approximately half a second. The delay can be modified by changing the number of cycles in the loop. For example, a value of 156 will give a delay of a quarter of a second.

Incidentally, if your computer is not a PC*jr*, you can determine the delay provided by a single cycle of a loop counter like the one in line 130 by entering a routine similar or identical to this:

```
10 'TIMER TEST
20 FOR N = 1 TO 100000:
   NEXT N
30 BEEP
```

If your machine doesn't have a BEEP statement, use one of its sound functions. After you enter the program, type RUN and then simultaneously press ENTER and start a stopwatch. When the loop has completed counting and the computer emits a beep or tone, stop the watch. Divide the number of seconds by 100,000 to find the time required for each cycle of the counting loop.

First-time users of this program are surprised how fast the number displayed in the box vanishes. When line 130 is adjusted for a 0.25-second display time, the number appears as a quick flash on the screen. It's impossible for me to read a number in the standard fashion (from left to right in serial sequence) in such a brief instant. Therefore, I try to form a mental image of the digits by storing the entire number at once and then reading it back a digit at a time while keying it into the computer.

LISTING 3. HAND-EYE COORDINATION TEST

```
10 'HAND-EYE COORDINATION
   TEST
20 'COPYRIGHT 1985 BY
   FORREST M. MIMS III
30 KEY OFF:CLS:STRIG OFF
40 SCREEN 1,0:COLOR 1
50 SC=12
60 WINDOW (-60,-60)-(60,60)
70 FOR X=60 TO 0 STEP -5
80 A=STICK(0):B=STICK(1)
90 A=A-60:B=120-B:B=B-60
100 PSET (A,B)
110 A=ABS(A):B=ABS(B)
120 IF A>X OR B>X THEN
    BEEP:SC=SC-1
130 LINE (-X,-X)-(X,X),,B
140 CLS
150 NEXT X
160 PRINT "SCORE =";SC
170 STRIG ON
180 Z=STRIG(0)
190 IF Z=-1 THEN 30 ELSE 180
```

LISTING 4. CENTERING ABILITY TEST

```
10 'CENTERING ABILITY TEST
20 'COPYRIGHT 1984 BY
   FORREST M. MIMS III
30 SCREEN 1,0:COLOR 1
40 KEY OFF: CLS
50 TIME$="00:00:00"
60 WINDOW (-60,-60)-(60,60)
70 CIRCLE (0,0),30
80 X=STICK(0):Y=STICK(1)
90 X=X-60:Y=120-Y:Y=Y-60
100 PSET (X,Y)
110 T=TIMER
120 IF X=0 AND Y=0 THEN
    BEEP:GOTO 150
130 PRESET (X,Y)
140 GOTO 80
150 LOCATE 24,7:PRINT "ELAPSED
    TIME (SECONDS):"; T
160 FOR N=1 TO 1000:NEXT N
170 STRIG ON
180 Z=STRIG(0)
190 IF Z=-1 THEN 40 ELSE 180
```

This program can be easily modified to include additional features. For example, you can include a second timer loop that requires the user to enter the number within a specified time interval. Also, the program can be revised to repeat the cycle a maximum of, say, three times.

A particularly interesting modification would have the program present to a range of subjects a specific number of random numbers and then tally their scores. The numbers could be presented for various times to pinpoint the minimum response time for each subject.

Audio-Visual Reaction Time Test

Reaction time, as aficionados of gun fights in western movies can quickly attest, has long been a part of folklore and games. The personal computer provides an excellent tool for measuring various kinds of reaction time.

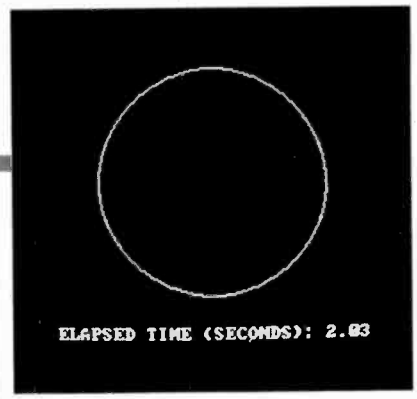


Fig. 2. Screen display after the movable dot has been placed at the center of a circle in the Centering Ability Test program.

Recently I developed a simple program that measures in relative units the time required for a person to strike the P key on a keyboard after a white X is flashed on the blue screen of a computer. The same program can also measure the time required to strike the P key after a beep is sounded. After my family and I tried this program, we were surprised to learn that we reacted more rapidly to one of these stimuli, and I'll reveal which below.

The reaction time program is shown in Listing 2. As will soon become evident, the program includes two procedures that help preclude fortuitous or improper responses. Lines 50–60 print instructions on the monitor that allow the user to select the program's visual or audio response mode. After the response has been made, line 70 clears the screen and sets the reaction timer (T) to 0.

The stimulus could be presented to the user a fixed time after the program is run. After a few runs, however, the user would quickly anticipate when to press the P key or any other designated key, thereby producing much faster than normal reaction times. To eliminate this problem, the program presents the stimulus at a random time after the program is run.

Look at lines 80–120 in Listing 2 to see how the random time intervals are produced. Line 80 reseeds the random number generator, and line 90 creates a random number between 100 and 1000 and assigns it to a variable designated R. The lower limit of 200 is needed to provide some delay after the program is run. Lines 100–120 form a timer loop that establishes the actual random delay before the stimulus is presented.

LISTING 5. Hi-LO GAME

```
 5 CLS
10 N=INT(RND*(100+1))
15 T=0
20 INPUT "ENTER GUESS:",G
30 T=T+1
40 IF G=N THEN 100
50 IF G>N THEN PRINT "TOO
   HIGH.":GOTO 20
60 IF G<N THEN PRINT "TOO
   LOW.":GOTO 20
70 PRINT "CORRECT. TOTAL
   GUESSES=";T
80 GOTO 10
```

Line 110 within this loop traps cheaters, scoundrels, and jumpy-fingered individuals who press the P key *before* the stimulus has been presented. Should this occur, program control is transferred to line 240, which tells the computer to beep and announce IMPROPER RESPONSE! on its screen. The program then resumes execution from the top.

Assume the random delay timer runs its course. In accordance with the selection made back at line 60 (S$), lines 130 and 140 select between audio (beep) or visual stimuli, while line 150 flashes an X on the screen. The program then enters the counting loop defined by lines 160–170. Each time the loop completes a cycle, T is increased. Only when the P key is pressed does the program exit the timing loop.

Line 180 takes care of the arithmetic by calculating the average reaction time for the tests made since the program was started. Finally, lines 190–200 print on the screen the reaction time for the current test and the average reaction time and instructions for how to proceed with still another test.

The program in Listing 2 can be improved and modified in many ways. For example, computers with built-in clocks can provide the actual elapsed reaction time rather than relative numbers. Additionally, both the audio and visual stimuli can be altered. For example, the white X on a blue background can be changed to any other character or special shape having other foreground and background color combinations. Also, the character can be randomly positioned on the screen.

Furthermore, specialized provisions can be added to make the test much more difficult. For instance, the screen might display a randomly selected character and require that the key for that character be pressed. Or the program might test left and right hand response by requiring each hand to respond to a particular symbol.

A simple but tricky test I plan to try will require a response only when a particular symbol is flashed on the screen. All other symbols must be ignored. In this test the user will need to think about the symbol before making a response, not just respond when the symbol first appears.

The audio mode also has many possible variations. For example, the beep can be replaced with a sound or tone function. Reaction time as a function of sound frequency can then be tested. A much more complicated variation would test both memory and reaction time by having the program first present a tone having a randomly selected frequency. The user would then press a key only after a tone of the same frequency was repeated. Other tones would be ignored.

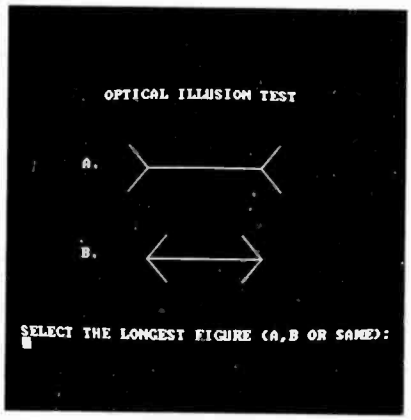


Fig. 3. The optical illusion test in Listing 6 produces this screen image.

Oh yes, earlier I mentioned that my family and I were surprised to find a significant difference between visual and audio reaction times. I would have thought that the time required to react to a visual stimulus would be faster than that for a sound. It turns out that the members of my family react more quickly to sound. For example, my average response to a recent series of 10 visual reaction time tests was 45.6 My average response to a series of 10 beeps was a much faster 28.9.

The reaction times for the beeps, at least in my case, tend to be very uniform, while those for the visual stimulus usually include a few that are significantly slower than the remainder. Eye fatigue that comes from staring at the computer display plus an occasional untimely blink probably account for this anomaly.

Hand-Eye Coordination Test

To score well with most video games requires excellent hand–eye coordination. I have devised an ultra-simple video game that provides a quick measurement of hand-eye coordination.

The program begins by presenting a large box on the screen that quickly becomes smaller and smaller. The object of the game is to manipulate a joystick to keep a dot on the screen within the borders of the shrinking box. Should the dot wander outside the borders of the box, the computer will beep and deduct 1 from the player's maximum possible score of 11.

Obviously, the easiest way to make the highest possible score is to move the dot to the exact center of the shrinking box. However, because the box shrinks very rapidly, first-time players tend to overcompensate and move the dot too far at a time. In other words, in this test, experience provides a major asset.

The program for the hand–eye coordination test is given in Listing 3. Though the program is straightforward, it does use some PC*jr* BASIC statements that might not be readily available in other dialects of BASIC.

Line 50 establishes the maximum possible score plus 1. The WINDOW statement in line 60, which will be familiar to users of *xy* plotters, is a powerful statement that allows the screen coordinates to be redefined. Since the PC*jr* joysticks produce values ranging from about 3 to

(Continued on page 84)

LISTING 6. OPTICAL ILLUSION TEST

```
10 'OPTICAL ILLUSION TEST
20 'COPYRIGHT 1984 BY FORREST M.
   MIMS III
30 KEY OFF:CLS
40 SCREEN 1,0: COLOR 1
50 LOCATE 2,10:PRINT "OPTICAL
   ILLUSION TEST"
60 LOCATE 8,8: PRINT "A."
70    LINE (95,47)-(111,63)
80    LINE (95,79)-(111,63)
90    LINE (111,63)-(207,63)
100   LINE (207,63)-(223,47)
110   LINE (207,63)-(223,79)
120 LOCATE 16,8: PRINT "B."
130   LINE (127,111)-(111,127)
140   LINE (127,143)-(111,127)
150   LINE (111,127)-(207,127)
160   LINE (207,127)-(191,111)
170   LINE (207,127)-(191,143)
180 LOCATE 23,1
190 INPUT "SELECT THE LONGEST
   FIGURE (A,B OR SAME):",S$
200 IF S$="A" OR S$="B" THEN
   PRINT "INCORRECT":GOTO 230
210 IF S$="SAME" THEN PRINT
   "CORRECT"
220 GOTO 220
230 BEEP:FOR N=1 TO 1000:NEXT N
240 GOTO 30
```

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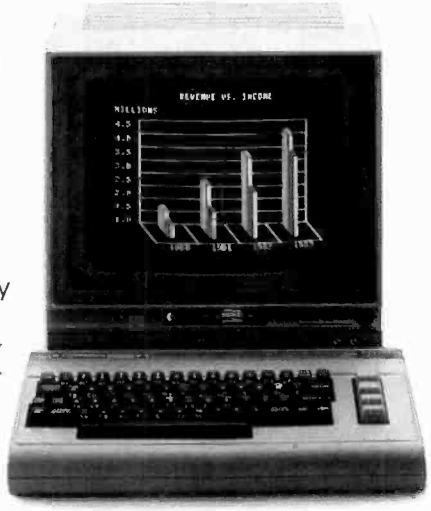

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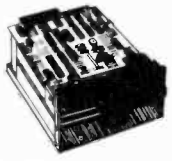

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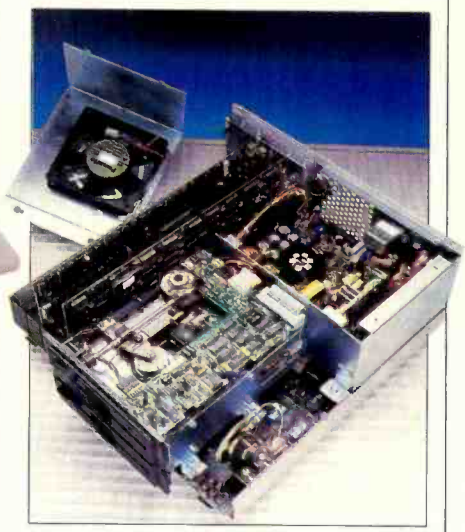

ITT XTRA

Another giant enters the IBM compatible fray

BY ROBIN WEBSTER

THOUGH there's hardly any standing room left in the IBM-compatible club, giant ITT has decided to wedge its way in. ITT has been working hard (through major newspaper and television advertising) to stress that its new ITT Xtra personal computer has everything a user might need—and then some. Given this approach, and the fact that such companies as Compaq, Panasonic, Leading Edge and Texas Instruments have all found ways of adding features to the standard IBM PC (portability, internal printers, faster central processors, and so on), I expected that ITT's "Xtra" tag was meant seriously. However, as we'll see, the ITT Xtra offers only a few minor benefits over the IBM PC.

Hardware Overview

The ITT Xtra's hardware is quite straightforward. It comes with a system unit, a keyboard, and a monochrome or color monitor—and uses an IBM-standard Intel 8088 microprocessor

The standard Model 1 Xtra system costs $2495 and comes equipped with 128K RAM, one 360K floppy drive, a video adapter card, and parallel and serial ports. The review system was a Model 2, which features 256K of main memory, two floppy disk drives, both I/O ports, and a color monitor. This configuration sells for $3425.

The Xtra's system unit is quite compact, measuring only 15¾" × 14" × 5½"; this is about 3" narrower than the IBM PC. It is two-tone beige, has rounded edges, and is fabricated out of aluminum sheeting with a molded plastic front.

Set just off center in the front of the system unit are two half-height floppy disk drives (360K each). These drives use flip-down latches to retain disks rather than spring-loaded catches that hold and eject disks automatically. The Xtra's

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Thinking ahead, ITT included a 128-watt power supply in the Xtra, which is sufficient to support the half-height 10M-byte hard disk available as an option.

For those who have used the IBM PC keyboard long enough to become familiar with its rather awkward key placements, the Xtra's 84-key "corrected" keyboard will present some initial difficulties. For example, the return key is arranged horizontally, and the tilde/apostrophe key has been moved above and to the right of it; the left-hand shift key is to the right of the reverse slash/vertical rule key; and the plus key on the numeric pad has been made small to make way for a dedicated enter key. All this may not seem like much, but it will certainly prove disconcerting for an hour or so, until you get used to it.

One of the games IBM PC users have to play is determining whether or not the CAPS LOCK and NUM LOCK keys are on or off. Thankfully, the Xtra's equivalents remove this guesswork. Green light-emitting diodes indicate whether they are active or inactive. This is a nice touch that doesn't really cost much to include.

Although they included these conveniences, the designers unfortunately didn't pay as much attention to the "feel" of the keyboard. Whereas the IBM keyboard provides tactile feedback so that you know when you've pressed a key correctly, the Xtra's keyboard feels quite lifeless and the key tops wobble around a bit too much. The net result is that typing errors are easier to make. Overall, I prefer the IBM keyboard.

I/O Connectors

All input/output connectors, as well as the ac power socket, are arranged along the back of the Xtra's system unit. Don't bother to look for a reset switch, because there isn't one. Instead, there is only a single on/off switch placed at the top-left corner (looking from the rear). A set of I/O ports—independent of the five internal expansion slots—are arranged along the bottom edge of the rear; the review machine featured one parallel printer port, an RS-232 serial port, and a blanked-off interface slot. According to an ITT spokesperson, the third slot is left over from an earlier design, and the system unit template has not yet been updated. A color monitor card occupied one of the five expansion slots inside the machine.

Removing the outside casing of the system unit is very easy since only two small screws have to be removed from the rear before the top cover can be lifted away. The Xtra's internal layout is very neat.

For starters, there are no massive ribbon cables snaking all over the place. Also, the two main motherboard configuration switches and the motherboard RAM chips are easily accessible.

Surprisingly, the noisiest part of the Xtra is the 4½" cooling fan, which is mounted horizontally over the motherboard like the fan in the IBM PC. I say "surprisingly" because the ITT spokesperson stressed that the design team had paid special attention to using a quiet fan system. Maybe the review machine was a bad example, but I never did get used to the whine it produced.

Since the Xtra is based on the Intel 8088 microprocessor, it should theoretically provide the same computing power as the IBM PC. However, after I ran a few simple performance tests, it became clear that there are differences.

Performance

In preparing to run the tests, I decided to see how the Xtra would react to an attempt to run IBM's BASICA system. First, I booted the Xtra off a PC-DOS 2.1 disk and made sure that everything was working correctly. Then I typed "BASICA" and waited to see what would happen. Naturally enough, the Xtra system couldn't cope with the true-IBM code and simply generated a "Divide Overflow" error message before redisplaying the A> prompt. Although it didn't recognize the IBM BASICA program, the Xtra did not seize up like some other IBM compatibles put through the same test.

Looking at a directory listing of the ITT-DOS disk, I noticed that there were in fact two BASIC files—one was called BASICA and was 644 bytes; the other was called XBASIC and was about 57K. Clearly the ITT BASICA file passes control to the "true" BASIC program —XBASIC—whenever the former is invoked.

Running a simple BASIC program (do a FOR/NEXT loop 10,000 times) on the Xtra took 11 seconds, while it took an IBM PC 13 seconds. At this point the Xtra was clearly ahead. Curiously, in running some other tests the Xtra fell marginally behind: Running a small BASIC program that calculated all prime numbers up to the number 50 took 85 seconds on the Xtra and only 67 seconds on the IBM PC; and sorting a 100-record database in dBase II took 77 seconds on the Xtra and 74 seconds on the IBM; using the DOS Find filter to search three files for a particular section of text took 34 seconds on the Xtra and 32 seconds on the IBM PC. There is nothing startling about these differences, but they do show that the IBM PC has somewhat of a performance edge.

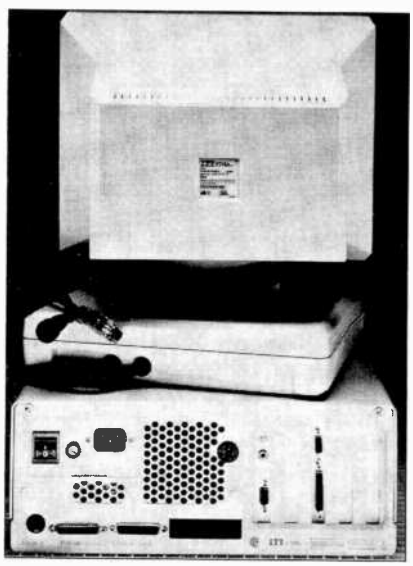
Software Compatibility

Since the ITT Xtra is supposed to be IBM compatible, I decided to try a wide range of popular IBM software products on the machine. I booted the ITT DOS and then tried to run the first application, version 2.4 of dBase II. Everything seemed to go well up to the point where dBase II asked if I wanted to input data into my newly created file. Once I responded "Yes," an error message appeared, stating "End Of File Found Unexpectedly." No matter what I tried, I couldn't get dBase version 2.4 to budge beyond this point so long as I used ITT DOS. However, I could use dBase 2.4 on the Xtra when I booted the system off a PC-DOS 2.1 system disk.

As it turned out, the problem was due to an error in the way dBase 2.4 interfaces with MS-DOS 2.11. By using the DOS Debug program to "patch" the 2.4 version according to a sequence provid-

(Continued on page 84)

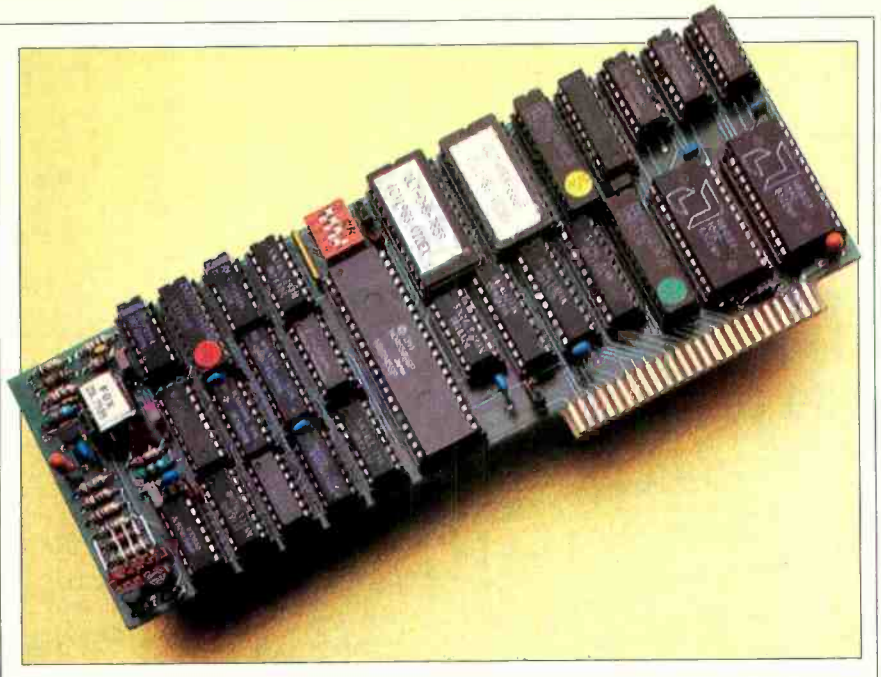
Connectors on the back of the Xtra.



ULTRATERM

The ultimate display board for Apple II computers

BY JAINE SAFFIR



SELECTING an 80-column card for the Apple II+ microcomputer is a confusing business since everybody but your local grocer seems to be making one. Until recently, the best advice to follow was to go with the standard, Videoterm by Videx.

That is no longer true.

Videx has a new, extended display card called Ultraterm. But describing Ultraterm as just another 80-column card is like calling the palace at Versailles housing. The range of displays it can produce is awesome—no other card on the market even comes close to it.

Ultraterm, which has a suggested retail price of $379, has a built-in soft switch and two distinct character sets. It can produce seven different displays featuring any two of four attributes, all by keyboard control.

Character Sets

The standard character set, which is built in a 9 × 12 dot matrix, is an improvement over the standard 7 × 9 Videoterm set. The result is that the descenders on letters such as "y" and "g" are better formed and the middle bar of an "m" is clearer. The full 96-character ASCII set is available as well as 32 graphic elements that can be generated from the keyboard by using certain control key sequences.

The enhanced character set, formed in a 9 × 16 dot matrix, is a full serif font similar to the monochrome display on the IBM PC. It also contains all 96 ASCII characters and 32 block graphic elements that can be used to design forms and charts. The characters resemble those you are reading now, which are in the Times Roman style. They are so easy to read that they are a real eye opener to those of us used to staring at the normal Apple character set. How Ultraterm produces this set involves an interesting bit of hardware hocus pocus.

Ultraterm uses a familiar video technique, called interlacing, to produce its characters. It produces twice the vertical resolution of the normal Apple display. And double the resolution means a tighter-looking display with more clearly drawn characters. Your monitor, however, may not be able to handle it adequately.

Since the display is updated at half the usual speed, you need a monitor with a high-persistence tube. Otherwise, the display may start to fade before it can be refreshed. A bit of research has convinced me that most amber screens work fine, but the standard green screen monitor with a P-4 or P-31 phosphor will flicker when the Ultraterm display is produced. Turning down the brightness helps a lot, but if you're hooked on green, you'll need a monitor with longer persistence, like Apple's Monitor III, that uses a slow P-39 phosphor.

Display Sizes

The size of the Ultraterm display depends on the character set in use. A usual 80 × 24 display, which can be produced with either the standard or the enhanced character set, can be extended to 96 and 160 characters across using the standard font. The enhanced set can be called up in four other screen sizes—80 × 32, 80 × 48, 132 × 24, and 128 × 32. Using a word processor with 48 lines of displayed text or a spreadsheet with 160 characters across is simply fantastic.

Ultraterm produces the extended screen widths by outputting characters at twice-normal rates. As a result, you will need a monitor with a bandwidth of at least 18 MHz to avoid smeared characters. Most modern monitors can, in fact, handle this sort of display, but low-quality monitors are out of the question. Ultraterm is an extremely sophisticated display device, and you can't reasonably expect to use it with a bargain basement monitor.

Even if your monitor has the necessary bandwidth, you may still find that some of the characters in the wider display modes run off the edges of the screen. A bit of tweaking on the horizontal linearity pot will eliminate the overscan. If you imagine that it's difficult to stare at a 160-character line, you're quite right, but choosing the right combination of display attributes will make the line much more legible than you might expect.

Display Attributes

No matter which display mode you decide to use, Ultraterm allows you to utilize two active screen attributes. These are low light and high light for normal white on black characters and low intensity and high intensity for inverse characters. You can software-select any combination you want at any one time and even switch attributes in the middle of a program, which is a neat way to call out error messages, for example, in home-made software. A screen made up of low- and high-intensity inverse characters looks a lot like the displays you see on the Macintosh and Lisa and makes a line 160 characters wide surprisingly readable.

Software Support

Hardware like Ultraterm isn't worth anything if it's not supported by mainstream software. Videx had this bit of basic wisdom in mind when it designed Ultraterm: The card's firmware has an operating mode that allows it to emulate Videoterm. And since Videoterm is supported by 99.99% of all the canned software that can work in an 80-column mode, Ultraterm is right at home in the large orchard of Apple software. Not only that, but most newer software and

(Continued on page 98)

PHOTO BY BOB LORENZ

Big business accounting for

IBM's new Business Management Series for Personal Computers.

IBM's Business Management Series (BMS) can improve your accounting in so many ways, they're almost uncountable.

It's derived from accounting software big IBM machines are famous for, but for not so big an investment.

(If you don't have a PC already, keep reading. BMS is a terrific reason for buying one.)

There are six easy-to-learn programs in BMS, and they can work alone or with each other.

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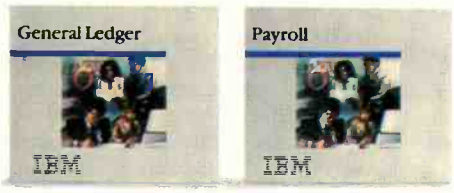
Inventory Accounting helps you maintain more responsive, and therefore more profitable, levels of stock by taking its information directly from....

Order Entry and Invoicing, which offers flexible methods of pricing, discounting and taxing while it helps you automatically update....

Accounts Receivable for a clear picture of your open accounts to improve



The BMS programs work alone or as a team. You can start with one, such as General Ledger or Payroll, and add others later. Or, buy all at once. If you plan to own several, consider an IBM computer

companies with smaller numbers.

cash flow and reduce bad debt.

Payroll keeps records, writes paychecks and W-2 forms, easily tackles multiple pay rates and frequencies, and much more.

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For their number, and a free brochure, call this one—800-447-4700. (In Alaska and Hawaii, 800-447-0890.)

like the PC/XT. It lets you store them, permanently, inside your machine. Very handy. Here's another tip. IBM's new Personal Decision Series (for spreadsheets, writing, graphing, etc.) can take information directly from BMS. Very, very handy. And ask about IBM Extended Support, a way to get software updates and telephone assistance, direct from IBM.

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SOFTWARE REVIEWS

PROKEY

Keyboard customizer improves quality of life for micro users

BY JOHN SMITH-RICHARDSON

PROKEY is a software package from a company called RoseSoft that can customize any key or combination of keys on an IBM PC or compatible to represent other keys and functions. It is also a macro definer for individual keys—"macro" meaning a string of characters of any length.

The program, positioned in RAM between the keyboard interpreter and the applications program being run, is transparent to the user. It intercepts keyboard entries before they reach the applications program and redefines the keys' functions, or it converts keystrokes to macros.

Almost every key or combination of keys can be customized to represent any other key(s)—up to 300 individual functions. Alternately, a key can be preloaded with a macro that can represent program commands or even a complete document of 2000 words (or 12,000 characters). Simply touching one or two keys will output the macro.

One of ProKey's major strengths is that it lets you define any of the PC's graphics characters by entering its ASCII code. For example, if you are preparing a document that makes frequent use of the infinity symbol (∞), which is accessed on the PC as ASCII code 236, you can define a normally unused key or a supershifted one to represent that symbol. (CTRL-A and ALT-A are the supershifted modes for the A key.)

Unlike most other keyboard redefiners, ProKey does not require the user to exit the applications program to define a key. Keys can be defined "on the fly"—they can be redefined and then switched in and out while an applications program such as WordStar or dBase III is being run. Alternatively, just one, or all, keys can be predefined, or the macros can be assigned to their keys by a definition file created with a word processor.

Whether prepared on the fly or with a word processor, a customized keyboard can be saved to a "definition file" that can be manually or automatically loaded by ProKey. You can save to disk directly after you've finished using the applications program or, if you need several different versions of a customized keyboard, you can prepare them in advance and save them to disk, recalling them as necessary.

Specifications

Product: ProKey
Mfr: RoseSoft
4710 University Way N.E.
Suite 601
Seattle, WA 98105
Price: $129.95
Requirements: IBM PC or compatible, one disk drive, 64K RAM minimum, 96K preferred

Although it is loaded into RAM, ProKey itself, as well as the key definitions it uses, can be switched in and out to conserve memory. When ProKey is switched out, the RAM it uses to define keys is released for use by the applications program. Since ProKey can lie dormant, it is not necessary to load it back into memory when it is again needed: You can simply switch it back in and call up a definition file while the applications program is running.

In addition to conventional macros, which consist of strings of characters, ProKey's macros can be programmed with "fill-in-the-blank" fields, which can be of fixed or variable length. The macros can even be nested to refer to each other so that a "master" macro can call up or define other macros. For example, the same macro that might contain the heading for an accountant's spreadsheet might also redefine the PC's keypad to function only in the numeric mode, moving the cursor positioning to four alpha keys. In this way the accountant would not have to switch back and forth continually between the keypad's numeric and cursor positioning modes.

Let Me Count the Ways

Almost every key can be defined in four different modes: the normal character, the shifted character, the ALT (alternate) character, and the CTRL (control) character. As an example, the macro for ALT-K would be different from the one for CTRL-K, with SHIFT-K containing yet another macro or key definition. Even the normal K itself could be defined as a different key or as a macro.

If, while running an applications program, you find that it would be conve-

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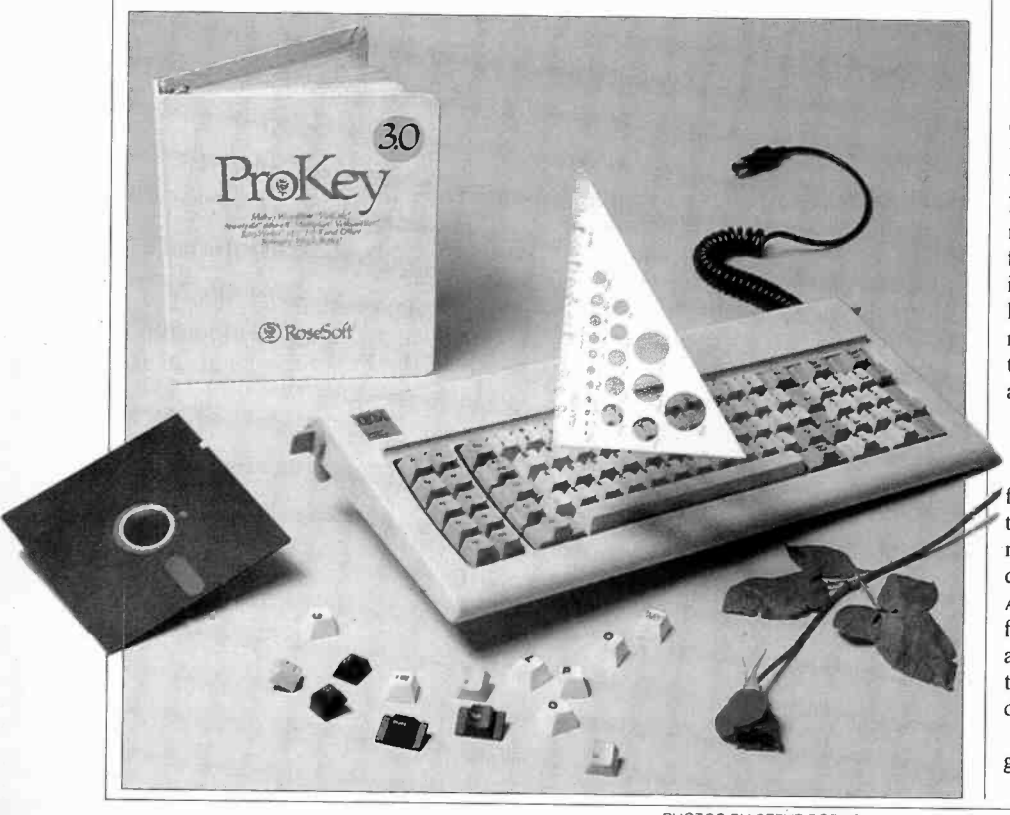

PHOTOS BY STEVE BORNS

JANE

Integrated software for Apple II computers

BY GORDON McCOMB

IT'S no wonder integrated software programs have become popular. By lumping similar command structures together, it is easier to jump from one application to another. You don't have to relearn the basic commands of each, which is especially helpful if you forget key commands for functions you don't use often. It's also handy to have an application available without having to stop a current program to boot another. But it's too bad they're so expensive. The widely publicized Lotus Symphony and Ashton-Tate programs, for instance, cost $695—no small change. What's more, most integrated packages are available only for the IBM PC and its various clones. What's a user of a Commodore 64 or Apple IIe/IIc to do?

Start by trying Jane, a novel and inexpensive integrated package from Arktronics. The basic Jane package costs $125; that's less than $42 for each of Jane's three built-in programs: Janewrite (a word processor), Janecalc (an electronic spreadsheet), and Janelist (a list manager). For $195, you can get Jane with a sturdy mechanical mouse. Either way, not a bad deal.

How To Use Jane

Jane departs from the other integrated packages in its heavy use of graphics symbols—otherwise known as icons—that represent everyday objects. These icons include scissors, paste jars, cameras, and stop signs. Rather than type in a long (and often confusing) command, you point a mouse or other input device at a symbol. Point at the stop sign, for example, and Jane knows you want to stop what you're currently doing.

But take note: Jane is not a Lotus Symphony or an Ashton-Tate Framework. For example, where a Symphony spreadsheet can be up to 256 columns by 8192 rows in size, the maximum Janecalc worksheet is only 20 columns by 24 rows.

In doing this review, I used Jane on my Apple IIc. The same program also works, without modification, on the IIe. The package I got didn't come with a mouse, so I had to add one of my own (some type of pointing device is required for Jane because there's no way to select the program's icons from the keyboard). I used the AppleMouse with more than acceptable results. I also tried Jane using a KoalaPad touch tablet and a Kraft joystick.

The joystick didn't do as well as I expected, and the Koala touch tablet wasn't very accurate without the use of the plastic stylus that comes with it. Most important, when I used the stylus, working with Jane became a chore. I found myself picking up the stylus every few seconds to move Jane's on-screen pointer.

Starting Jane is easy. Just turn the computer on and insert the program disk. If you have a two-disk system, you can put the program disk into one drive and the data disk into the other. After a few moments, Jane's opening menu pops into view. On the top of the screen is a gang of icons—hand, arrow, scissors, camera, paste jar, and more. This, the main menu bar, appears in all of Jane's applications.

Work begins by pointing to one of the three application icons (typewriter, calculator, or filing cabinet) and clicking the button on the mouse. For example, to go to Janewrite, I moved the pointer to the typewriter and tapped the mouse button. A directory window appeared showing me the Janewrite documents currently stored on the data disk.

One Janewrite file was already there (a sample thoughtfully placed there by Arktronics), so I pointed to it and clicked. Once again, the disk drives whirred into action and another window appeared on the screen. Inside the window was a sample personal letter. Keep in mind that I hadn't yet touched the keyboard; everything had been done with the mouse.

To test Jane's ease of use, I cut and pasted the first paragraph of text and placed it at the bottom of the page. I purposely didn't look at the manual to find out how to do it—I let my intuition be my guide.

I first "grabbed" the camera by pointing at the camera icon, then tapped the mouse button. I then selected the text I wanted to move—the entire first paragraph—by dragging the camera over it. The text went away—but not forever. I went back to the top of the screen, grabbed the paste jar, and positioned it at the bottom of the document. I clicked the mouse button. Within a matter of seconds, the text was moved.

To be fair, I should mention that I'm a seasoned Apple Macintosh user and using mice and icons has become second nature to me. Since Jane is very Mac-like in its operation, I found that I could do 75% of my work without referring to the manual. If mice and icons are new to you, you may need a period of adjustment and a reading of the manual.

(Continued on page 94)

TURBO PASCAL

A superb Pascal system for only $49.95

BY DAVID FRANKEL & MICHAEL K. GUTTMAN

TURBO Pascal from Borland International burst upon the microcomputer world last year, selling more than 120,000 copies and winning praise from micro users. Although Turbo, at $49.95, is not the first low-cost edition of Pascal, it is the first to offer so many convenient features for both new and experienced Pascal programmers.

Beating the Traditional Tradeoff

One of the things that makes Turbo Pascal so interesting is its solution to the painful dilemma programmers once faced in deciding between compiled and interpreted languages. Interpreted languages allow the programmer to develop software interactively, but generally produce code that executes slowly and makes poor use of memory and other system resources. On the other hand, compiled languages produce tighter, faster code, but force the user through a relatively lengthy and clumsy process for writing, compiling, linking and debugging programs.

As a result, most programmers begin by learning an interpreted language, such as BASIC or Logo, whose interactive features make learning quicker. Eventually, however, the need for more efficient program execution forces most to switch to a compiled language, such as Pascal or C. The programmer must not only learn the new language, but also must give up the convenience of programming interactively.

Turbo frees programmers from the horns of this dilemma, making it possible for them to enjoy the benefits of interactive development along with the advantage of producing efficient compiled code. A new programmer can both learn the language quickly and, once experienced, perhaps never outgrow it at all.

The Turbo Environment

Turbo Pascal achieves its magic by cleverly integrating a fast compiler and a full-featured editor. The user writes code using the editor, which mimics most of the functions (and key sequences) of standard WordStar. A three-keystroke command invokes the compiler, which can process a 200-line program in about 10 seconds.

If compilation is successful, the program immediately executes; no linking is required. If a compilation error is found, the compiler prints out an error message. After the user presses another key, the compiler exits to the editor and positions the cursor at the offending line of code.

For those accustomed to other compilers, such performance borders on the astounding. The secret is that the edit-compile-run cycle takes place in memory: It requires no disk accesses other than those performed by the program code itself. Options allow saving the source and compiled code on disk.

Who Benefits?

Serious software developers will certainly appreciate the interactive nature of Turbo Pascal. Less experienced programmers, who have learned an interpretive language, usually BASIC, might be even happier. Now they will have an opportunity to migrate to Pascal with considerably less trauma.

In particular, educational institutions can benefit. Instructors can teach students a computer language right from the start without having to explain the complicated mechanics associated with most compilers.

Other Advantages of Pascal

Another major advantage of Pascal is that it is a "structured" language. Instead of subroutines, it uses constructs called "procedures" and "functions," which can declare their own local variables. If a variable is declared local to a procedure—even if the same variable name is used in another procedure or in the main program—the language treats the two variables as separate entities. Using this technique wisely, the programmer need not worry about accidentally using the same variable name for separate items.

Another advantage is that there are no line numbers in Pascal, a decided convenience. A corollary benefit is that a programmer can fit into any program a procedure designed to be used in several programs without having to coordinate its line numbers with the line numbers of the main program. Procedures are called by meaningful names assigned by the programmer rather than by line numbers.

A Few Drawbacks

One of Turbo's biggest advantages can also be a drawback. Turbo has no linker. Although this lack increases the interac-

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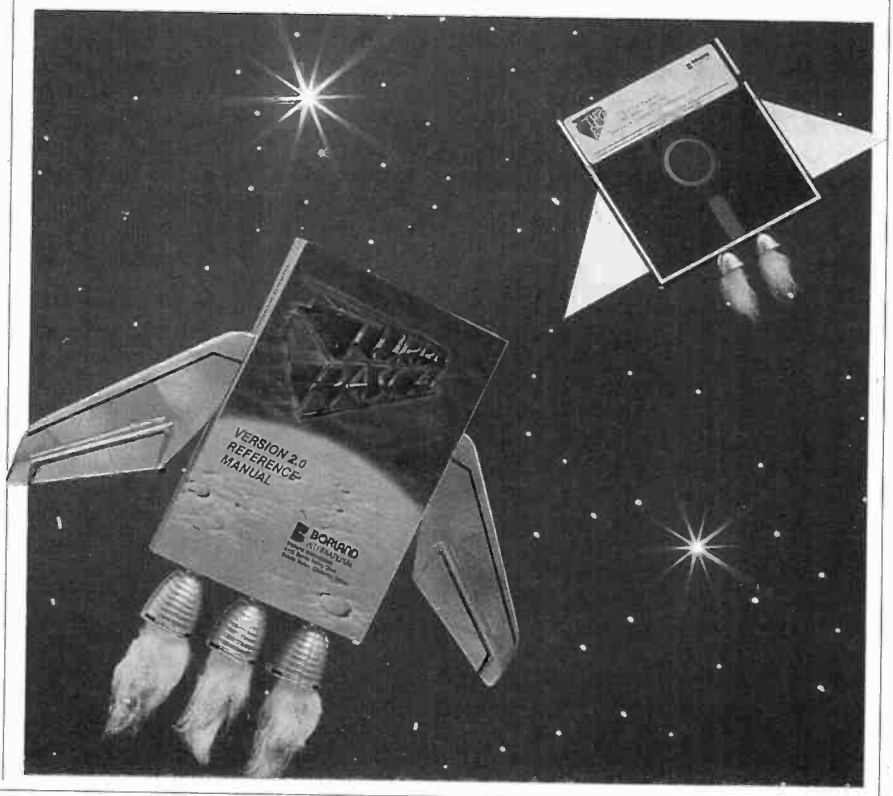

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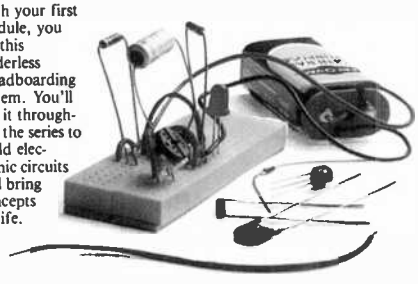

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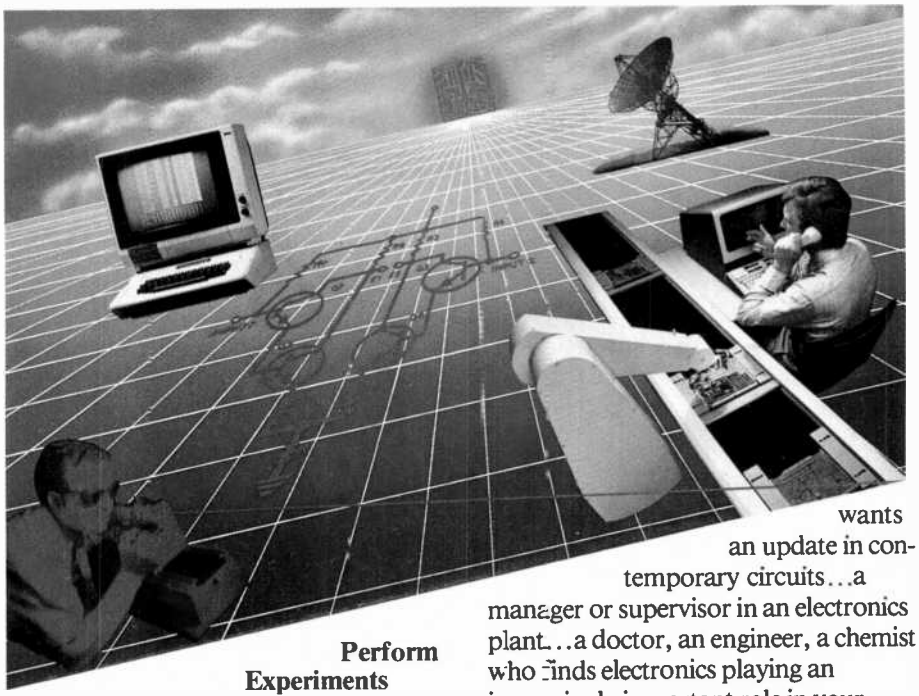

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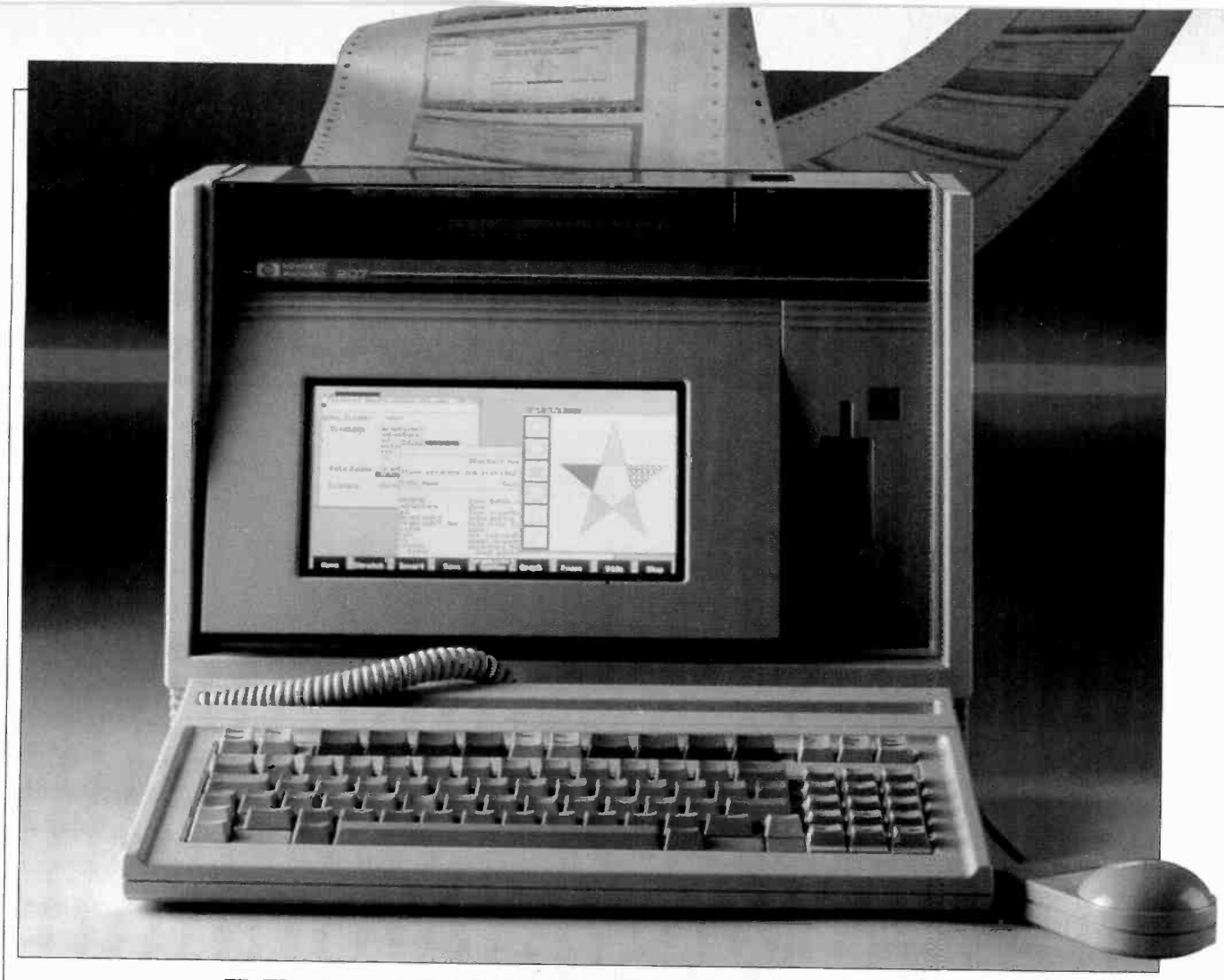


HP INTRODUCES FIRST UNIX TRANSPORTABLE

Motorola 68000-based machine has gas plasma display, 512K or user RAM, Unix in ROM, and built-in ThinkJet printer

BY MARK ROLLINS

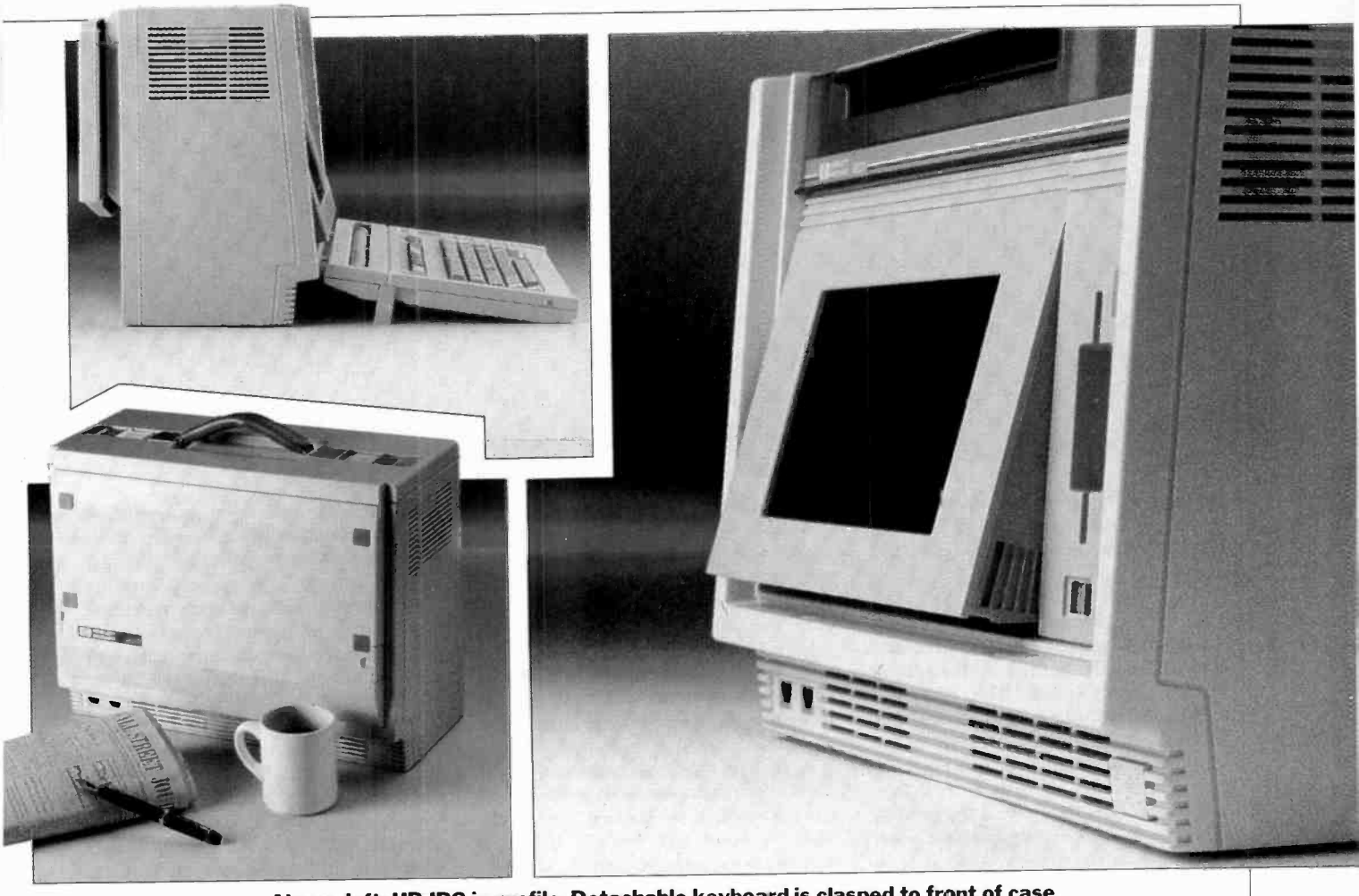
WITH so many new personal computers appearing on the market at low or moderate prices, it is difficult—if not dangerous—to identify one as significantly superior. It's even riskier to herald one as a technological breakthrough. Yet that is exactly what I propose to do with the new Hewlett-Packard Integral Personal Computer (HP-IPC).

Although, as a system developer, my experience is different from applications-oriented end-users who might buy this machine, all of us share two primary goals for selecting a good system: saving time and protecting our software investments. In the new HP-IPC, Hewlett-Packard has successfully achieved its primary design goal: to give applications-oriented end-users access to Unix-based capabilities and software. Meeting this objective, in turn, Hewlett Packard satisfies our selection criteria because of the multitasking and portability of Unix.

HP has achieved its technological breakthrough by meeting its objective in a machine that is light, self-contained, and transportable. The IPC has a very fast microprocessor and graphics coprocessor; built-in disk drive, printer, and expansion connectors; and a lot of mem-

Mark Rollins is the former editor of Microsystems *and currently a free-lance author and system developer.*

PHOTOS BY DAVID ARKY



Above, left: HP-IPC in profile. Detachable keyboard is clasped to front of case (below, left) to protect unit while in transit. Right: Flat panel display pops out at a convenient viewing angle at the touch of a lever. Disk drive is at right of display.

ory, including 256K bytes of ROM, containing both Unix and an end-user interface. All of this for a price that is almost unbelievable, especially to those familiar with previous HP pricing strategies. The quality is typical Hewlett-Packard; the price is not.

Unix multitasking allows this machine to run *several* programs at once without the end-user noticing any slowdown. The way it is implemented as multiple windows is particularly impressive. Don't be fooled—this window system is very different from other current window systems and far superior. In most window systems, the only program that is actually running is the one being viewed; the rest of the programs must be temporarily stopped. On the HP-IPC, all the programs run continuously, providing a powerful time-saving capability.

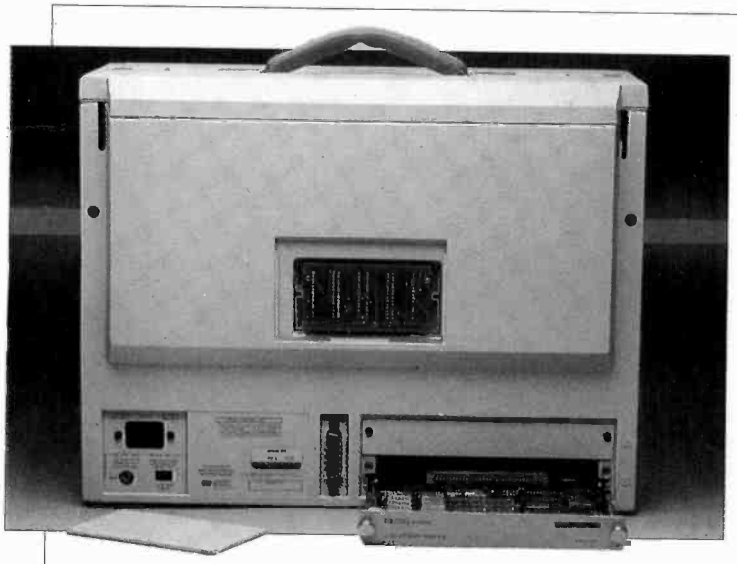
The Standard Machine

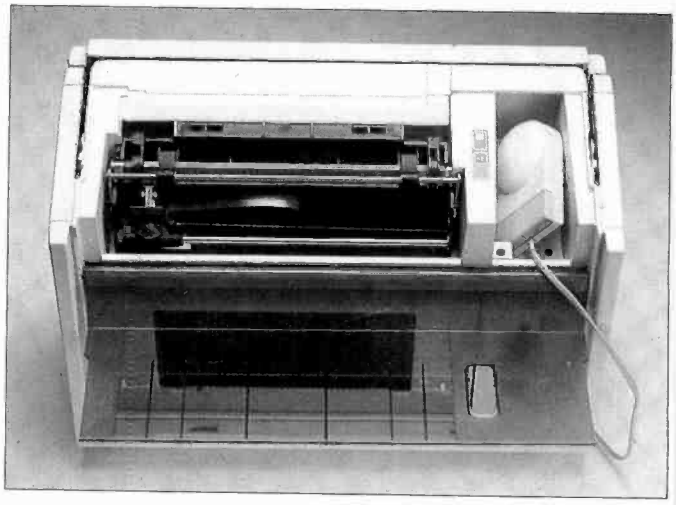
The HP-IPC is a 25-lb transportable that includes the following standard features: 10-MHz MC68000 CPU; separate 16-bit display processor with high-speed window management; 800K bytes of memory (256K bytes of ROM, 512K bytes of RAM, 32K bytes of display RAM); built-in 32-line by 80-column high-resolution electroluminescent display; built-in 150-cps ink-jet printer; detachable keyboard; real-time clock; speaker; built-in 710K-byte $3\frac{1}{2}$" microfloppy disk drive; HP-UX (Hewlett-Packard's System III Unix implementation) and PAM (the HP Personal Applications Manager) in ROM; and built-in automatic RAM disk. It also has the following expansion facilities: built-in HP-IB interface; two expansion ports; bus expander for an additional five bus slots; two HP-HILCs (for connecting a mouse, digitizer, etc.). The price for all of this is $4995.

Options include: 15M-, 24M-, and 55M-byte hard disks with and without either floppy or tape backup; separate 710K-byte $3\frac{1}{2}$" microfloppy single and two-drive units; HP's LaserJet printer (RS-232); daisy-wheel printer (RS-232 or HP-IB); dot matrix printers with various graphics and multiple typefont capabilities (RS-232); two-, six-, and eight-pen color plotters (RS-232 or HP-IB); all the other peripherals HP manufactures for the HP-IB interface.

The system software bundled with the machine includes many of the standard Unix System III utilities and such other tools as the *vi* text editor, as well as the HP-UX kernel and the HP Personal Applications Manager. In addition, there is an optional C development package. The first offering of application software includes: *word processing:* Memomaker (HP); *spreadsheet:* Multiplan (Microsoft); *graphics:* Picture Perfect (CSC); *project management:* Microtrak (Softrak); *communications:* Data Communications (HP); *math/statistics:* Calculator (HP), TK!Solver (Software Arts); *database:* Unify (Unify), Informix (Relational Database Systems); *real estate:* REMS Software (REMS); *CAD:* Chemical Engineering (Kelix), Structural Engineering (ECOM), Surveying (Land Innovation), Topography (Pac Soft).

Hewlett-Packard, reviewing its overall networking strategies for PC and desktop computers, claims that the HP-IPC will definitely be included in its





planning. The company *does* have a shared-resource manager that links the HP-IPC to the Series 80, 200, and 500 workstations.

Evaluation

I ran tests on a pre-release system, and it ran flawlessly. Setting up the system was simplicity itself. The computer stands upright, like a sewing machine, with a cushioned handle attached to the top, covered by a cloth sheath. You simply pull the cover off, open two catches, swing back the top to reveal the printer, connect the keyboard (built into a panel that protects the display when it is in transit), plug the system in, insert a boot disk, and press the ON button.

The first thing you see are some HP messages on an electroluminescent display that reveals black characters on a yellow-orange background. Unlike most of the lap portables that use the still-developing LCD technology, the HP-IPC has a very readable display. In addition, by pressing a two-key sequence, you can invert the display to orange letters on a black background.

Actually, the first software you'll want to run is the Tutor program, which you accomplish by booting the system with the Tutor disk inserted. This is a well-organized, easy-to-follow, step-by-step tutorial on using the system and PAM, the Personal Applications Manager. PAM allows you to perform most system operations, including creating, editing, saving, copying, and printing files; creating and managing windows; and running programs. There is an optional mouse, which was provided for us with the system, that makes the cursor movement and selection features of PAM quite simple to operate.

If you wish to run the HP-IPC as a Unix system, you simply insert the Unix disk, run one of the shell command interpreter programs, hide the PAM window, and reconfigure the size of the shell window to fill the display area. This is a particularly convenient feature if you

UNIX?

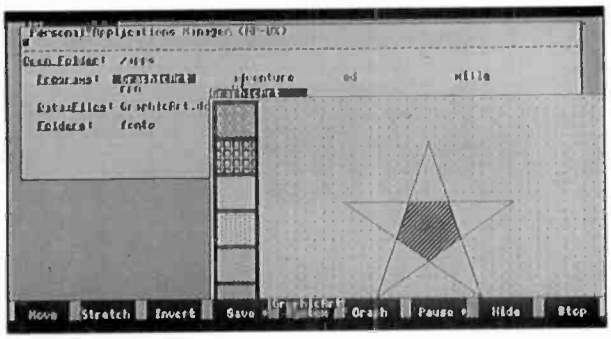
BY CHRISTOPHER TERRY

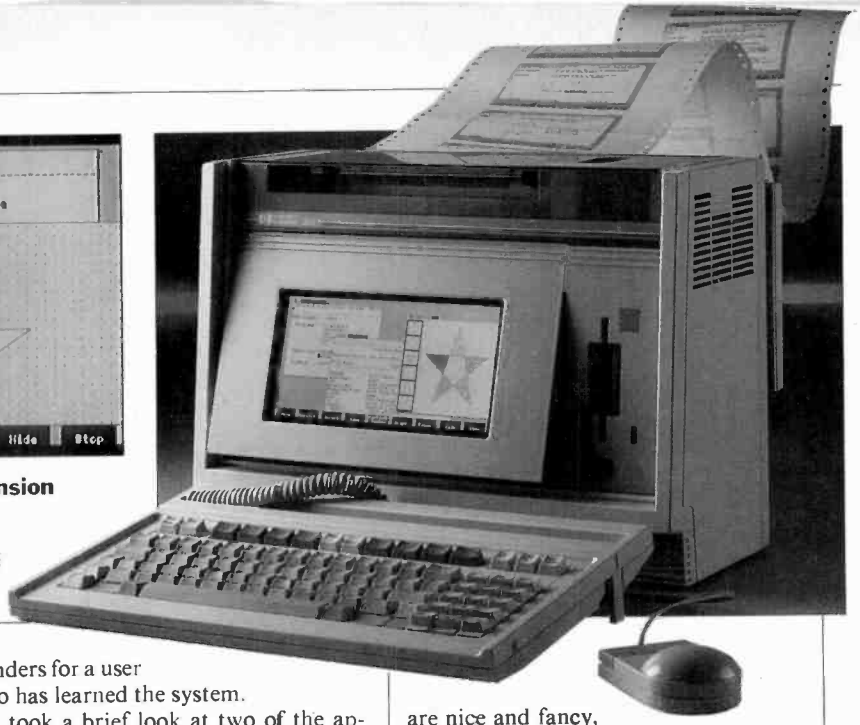
DURING the past year, "Unix" has been the buzz word that swarmed around microcomputer users. Computer magazines have published hundreds of articles about Unix; in fact, two monthlies are entirely devoted to it. At the January 1984 UniForum conference, more than 100 vendors demonstrated hardware running Unix and software to go with it. The April issue of *Microsystems* carried a directory of more than 300 software packages to run under Unix from 118 vendors.

In spite of the uproar created by marketeers, Unix is not the leading microcomputer operating system. At the Spring 1984 COMDEX, Mark Ursino (operating systems product manager for Microsoft) commented "... Unix, if you add up all 50 flavors, does dominate the market for multiuser general-purpose micro-based business computers ... and that market is only about 10% of the general-purpose microcomputer market." He also pointed out that AT&T's claim, that 70,000 computers of 75 types are running Unix, sounds less grand when you realize that the average is only 933 systems per type. In reality, about 25,000 of these are Tandy model 16s, 15,000 are Fortunes, and 20,000 are Altos, all running Xenix or one of its derivatives. With at least 5000 or more PDP-11s or VAXs, about 10,000 systems are left, shared between the remaining 68 types. The average falls to 147 Unix systems per type.

At present, then, Unix can hardly be thought of as dominating the market, particularly when you consider that IBM sells more than two million PCs, all of which run MS-DOS. AT&T, however, is trying to capture more of the market with its 3B line of minis and supermicros, and even IBM is supplying PC/IX for the PC and is offering or evaluating at least four other versions of Unix on machines ranging from mainframes down to the Series 1. With one giant actively pushing Unix, and the other at least keeping an open mind about it, this year we may see Unix growing more popular, if not becoming a universal operating system. So let's look at some of the factors that may help or hinder the emergence of Unix.

First, and perhaps most important, is that Unix was designed from the very start to be machine independent. The kernal, which contains all the logic for file management and multitasking, takes no account of the architecture of the machine on which it is running. All the portions that are machine-dependent, such as control of and communication with the disk drives and other peripherals, are segregated in modules that have a standard and predictable interface with the kernal. Unix is therefore *potentially* capable of running on any machine from an IBM mainframe to a 16-bit PC. This is not to say that porting Unix from one machine to another is easy—it is not—but at least it is possible, which is more than can be said for any other operating system. IBM and DEC operating systems are heavily dependent upon IBM and DEC hardware. MS-DOS, while it has Unix-like features, is transportable only between different configurations of machines using the Intel 8086/80186/





Far left: ROM compartment and two expansion slots are accessible from rear. Near left: printer unit and storage compartment on top of unit. Above: A simple example of the HP-IPC's windowing capabilities.

have as great a distaste for forced menu-driven systems as I do. On the other hand, for the relative novice, the menu and help facilities that HP provides greatly reduce the potential anxiety of running the system.

The documentation HP provided with the HP-IPC is comprehensive and well-written, and especially commendable considering it was reviewed pre-release. The tutorial was provided in hard copy as well as machine-readable form, and the rest of the documentation on specific features and facilities was every bit as clear and easy to follow as the tutorial. In addition, summary and reference documentation were provided for quick reminders for a user who has learned the system.

I took a brief look at two of the application packages provided, Microsoft's Multiplan spreadsheet, and HP's graphics drawing package, GraphicArt. I used *vi* to write the benchmark program mentioned below. Multiplan performed as expected, with the added enhancement of very fast screen handling.

GraphicArt was a joy. It includes a multitude of features, including all the shape, fill, and pattern options you could want and various type style and size options. A question often asked is, "The drawing features of this or that system are nice and fancy, but what can you really do with them?" The answer is, store the pictures you create in a file for later recall as part of a presentation or for printing or making slides. I didn't find this facility to store files, but after talking with the HP technicians, I suspect that it will be forthcoming soon.

What HP *does* provide at the moment is a built-in print screen function (it's a single dedicated key on the keyboard) that prints to the built-in ink-jet printer in full graphics. Very nice.

(Continued on page 88)

80286 family of CPU chips. CP/M has indeed been transported from the original 8080/8085/Z80-based machines to 8086- and 68000-based machines, but other considerations have prevented it from making much impact in those areas. So we can see that for its portability, Unix is the favored candidate for an operating system. It will not only allow third-party vendors to write software that can run on any machine, but will also protect buyers' investments in software should they upgrade their hardware. It is these potentialities that predominate in the mass market's excitement about Unix.

But the Unix universe is not without its problems. The "50 flavors" mentioned by Mark Ursino still provoke lively discussion as to whether they are all "Unix," and cause dismay among those who want a completely standard software development environment. Fortunately, the standards committee of \usr\group, representing commercial Unix users, has done a great deal toward defining the generally accepted components and practices. Its recommendations for future enhancement are accepted by AT&T and will be incorporated into System V. Nevertheless, Andy Hall, AT&T's director of System V development, has admitted that there is still much to be done before Unix becomes a completely viable transportable operating system in the commercial market. One has to remember that Unix was designed to serve specific needs in a research environment and that many of its techniques are 15 years old—a lifetime in the fast-moving computer industry. Where most work needs to be done (and is already in progress) is in system security, to meet the needs of commercial databases; networking; real-time processing; and the development of intelligent virtual device interfaces that will relieve the applications programmer of the need to know and take into account the characteristics of modern display screens and printers—especially since graphics are becoming of greater and greater importance to business users.

However, Andy Hall also pointed out that the potential Unix markets have grown. The reason is that the steadily increasing amount of computing power that can be crammed into a VLSI chip and the steadily decreasing prices for electronic (though not electromechanical) components have lowered the corporate level at which approval is required for purchase of a computer. He foresees within a few years a moderately priced portable machine running the Unix kernal in 128K or 256K with a user-friendly shell and a set of Unix tools tailored to the declared purpose of the machine. We can already hear Unix purists screaming: "If it isn't the full set, you just can't call it Unix!"

Hall's prediction may have been too conservative. The HP-IPC is just such a machine, in the $5000 price range. If it does everything claimed for it and really serves the commercial needs, this machine may be the first of a multitude of other enhanced and less expensive machines. These will provide the market penetration that Unix enthusiasts have been eagerly awaiting. ◇


SONY

WHAT YOU CAN GET ONLINE

Online database services have become powerful business and research tools

BY JEFF HECHT

It took a diligent reporter to find out that Mehmet Ali Agca, the man who shot Pope John Paul II in 1981, was an escaped murderer who two years earlier had written a letter threatening to kill the Pope when he visited Turkey. But it was no ordinary journalistic detective work of the kind that relies on meeting anonymous sources in back alleys or rummaging through moldering heaps of newspaper clippings. Instead the reporter searched Mead Data Central's Nexis online database for the assassin's name and found reports of the two earlier incidents.

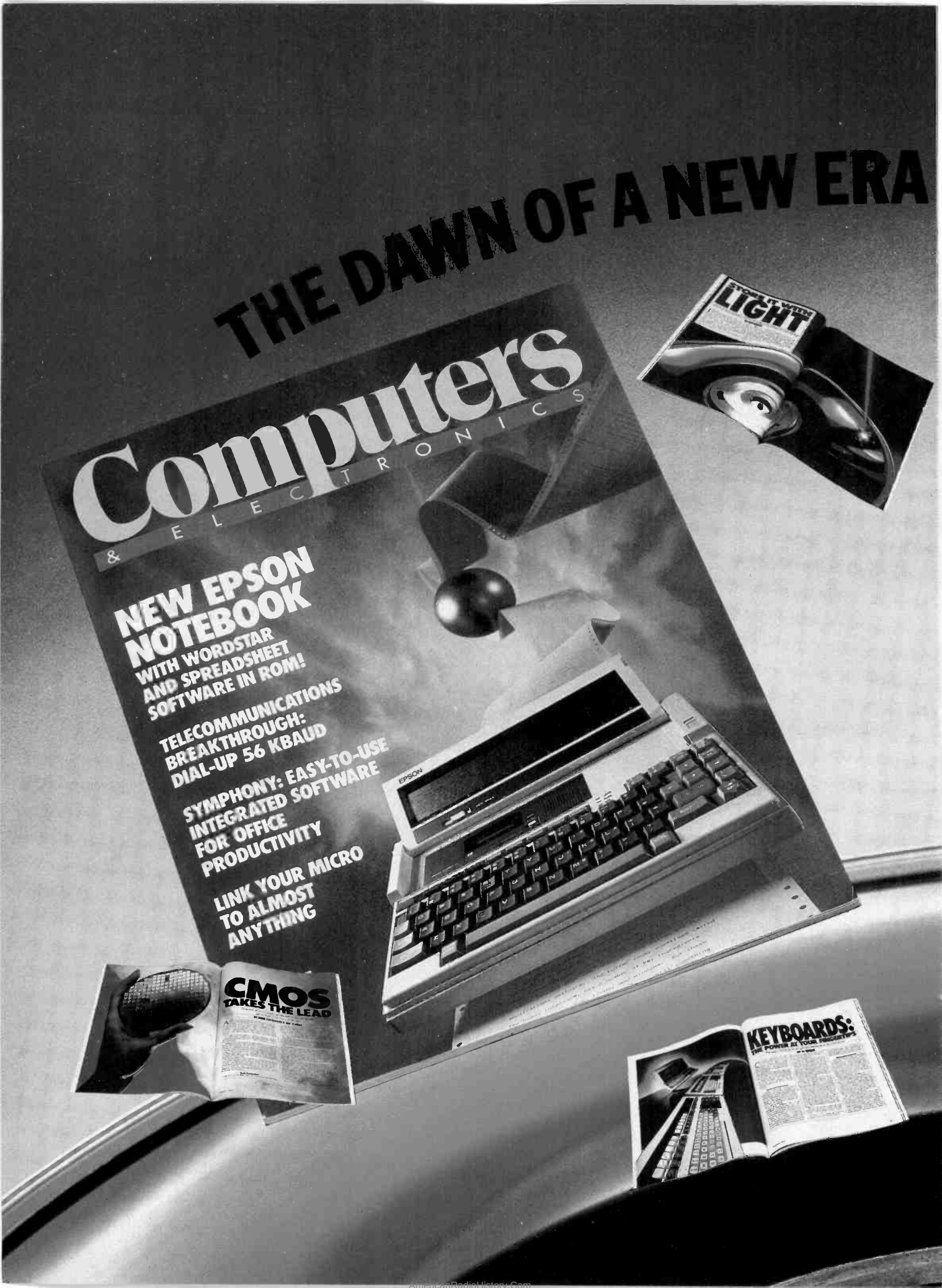
That's just one example of how online information services can find the right straw in an immense haystack of raw data. Originated for links to remote terminals, such services have become popular with users of personal computers, who can tap into them with a standard 300- or 1200-baud modem and a telephone line. Online services now offer an impressive variety of information. The databases they make available include job listings and airline schedules, properties of plastics and architectural specifications, bibliographies of mathematical research and lists of stolen rare books, and so on, seemingly without end.

The variety of databases is large enough to require directories to keep track, but depending on how "database" is defined, counts of available databases differ. Over 2400 have been counted around the world by Carlos A. Cuadra, whose firm, Cuadra Associates, of Santa Monica, CA, compiles quarterly editions of its directory. In one three-month period last year, he said, over 180 new

Jeff Hecht is a free-lance author who has written frequently for this magazine on computer systems.

PHOTO BY BARRY BLACKMAN

THE DAWN OF A NEW ERA



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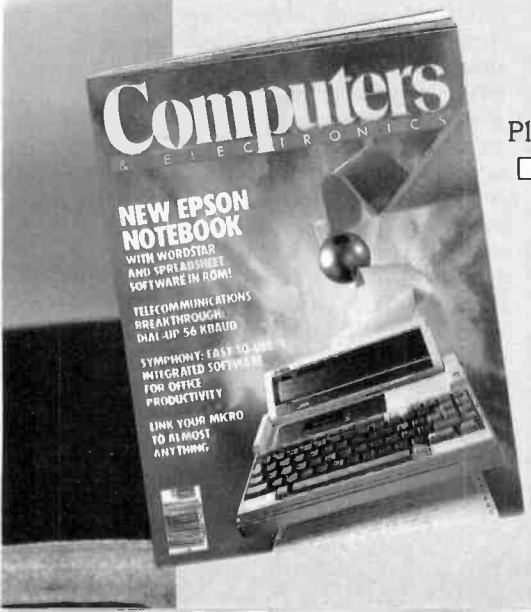

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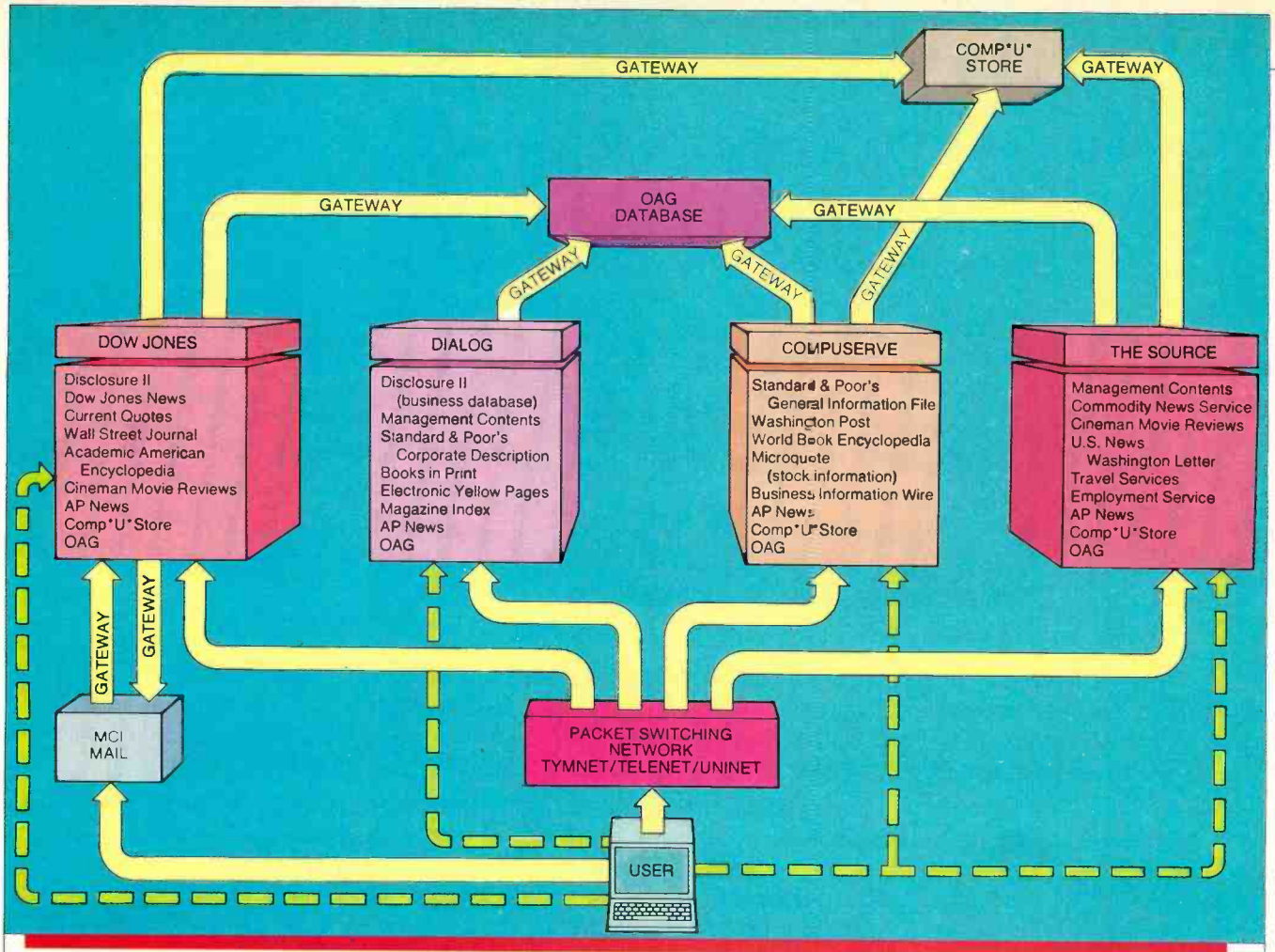


GETTING INFORMATION FROM ONLINE DATABASES

Information from online databases can be accessed in a number of ways. Probably the most common is from a database provider (databank) such as Dialog. Database producers (AP News, Books in Print) send information to the databank's computers. Users access the information from providers.

Another method is via a "gateway," an online system that acts as a link to another service. A popular gateway service is the Official Airline Guide. Information in OAG is changed at the rate of 30,000 records daily, which makes the task of transferring information to other databanks impractical. Comp*U*Store, an online shopping service that provides items of just about every kind for home and business, is accessed via several gateways.

Some services, such as Dow Jones, may be accessed directly (dashed lines). They may, in turn, act as gateways to other services. Dow Jones and MCI Mail symbiotically serve as gateways to each other.

The same service may be available on several databanks, but in different forms. The AP videotex service, for example, provides Dow Jones, The Source, and CompuServe subscribers with foreign and national news, sports and weather, but on a current basis only. Stories older than one week are removed from the system.

Dialog offers the full AP news service, 48 hours old. Once on the system, it remains indefinitely, to provide an excellent source of historical information on breaking news.

databases went online, while 72 old ones were dropped. Cuadra classifies databases finely; for example, his directory considers each of the roughly 225 newsletter databases on the NewsNet service (Bryn Mawr, PA) as separate. On the other hand, the *Omni Online Database Directory*, which lists only about half as many databases, lumps all the newsletters together as a single NewsNet database.

The United States, Canada, and Western Europe are leaders in databases, with Japan following, perhaps because of its complex *Kanji* script. English is by far the most common language; some European databases are in French or German, and a handful are in other languages. Some information services are international. The French Questel and the European Space Agency's Information Retrieval Service (ESA-IRS) are at least nominally available in the United States via trans-Atlantic tie-lines. The British Pergamon's InfoLine is available via Tymnet and Telenet.

Bibliographic Databases

Bibliographic databases were among the first to develop and are still prevalent. Many started out as printed publications listing research papers, including brief abstracts of them, published in a particular field; for example, Britain's Royal Society of Chemistry offers both online and printed versions of its *Chemical Engineering Abstracts*. The printed versions remain useful for keeping up with new research, but it's far easier to search for specific references online.

To help users extract the information they want, online services have developed database-searching software that is almost as varied as the data. Some software is written for the casual user, such as a person browsing through a job-listing database. Other services write software to improve the efficiency of searches by such specialists as lawyers and legal aides in files of patent and legal data. The specialized software may even include auxiliary databases, such as IFI/Plenum's Claims/Class database, which indexes classification codes used in the company's patent databases. Lately some third-party software vendors have started to offer programs to aid database searches (see the article on page 58).

Most online services deliver starkly

functional text to the screen, without the graphics or color of videotex displays on television sets (see "Whatever Happened to Videotex?" sidebar). Many databases intended for casual use are menu-driven but allow experienced users to bypass the menu. However, search routines for professional use typically require knowledge of specialized commands listed in a manual or user's guide. It takes time to learn the commands, but they make searches more efficient.

There are two ways to access information from database providers and information services: a direct telephone call to one of the nodes maintained by the service or a call to an intermediary network. The most common of these "packet switching networks" are Telenet, Tymnet, and Uninet. They provide local numbers so a user can branch out to the database or information service wanted.

Like any computer program, database text searches can be painfully literal. A search for "Richard Nixon" will not uncover "Richard M. Nixon." If the program is looking for "Richard" and "Nixon," however, it could bring to light an article on Richard Jones and Frank Nixon. Nor will the computer consider "embezzlement" to be a "crime." But these are minor problems offset many times over by the ease of the search.

Searching a Database

Remember the last time you searched through a library for articles on a particular topic? The job started with a search through a few years of the *Reader's Guide to Periodical Literature.* If you were lucky, the topic was listed in the way you expected, but more likely you had to look up several variations in the wording to find the desired articles, repeating the process for each year. Then you had to dig into the stacks and hunt for the publications—all too often, futilely. And the most recent articles, typically the most important in science and technology, were inaccessible because of the time it took to compile and print the *Reader's Guide* volumes.

You could do the job quicker and better by searching a bibliographic online database. You could search for your topic by entering a word or words to describe it, either selected from a set of standardized indexing terms or specified for your custom needs. Each individual term would probably give you more potential leads than you wanted. For example, a sample search found that 12,126 entries in the BRS mention "computers." However, this set can be narrowed down by specifying that entries include all of a set of terms, which, in this example, would limit the number of "hits" to 34. Then you could print out references to the articles on the desired topics. Many databases give a short descriptive abstract of the article as well as the author and title, making it easier for you to decide if the article is worth examining. Some information services will produce copies of the entire article offline and mail it, for an extra fee.

That isn't all a good database search routine can do. Specific authors or institutions can be searched as well as topics. For example, scientists can follow the activities of other research groups. There also are special-purpose bibliographic databases designed to retrieve hard-to-get information. Because many important scientific results are described only at conferences or appear there before they appear in technical journals, special databases exist that cover only meetings. One is the Conference Papers

THE BIG FOUR

BY D.J. HERDA

Of the hundreds of database services available to modem owners in the U.S., four account for more than an estimated 70% of electronic information business: The Source, CompuServe, Dow Jones, and Dialog. Although you can search the offerings of hundred of database suppliers until your micro fries, chances are you'll find precisely what you're looking for in one of the Big Four.

The Source, 1616 Anderson Rd., McLean, VA 22102; 800-336-3330. In August 1983, this Readers Digest-owned subsidiary cut initial membership fees by more than 50%. Since then new memberships have increased about 3000 per month, to reach more than 65,000.

One of the most useful and innovative services of The Source is Compact Conferencing. This feature, popular with businesses, permits several people to communicate from different locations at the same time. Electronic Mail is also widely used. You log on, type the command MAIL S, enter the identification numbers of the recipients you wish to contact, type in the text, and end with the command SEND. Seconds later recipients pull your correspondence, typos and all, out of their electronic mailboxes.

One of the newest features from The Source is real-time Investor Services that provides up-to-the-second stock quotations. After checking the price of a stock, bond, or option, you can buy or sell online (if you have established a brokerage account with Spear Securities) and receive instantaneous confirmation. The service keeps a running tab of your portfolio and may save you up to 30% on full-cost brokers' commissions.

CompuServe Information Service, PO Box 20212, Columbus, OH 43220; 800-848-8199. CompuServe, a division of H&R Block, is one of the largest general-interest information services in the country. It provides hundreds of data services in several categories. Its original feature, Consumer Information Service (CIS), recently added Executive Information Service (EIS), a separate business-oriented subscriber network. Subscriber membership for CIS alone is 150,000. (CompuServe says figures on EIS membership aren't presently available.)

Among CompuServe's most innovative features are its User Forums, electronic bulletin boards of over 100 different categories, Electronic Mail, and a nationally available shop-by-computer service offering products from Sears, Bloomingdale's, American Express, and over 70 other stores.

Although CompuServe has plenty of head-to-head competition in The Source and Dow Jones, it offers a few things not currently available from most other online information networks. One is the new T.W.A. Travel Shopper Service. Like Dialogs, it enables customers to book airline flights and choose their own seats through their home micros. Another is Citizen Band Simulator, a live, interactive dialogue service on which hundreds of people congregate electronically to confer as over a citizen band radio.

Dow Jones News/Retrieval, PO Box 300, Princeton, NJ 08540; 800-257-5114. More than 70,000 members, mostly people in business and well-heeled investors, currently subscribe. Although it offers some general-interest reporting on news, weather, sports, and movies, its emphasis is to provide people with news they need to make smart business and investment decisions—hard news stories from *The Wall Street Journal* and *Barron's,* for example, plus Financial

(Continued on page 90)

Using Dialog to find laser printer articles in COMPUTERS & ELECTRONICS.
Above: In-search menus for database choice (left) and input screen for search criteria (right).
Below: Manual search procedure and sample database record.

Tell Dialog to leave current database and enter No. 275 (Computer Database) ➤ *BEGIN 275*

Summary of charges for prior database ➤
```
21NOV84 9:43:15 USER25018 ;
$0.23 0.009 HRS FILE 1#   ;
$0.07 UNINET              ;
$0.30 ESTIMATED TOTAL COST;
```

Description of selected database ➤
```
FILE 275:COMPUTER DATABASE 83-84/1ss22
(COPR. MANAGEMENT CONTENTS 1984)
```

Tell Dialog to find all articles that have the words *laser* and *printer* adjacent, only from *Computers & Electronics* ➤ *SELECT LASER (W) PRINTER AND JN = COMPUTERS & ELECTRONICS*

Dialog set header ➤ `SET ITEMS DESCRIPTION`

Articles with laser and printer ➤ `119 LASER (W) PRINTER`

Total articles found from C&E ➤ `343 JN=COMPUTERS & ELECTRONICS`

Set #1 has 3 articles that meet all criteria ➤ `1 3 LASER (W) PRINTER AND JN=COMPUTERS & ELECTRONICS`

Tell Dialog to show the first record from set #1 in format 5 (include abstract) ➤ *DISPLAY 1/5/1*

Dialog record header ➤ `DISPLAY 1/5/1`

Dialog accession number ➤ `168225 CEL8460036`

Article title ➤
```
LASERJET PRINTER-SOONER THAN ANYONE EXPECTED-
AN AFFORDABLE PRINTER
```

Author ➤ `BERNARD, J.`

Bibliographic listing ➤
```
COMPUTERS & ELECTRONICS VOL.22 NO.7, JULY 1984, P. 36-38,87, 4 PAGES
COUNTRY OF PUBLICATION: U.S.A. LANGUAGE: ENGLISH
```

Universal journal identifiers ➤ `CODEM: CMELDS ISSN: 0032-4485`

Where to get full text prints `AVAILABILITY: AVAILABLE FROM MANAGEMENT CONTENTS`

Record identifiers ➤
```
DOCUMENT TYPE: JOURNAL ARTICLE TYPE: TECHNOLOGY; HARDWARE; PRODUCT EVALUATION
SPECIAL FEATURES: INCLUDES PHOTOGRAPHS; DIAGRAMS; OUTPUT
```

Abstract ➤
```
   THE HEWLETT-PACKARD LASERJET PRINTER WAS DESIGNED TO BE THE LEADER
IN AFFORDABLE LASER PRINTERS. THE PRINTER USES ELECTROPHOTOGRAPHIC
DRUM ASSEMBLY CARTRIDGES DEVELOPED BY CANNON FOR ITS LOW-PRICED COPIERS
WHICH USE PLASTIC INSTEAD OF THE TRADITIONAL PHOTOSENSITIVE SELENIUM. A
SEMICONDUCTOR LASER IS USED TO PLACE A MEGATIVE CHARGE ON THE DRUM TO WHICH
THE POSITIVELY CHARGED TONER ADHERES. LEDS BENEATH THE MAIN CONSOLE KEYS
INDICATE THE OPERATION OF THE PRINTER. IT CAN OPERATE IN A "PRINT" MODE
FOR TEXT, AND EITHER "PORTRAIT" OR "LANDSCAPE" MODE FOR GRAPHICS. THE
RESOLUTION CAN BE SET TO 100, 150, OR 300 DOTS PER INCH AND IS UNDER SOFTWARE
CONTROL. ANY MATERIAL THAT CAN RUN THROUGH A COPIER CAN BE USED FOR PRINTING.
THE ESCAPE SEQUENCES ARE INCOMPATIBLE WITH STANDARD PRINTERS AND DRIVERS ARE
REQUIRED FOR WORD PROCESSING.
   THE PRINTER, PRICED AT $3500, IS "FAST, CLEAN, EXTREMELY QUIET," SUITABLE
FOR ANY BUSINESS APPLICATION. INCLUDED ARE PHOTOGRAPHS OF THE PRINTER, DIAGRAMS
OF THE PRINTER SYSTEM, AND OUTPUT COPY.
```

More record identifiers ➤ `PRODUCT NAME: LASERJET, HEWLETT-PACKARD, PRINTERS`

to help with search strategy ➤ `DESCRIPTORS: LASER PRINTERS; PRINTERS; NEW PRODUCTS; HARDWARE`

Index, offered by Cambridge Scientific Abstracts and available over Dialog and other services. A careful search of such databases can help an absent-minded professor find a paper remembered only dimly as something about quasars presented by someone from Stanford University at a 1979 conference.

Bibliographic databases come in many shapes and sizes. The 2,000,000-entry Inspec database, compiled by Britain's Institute of Electrical Engineers, covers the whole range of electronics and electrical engineering. In contrast, the more specialized Cold Regions database compiled by the Army Corps of Engineers contains only 74,000 entries, all limited to research on the Antarctic and on civil engineering in cold regions. And a few databases, covering topics as narrow as construction regulations in West Germany, may contain only a few thousand entries.

Full-Text Services

Bibliographic databases can be very valuable, but they have their limitations. The compression that generates the abstract inevitably loses some of the detailed information of the full text. Some material, such as newspaper articles and newsletters, is difficult or impractical to abstract. Full-text databases offer an alternative. With the widespread use of computerized typesetting, the full text is often available readily and inexpensively from publishers.

Some full-text databases are intended specifically for professional users. For lawyers, Mead Data Central offers Lexis, which contains the full texts of federal court decisions and many state court rulings. The 25,000 searches performed each day for several dollars each, save untold hours of painstaking scanning of legal tomes.

Mead also offers Nexis, which contains texts of 50 magazines and newspapers, an equal number of newsletters, and about a dozen wire services. New competition in that field comes from the Information Access Co. of Belmont, CA, which last year introduced two full-text databases on Dialog. Magazine ASAP includes texts from 50 major general-interest magazines, including COMPUTERS & ELECTRONICS, the *Saturday Evening Post*, and *Playboy* (without its graphics). Trade & Industry ASAP serves a more specialized audience with texts of major industry-specific magazines, such as *Automotive News*, *Electronic Design*, and *Progressive Grocer*.

Full-text searches are great for uncovering what doesn't show up in the headline, but they have their limitations. The bulk of material can be expensive to store and time-consuming to search. Thus, only major magazines and newspapers generally are stored in full-text format.

The situation is different for newsletters because they are short and very timely—and often very expensive. Annual subscriptions reach a few hundred dollars. One service, NewsNet, puts 225 newsletters on line, including *Africa News*, *Banking Regulator*, *Interactive Video Technology* and *High Tech Patents: Laser Technology*. Many publishers transmit the text before it's available in print for access at prices from $0.40 to $2.00 per minute. Back issues of the newsletter remain online, where they can serve as a database. And a Newsflash service alerts subscribers by electronic mail of news involving subjects of special interest, such as reports involving their company or major competitors.

Reference Databases

Databases can also be loaded with reference information to serve as online encyclopedias or handbooks. Some of these databases are merely online versions of such reference standards as *American Men and Women of Science*. That isn't a great advantage if all you want can be found in ordinary indexes, in alphabetical order—but information needs often go beyond that. A search of the online version could quickly identify astrophysicists who received doctorates from Caltech during the 1950s, for example, an extremely tedious task to compile by hand from the print version.

Many reference databases compile business, financial, and stock data, with emphasis on hard numbers. Although some are intended for casual investors, most are intended for financial professionals and carry prices to match. Sub-

(Continued on page 89)

WHATEVER HAPPENED TO VIDEOTEX?

At the start of the decade, it was predicted that in 5 years videotex systems would deliver graphics and text from computer files to over a million television screens in U.S. homes. The cold light of reality reveals an embarassing shortfall. By late last year, only a few thousand people subscribed to only three such systems. Moreover, the oldest, Miami's Viewtron, had just laid off about 20% of its work force a year after the start of service.

What happened? Videotex developers found themselves hampered by high costs, incompatibility with personal computers, a lack of services appealing to consumers, and an uncertainty in marketing direction. Online consumer-oriented information services aren't dying; but they do seem headed in a different direction, more oriented toward personal computers and businesses and probably less dependent on graphics and unsophistiated users than was the original idea of videotex.

When videotex was conceived over a decade ago, the goal was to build a system anybody could use to retrieve information from computerized databases through home television sets and telephones. Inexpensive adapters would convert transmitted data into eye-catching color graphics and would let the user control the two-way interaction. To simplify use, access would rely on a menu shown on the screen.

The Systems

Telecommunications specialists were excited when the British Post Office's telecommunications division (now British Telecom) introduced the first videotex system, Prestel, in the late 1970s. Some businesses signed up, particularly travel agents needing access to online airline information. But consumers didn't. Even consumer-oriented databases and services, including teleshopping, telebanking, and restaurant reviews, failed to draw them. Though Prestel has gained some subscribers by adding the ability to download personal-computer software, most customers remain businesses.

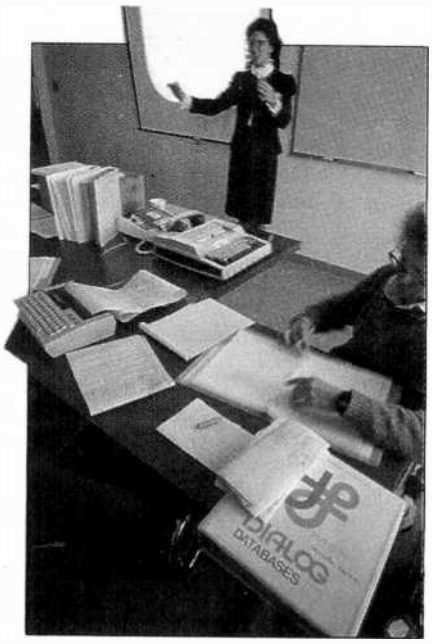
The Viewdata Corporation of America began offering Viewtron, the first U.S. videotex service, on October 30, 1983, in the Miami, FL, metropolitan area. Services are mostly local: teleshopping, telebanking, restaurant guides, educational games, horoscopes, subscriber bulletin boards, want ads, and a horse-racing index. But after a year, this subsidiary of the Knight-Ridder newspaper chain had lured only 2800 subscribers out of a total population over 1.6 million.

(Continued on page 90)

MAKING ONLINE DATABASES USEFUL

Microcomputer software is making it easier to find your way around large online databases

BY KERRY LEICHTMAN



THERE is now enough computer-accessible information to satisfy almost any research need. And that's one of the problems: so much information from such an abundance of sources that using it efficiently is difficult. Thankfully, this awesome data pool includes information on how to use it. And the online help is supplemented by a variety of books, magazines, software, and other training aids.

Database Producers

The database producers are the best resource for fledgling online researchers. These hi-tech vendors seem to provide universally good documentation, at a level of complexity tied to the database audience. Indeed, data providers are so confident of their own search resources, they rarely recommend outside help to their clients.

"Our users don't ask for extra aid," said Bill Van Orden, marketing communications specialist for NewsNet. "We tried to design NewsNet so help isn't necessary. I think we've succeeded. For instance, to read, you type READ. To scan, you type SCAN, and to search, you type SEARCH.

NewsNet gives new users one free hour to master these "difficult" commands. The NewsNet manual explains the details of conducting specific searches, with AND and OR qualifiers, and organizes NewsNet's databases alphabetically, three ways: by industry category, by service code, and by title.

NewsNet offers the least offline support, but the service is easy to use. Dialog, Mead Data Central, Orbit and BRS—other major databanks—offer varying amounts of lecture/hands-on training. All of the companies are more accommodating than you'd expect.

Mead Data, for example, has training centers in 30 cities. And under some circumstances, Mead trainers will come to you. Mead's personal touch continues beyond initial training. All users are assigned an account representative. When you get into trouble your rep is a toll-free call away. Kathy Judy, a training and development specialist with the company, says Mead is unique in its approach to follow-up training, which she says is extensive: "We assign a warm body to each user. We are self-contained."

The database producers are the best resource for fledgling online researchers

BRS and Dialog also offer frequent training sessions. Much of their non-classroom training is free access time, better known as hands-on experience. Dialog offers free access to one or two of its databases every month. Although you might not need to peruse World Aluminum Abstracts, if you're a Dialog subscriber and free access is offered, take it.

"People ought to use this time to get more familiar, more fluent with databases," says Jean-Paul Emard, Vice President of Online, publishers of *Online* and *Database* magazines. "Free access time is one of the best training methods."

BRS and Dialog also offer less flexible, yet still extremely capable, versions of their services to home computerists. These scaled-down versions, BRS/After Dark and Knowledge Index, cost less than the full-featured versions, and offer menus and other, more friendly, methods for finding information.

The casual researcher may need no more help than what the database producers offer. But database use, and the volume of information available, increase daily. Ken Duzy, database specialist and co-editor of the *Directory of Online Databases*, says his organization lists about two new databases every day. The first directory was published in 1979 and included 400 databases. The spring 1984 edition listed 2225 separate databases.

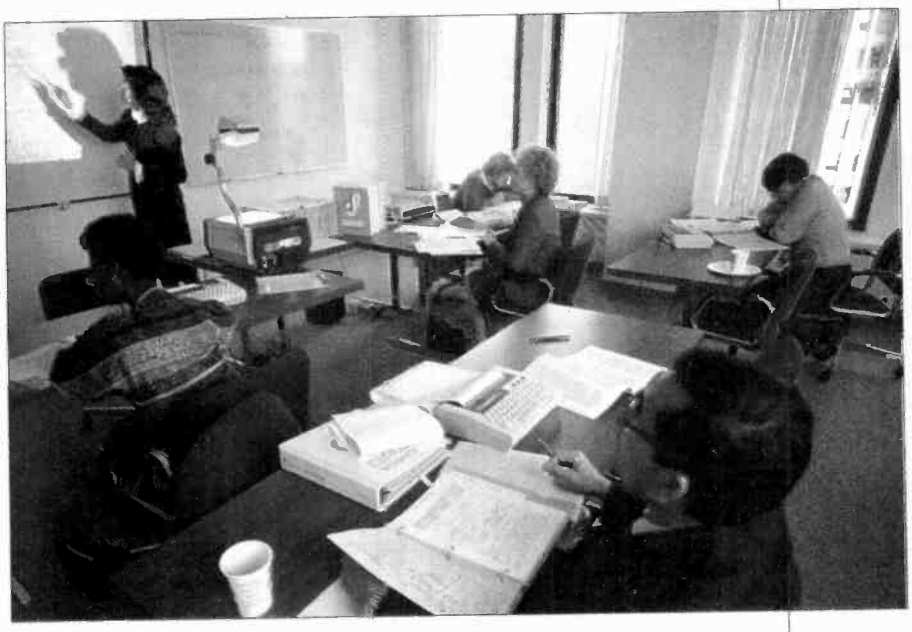
If you need more help, it's available.

Books

There are, all of a sudden, a number of excellent books for databasers. Kieffer and Hansen's book *Get Connected* (see table) is an excellent guide for the beginner. It begins with an historical perspective and well-paced introductions to the various database services. *Get Connected* and Glossbrenner's *The Complete Handbook* . . . focus on the personal computer user rather than the professional researcher. Therefore they deal with more of the databases a personal computerist will want to use.

The Online Micro User's Guide, by Hansen, also describes differing systems

PHOTOS BY STEVE BORNS



Dialog is one of the database producers that offers training sessions for its subscribers.

and styles of information services, but its main strength is in what it doesn't have. It glosses over history and other fodder and gets right to the information. While the presentation is drier than in the other books, the information is fairly similar.

Big-league databasers will be more comfortable with a book like *Online Bibliographic Searching: A Learner's Manual*, by Chen and Schweizer. It is a detailed guide to implementing search strategies. The tips and lessons in this book can help you reduce online expenses and access more of the data you need.

Magazines

Two extremely helpful sources for all researchers are *Online* and *Database* magazines. As with most trade journals, subscription rates are substantially higher than those for consumer periodicals. It is possible prices will fall as the numbers of subscribers grow. The magazines look at databases the way computer magazines look at computers: They review them, discuss how to use them, and generally keep subscribers informed about developments in databases.

Many computer magazines of a more general nature also cover database use. Their subscription rates are lower, and, of course, they cover broader subject matter.

Online Review and *Electronic Publishing Review* are for experienced researchers. The articles are scholarly and full of references. The material probably is very useful to the professional database researcher. Others may be intimidated by the methods and tenor of the magazines.

CompuServe publishes *Online Today*. It focuses on CompuServe, without treating it as the only form of telecommunications. CompuServe users will find this well-produced product invaluable. It is marketed both as a stand-alone magazine and a publication for CompuServe users. (Also of special interest to the CompuServe user is the book, *How to Get the Most Out of CompuServe*. It isn't much help as a bibliographic database aid, but it does a good job of covering CompuServe.)

An abundance of help, piled on top of my computer monitor, was there to assist me

Probably the most useful of all publications is Cuadra Associates' *Directory of Online Databases*, published quarterly. The spring and fall editions are thick compilations of all databases and database producers known to Cuadra. The summer and winter editions are supplements that update the previous volumes.

Software

Dialog, the largest database collection available, is supported by a good deal of third-party software. Of all this support, the most successful and the best known is In-Search. Although In-Search performs a fairly complex service, its strength lies in its simplicity.

With In-Search you can make all of your search decisions offline. When you get online, In-Search communicates with Dialog for you. Because the program speaks the same language as Dialog's computer, the transaction occurs faster than you could manage it, and without a single typing mistake (thus no time spent re-entering commands). In-Search saves you time. And since time (especially online time) costs money, it saves you plenty of that, too. It also helps narrow your search down to its essential components. The more areas of Dialog you poke your computer's nose into, the more it will cost. In-Search will avoid "hits" (search finds) in areas outside your field of interest, saving time by searching smaller areas.

In-Search covers the entire Dialog database, but you can get more specific. Information Access Company (IAC) offers its own Search Helper for IAC's databases: Magazine Index, National Newspaper Index, Trade & Industry Index, Legal Resource Index, and Newsearch. All of these offerings are available via Dialog. Then why not use In-Search? For occasional use, why not indeed. But if these databases are important to you, software with a narrower scope may be more helpful. Because many databases have unique commands, a search aid made specifically for one database may be more economical.

IAC also offers a package plan for

Kerry Leichtman writes for several computer magazines on computers and their applications.

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Books, periodicals, and software can help make online databases more useful.

database use. You can prepay IAC for a certain number of searches; and the more searches you prepay, the less each search costs. Of course if you don't use all of your prepaid searches, it becomes your write-off, not IAC's.

The communications program called SuperScout from the Business Computer Network (BCN) is bundled with *Information Online*. BCN has a unique approach to distributing information. For $5 per month, BCN subscribers have access to 15 databases and online services, including CompuServe, Dialog, BRS, and NewsNet without paying sign-up fees or monthly minimums. The Superscout communications software, which automatically accesses the selected service, is supplied free. To access Dialog, for example, members can call BCN, using SuperScout, and it signs them onto Dialog,with BCN's own password and membership identification.

The book *Get Connected* identifies a major drawback you suffer with such an intermediary: You don't have a personal identity on the databases, which is useful when you request nonelectronic information from the producer or database provider. As a result you don't get the support information or books or newsletters—or electronic mail—that most database providers send to their subscribers.

Also, with BCN, you can't use all the database's functions. On the other hand are economic advantages. You don't have to pay initial membership charges when applicable, nor must you meet the minimum use requirements of some databases. Unfortunately, the SuperScout documentation was indecipherable. I got the gist, that using the program involved more than booting the disk and dialing a number, but no more.

Conclusions

Database searching is not a difficult procedure to learn. Like anything new to you, it has its moments of depressing complexity and times of triumph. I remember my first minutes online with NewsNet. To test the system I tried a full-database search for "Union Maine Chemical." The Union Chemical toxic waste site is a heavily debated local issue here in Maine, and since I noticed a few newsletters on the service that dealt with toxic waste and environmental matters, I thought this search a good test. Lo and behold, it came up with one occurrence meeting my search criteria, a report in *Nuclear Waste News* about the allocation of superfund money to the problem here. That early success helped ease later disappointments.

But there weren't many disappointments. And when I did have trouble, an abundance of help, piled on top of my computer monitor, was there to assist me. ◇

A list of periodicals, books, and software, with producers' addresses, is on page 80.

PHOTO BY BOB LORENZ

GUIDE TO ONLINE INFORMATION SERVICES

THE chart on the next two pages lists major online services available to computer users in the United States and Canada.

The connect charges, the cost to the end-user for linking with the service over a modem line, usually vary according to the speed of the modem. Some services, however, charge a flat hourly fee regardless of the equipment in use.

Additional charges often depend on the database you access. Some services charge for items of information (hits), in addition to connect charges; others charge a premium for entry into their databases; still others do both. Some services pass on the communication charges—through Tymnet, Telenet, etc.—to the end user; others absorb the cost, or at least hide it in the connect charges.

Many services also offer offline printing of the information you display on the screen. The option is useful if you don't have a printer or if yours is too slow or busy to run off a lengthy list of periodical titles, abstracts, or other information.

Many of the services require that you learn a unique command structure, although some can be run from a menu. The menu-driven services tend to require you to spend more time online to obtain information. Using them, however, you don't have to go through the arduous task of figuring out sometimes cryptic codes.

Fortunately, many services offer customers training in the use of their services, usually seminars that are as in major cities.

The column headed "Partial List of Features" can only suggest what information is available. In some cases the enormous amount of information obtainable from any one service would fill a book. The best source of available features is the services themselves. Because new features are being added all the time, only the companies will be able to tell you whether something you want is currently online. ◇

ADDRESSES FOR ONLINE SERVICES

ADP Network Services
ADP
175 Jackson Plaza
Ann Arbor, MI 48106
313-769-6800
or 800-521-3166

BRS Search Service
BRS
1200 Route 7
Latham, NY 12110
518-783-1161
or 800-553-5566

Can/OLE
CISTI
National Research Council of Canada
Ottawa, Canada K1A 0S2
613-993-1210

Chase Econometrics
Chase Econometrics
150 Monument Rd.
Bala Cynwyd, PA 19904
215-667-6000

CompuServe Information Service
CompuServe
PO Box 20212
Columbus, OH 43220
614-457-8600
or 800-848-8199

DRI Database
Data Resources
1750 K St. NW, 9th Floor
Washington, DC 20006
202-862-3700

Delphi
General Videotext Corp.
3 Blackstone St.
Cambridge, MA 02139
617-491-3393
or 800-544-4005

Dialog Informational Service
Dialog Information Services
3460 Hillview Ave.
Palo Alto, CA 94304
415-858-2700
or 800-227-1927

Dow Jones News/Retrieval
Dow Jones & Co.
PO Box 300
Princeton, NJ 08540
609-452-1511
or 800-257-5114

I.P. Sharp Public Database
I.P. Sharp
2 First Canadian Place
Suite 1900
Toronto, Ont. Canada M5X 1E3
416-364-5361

NewsNet
NewsNet
945 Haverford Rd.
Bryn Mawr, PA 19010
215-527-8030
or 800-345-1301

Nexis
Mead Data Central
PO Box 1830
Dayton, OH 45401
800-227-4908

Orbit
SDC
2500 Colorado Ave.
Santa Monica, CA 90406-9988
800-421-7229

Pergamon Infoline
Pergamon International Information Corp.
1340 Old Chain Bridge Rd.
McLean, VA 22101
703-442-0900
or 800-336-7575

QL/Search
QL Systems
112 Kent St.
Suite 205
Tower B
Ottawa, Ont. K1P 5P2
Canada
613-238-3499

Questel
Questel
1625 Eye St.
Suite 719
Washington, DC 20006
202-296-1604

The Source
Source Telecomputing Corp.
1616 Anderson Rd.
McLean, VA 22102
703-734-7500
or 800-336-3330

GUIDE TO ONLINE INFORMATION SERVICES

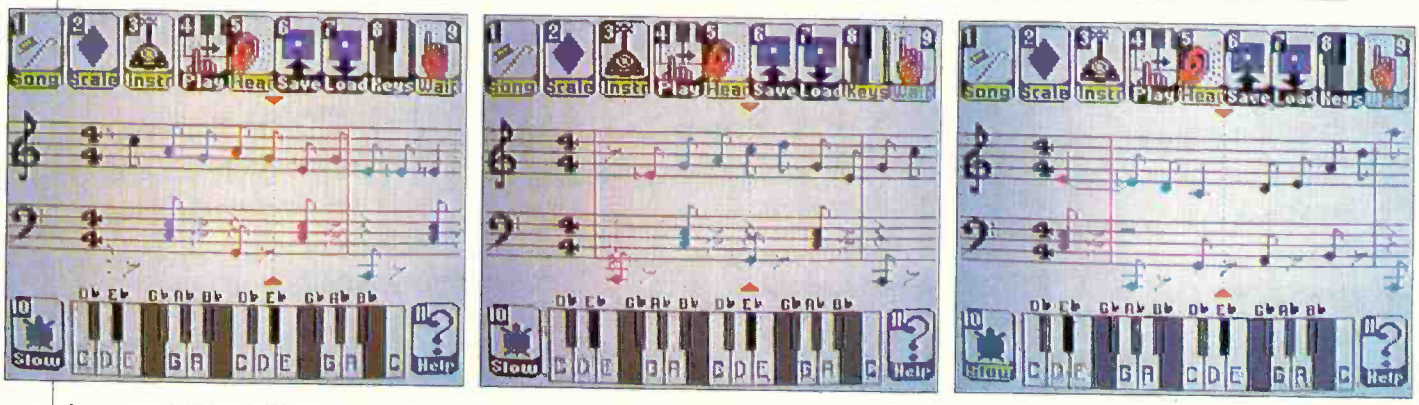
Services	Connect Charges/Hr	Other Charges	Communications Networks	Training Available?
ADP Network Service	300 baud $15 1200 baud $30	Price of transaction varies by data item. $500/month minimum	Autonet Telenet Tymnet	Yes
BRS Search Service	Prime time $16-$35 Nonprime $6-$25	Database royalty $0-$90. Telecommunications charge $8-$14. Open access service $50/year. Startup $75	Telenet Tymnet Uninet	Yes
CAN/OLE	$40-$100 (Can.)	Online hits (terminal display of data) up to $0.22 (Can.) each	Datapac	Yes
Chase Econometrics	Not available	Not available	Telenet Tymnet Uninet	Yes
CompuServe Information Service	300 baud: prime time (8 a.m.-6 p.m. M-F) $12.50; nonprime $6 1200 baud: prime time $15; nonprime $12	Sign-up fee: consumer service $39.95 executive service $69.95	CompuServe Net Telenet Tymnet Datapac	No
DRI Database	$28	$2200/year Up to $1.50/series search	Drinet Tymnet Uninet	Yes
Delphi	Prime time (7 a.m.-6 p.m. M-F EST) $16 Nonprime $6	OAG, NEW premium: prime time $35/hr; nonprime $25/hr. Lifetime membership with handbook $49.95	Tymnet	No
Dialog Informational Service	$25-$100 (average $65-$70)	Telecommunications charge: Dialnet $6/hr others $8/hr	Dialnet Telenet Tymnet, Uninet	Yes
Dow Jones News/Retrieval	Prime time $24-$72 (by minute)	Standard membership $75	Telenet Tymnet Uninet	Yes
I.P. Sharp Public Database	Infomagic rate: 300 baud $60 1200 baud $120	None	Telenet Tymnet Datapac	Yes
NewsNet	300 baud: prime time (8 a.m.-8 p.m. EST) $24; nonprime $18. 1200 baud at double 300-baud rate	$15/month. Premium read rate (selected publications) is typically double base rate	Telenet Tymnet Uninet Datapac	No
Nexis	$20	$50/month. Telecommunications $8/hr ($12/hr WATTS). Session charge: peak time (7:30 a.m.-7:30 p.m.) $9-$18/search; off-peak 50% off	Meadnet Telenet	Yes
Orbit	$40-$165	Telecommunications: Tymnet $8/hr Telenet $10/hr	Telenet Tymnet	Yes
Pergamon Infoline	$65-$125	Telecommunications $10/hr	Telenet Tymnet	Yes
QL/Search	Prime time $75-$85 Nonprime $30-$40	None	Teleglobe Telenet, Tymnet Datapac	Yes
Questel	$58-$107	Telecommunications $20/hr; $0.16 per hit (displayed information)	Telenet Tymnet Uninet	Yes
The Source	Prime time (7 a.m.-6 p.m. EST) $20.75 nonprime $7.75	Sign-up $49.95. $10/month minimum	Sourcenet Telenet Uninet	No

Hours of Operation (EST)	Offline Printing?	Customer Support Hours (EST)	Command or Menu Driven?	Partial List of Features
24 hr/day 7 days	Yes	9 a.m.-5 p.m. M-F	Command	FX (tracks 35 currencies), USEcon (economic database since 1947), SCAN (200 economic indicators), M&A (mergers and acquisitions since 1979), PROMT (article abstracts from 1500 journals), Townsend-Greenspan projections
24 hr/day M-F 6 a.m.-4 a.m. Sat. 6 a.m.-2 p.m. and 7 p.m.-4 a.m. Sun.	Yes	8 a.m.-1 a.m. M-F 8 a.m.-5 p.m. Sat. 8 a.m.-2 p.m. Sun.	Prime time: command After dark: menu	Prime service: 80 databases, mostly bibliographic, some full text, including *Harvard Business Review, Medical Letter, Lancet* and *NE Jour. of Medicine;* nonprime: science and medical databases and *Academic American Encyclopedia*
6:30 a.m.-9:30 p.m. M-F	Yes	8:30 a.m.-4:30 p.m. M-F	Command	30 Canadian databases, document-ordering service, Alberta Oil Sands Info, *Chemical Abstracts,* engineering Index and meeting schedule, COALPRO Research in Progress
24 hr/day 7 days	Yes	24 hr/day 7 days	Both, depending on service	75 national, regional, international, industrial (agricultural, automotive), demographic, historical and economic databases
24 hr/day 7 days	Yes	24 hr/day 7 days	Menu	Electronic mail, bulletin boards, games, CB simulator, OAG, travel planning (PARS)
24 hr/day 7 days	No	8 a.m.-6 p.m. M-F	Both, depending on service	Economic databases including U.S. Central (economic and demographic), U.S. Prices, Flow of Funds (from Federal Reserve data)
24 hr/day 7 days	Typesetting	8:30 a.m.-10:30 p.m M-F	Menu	Conferencing, bulletin boards, electronic mail, delayed stock quotes, OAG, UPI News, encyclopedia
Mid.-10 p.m. M-Th Mid.-8 p.m. F 8 a.m.-8 p.m. Sat.	Yes	9 a.m.-8 p.m. M-F	Command	200 databases, including *Predicast, Chemical Abstracts,* NTIS, Medline, Dun & Bradstreet, Electronic Yellow Pages, ASAP, Newsearch, Legal Resource Index
6 a.m.-4 a.m. 7 days	No	8 a.m.-Mid. M-F	Menu	Realtime and delayed quotes, *Wall Street Journal* (full text); MCI Mail, AP News, Medx, Petersen College Selection Service, portfolio tracking, OAG
24 hr/day 7 days	Yes	9 a.m.-5 p.m. M-F	Menu	120 databases with international information on finance, MCI Mail, AP News, Medx, Petersen College Selection Service, portfolio tracking, OAG
24 hr/day 7 days	No	9 a.m.-8 p.m. M-F	Command	250 newsletters; *Low-Price Stock Alert, Wellington Letter, Stranger Report, High-Tech Patents,* UPI News, OAG, Investext Series
24 hr/day 7 days	Yes	24 hr/day 7 days	Both, depending on service	Full text of 123 periodicals; *Federal Register* and *Code of Federal Regulations,* AP Political Service, *Encyclopedia Britannica,* Lexpat (U.S. patents), Forensic Services Directory
24 hr/day M-Th PST 5 a.m.-4 p.m. Sat. 4 p.m.-12 a.m. Sun.	Yes	8 a.m.-6 p.m. M-F	Command	Science and technology databases: patents, chemicals, engineering, energy, and government regulations; electronic mail
8:30 a.m.-9 p.m. M-F	Yes	8 a.m.-6 p.m. M-F	Command	SDI (update notice), international patents, rubber and plastics databases, *World Surface Coating Abstracts,* electronic publishing abstracts, Patsearch, computer patents, online document ordering, statistical analysis
24 hr/day 7 days local time	Yes	9 a.m.-5 p.m.	Command	80 databases, mostly legal, also mining, coal, and environmental; Canadian Press Newswire; electronic mail; Westlaw; Eurolex
22 hr/day M-F	Yes	8 a.m.-6 p.m. M-F	Command	Graphic match of chemical structures; 50 bibliographic databases, including patterns and textiles, notices of scientific meetings, French legal database
24 hr/day 7 days	Yes	8 a.m.-1 a.m.	Menu	Electronic mail, OAG, Investment Service (including trading through Spear), UPI and AP News, Accuweather, Compact Conferencing

SPRITES AND GRAPHICS

Sprite graphics enable even relatively low-powered micros to do animation

BY TJ BYERS



Icons and notes in Waveform Corporation's *Colortone Keyboard* music program are generated by sprites. As music is played, notes move along the staff. The use of sprites makes animating this type of display relatively simple.

DRAWING even a simple picture on a raster-scanned display is like creating an electronic mosaic. Before you get an image you must lay every single tile separately, that is, you have to plot each component pixel. Generating animated images can be a chore because every image must be plotted and stored separately.

Bit mapping is the traditional way raster screen graphic information is plotted and stored. Now there is something new. It works like a template or stencil. Its called the sprite.

Sprites

A sprite is a shape stored within a computer's memory and formed, like any other video graphic, by defining pixels on a grid. The difference is that a sprite needs to be defined only once. Afterwards, it is given a name and becomes resident on a single plane (see below). We could, for instance, call the pattern in Fig. 1 "butterfly" and store it in memory under that name, much as programs are stored on disks using file names. When we want to use the butterfly again, we simply call it up by name, and the computer puts it on the screen for us. No more laborious plotting pixel by pixel. The image is always in memory, immediately available.

Of course it is possible to store more than one sprite in memory. The actual number depends upon the computer itself. The Commodore 64, for example, allows up to eight sprites to be defined within a single program. Only one sprite, however, can be assigned to any plane. Eight sprites require eight planes.

The sprite planes can then be stacked one on top of another (Fig. 2). The planes and undefined pixels within the sprite pattern being transparent, all that will be seen on the screen will be the sprite images. Actually, the process resembles cartoon animation, in which cartoon figures are painted on transparent sheets of acetate that are superim-

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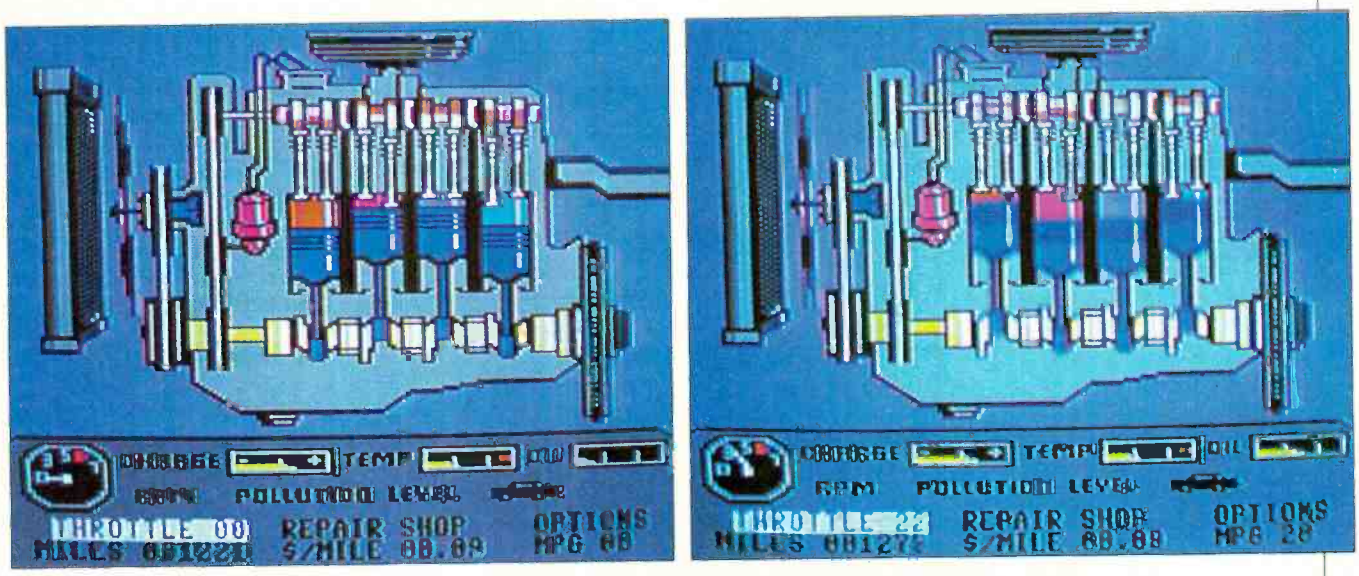
VIDEO DISPLAY COURTESY QUADRAM CORP.



Both sprites and bit-mapped graphics are used in Imagic's *Injured Engine*. Non- or slow-moving parts are generated using conventional bit-mapped techniques. The smooth movement of the pistons, piston rods and gases in the cylinders, though, is due to animation techniques making use of sprite characteristics.

posed over still backgrounds.

To make an image appear on the screen, you recall one of the sprite patterns. It doesn't make any difference which plane the sprite resides on, because it will show through the transparent planes that lie above it. When you execute a program, the sprites are called up one at a time or all at once—or in any combination.

Sizing a Sprite

Generally, sprite patterns are quite small. A Commodore 64 sprite grid, in which the butterfly in Fig. 1 was plotted, measures 24 by 21 pixels, while the now defunct TI 99/4A sprite is a mere 8 by 8. However, sprites are expandable.

You can take a defined pattern and make it two, or even four, times larger simply by issuing an EXPAND command. It's very much like enlarging a figure painted on a balloon by pumping more air into it. The shape or resolution of the pattern doesn't change, only its size. A small junky picture becomes a large junky picture. In many cases, however, the limited resolution that results can be a problem. Especially with intricate patterns, the grid just doesn't contain enough pixels to do the job properly.

A simple way to overcome this limitation is to combine sprites and planes. Let's say you want to build a house, but the number of squares you have to work with isn't enough to give you the detail you desire. What you do is divide the house into two parts and construct each within its own sprite.

By butting the two sprites up against each other, you have a complete house. You can use this ploy with as many sprites as necessary to achieve the detail and size you require.

Another way to make large graphics with sprites is to assemble them from pieces. The country road scene in Fig. 2, for example, uses ten sprites. Each sprite occupies a plane. The sprites are then positioned on their planes so that when the screen is viewed as a whole, they align to form a composite picture.

Notice that the "plane sandwich" also includes a background plane. The background plane can contain the usual solid colors, text, or graphics. Although most backgrounds are rough and chunky, it's not hard to create a backdrop resembling a New York or Chicago skyline.

Sprites in Motion

Sprites can be placed anywhere on the screen. All you need to do is state the x and y coordinates of the desired location. Once you have established the coordinates, the computer constructs the sprite around that starting point.

That brings up an interesting possibility. Since a sprite can be put wherever you wish whenever you wish, why can't you have it move around to simulate motion? You can!

Motion is achieved by stepping the sprite through the coordinate values. By moving the starting point—either up or down, from side to side, or both—in consecutive steps, you can create the illusion of motion on the screen. The motion will be smooth because sprite coordinates can be restated a single pixel at a time. And since the pixel is normally quite small, so is the incremental movement.

The motion of a sprite is limited to a single plane; the plane to which it is assigned. This restriction has interesting consequences, especially when more than one sprite is assigned to the same location on the screen.

Suppose that a sprite on plane 1 represents a tree and you have assigned the butterfly sprite to plane 2. If you activate just the butterfly, it will have free rein of the screen, and you can move it about as you wish using coordinate stepping. However, if you add the tree, what happens when the butterfly crosses the tree?

In the world of sprites, a lower-numbered plane dominates, that is, it is foreground to higher-numbered planes. In other words, the tree on plane 1 has priority over the butterfly on plane 2. When both planes are activated and both sprites are defined to occupy the same space at the same time, the sprite closer to the viewer takes precedence over anything behind it. Consequently, you will see only the tree, not the butterfly. The butterfly appears to fly behind the tree.

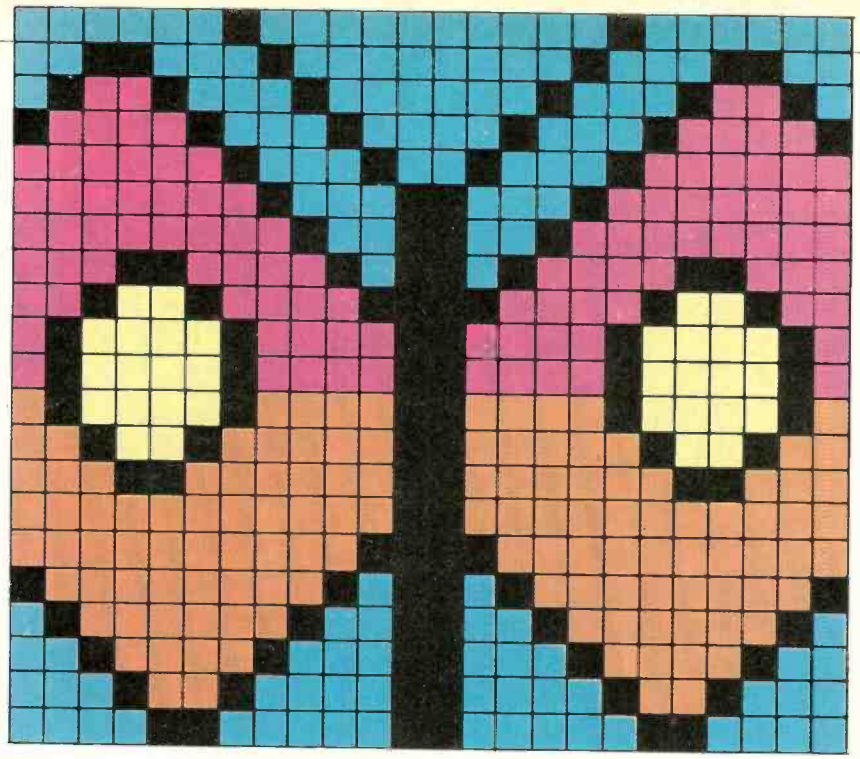


Fig. 1. A simple sprite is plotted on a grid. The bit pattern representing this sprite can then be stored in memory under the name "butterfly."

And the picture has a wonderful three-dimensional effect. This effect is enhanced when background colors, which have the lowest priority, appear through transparent holes in a sprite. Imagine, if you will, the possibilities of having several sprites in motion at the same time, such as a swarm of butterflies fluttering through a forest.

When you are moving composite sprites, such as those in Fig. 2, you must maintain the relative positions of the individual sprites at all times. By holding the scenery planes steady while incrementing the positions of the car parts, you can make the car appear to be traveling down the highway and passing behind the tree.

Collision Detection

Another attribute of sprites is their ability to sense and detect *collisions*. When one sprite passes in front of another, a collision takes place. Granted, sprite law dictates that the dominant sprite take precedence, but the collision is still noted. This collision signal can be put to good use.

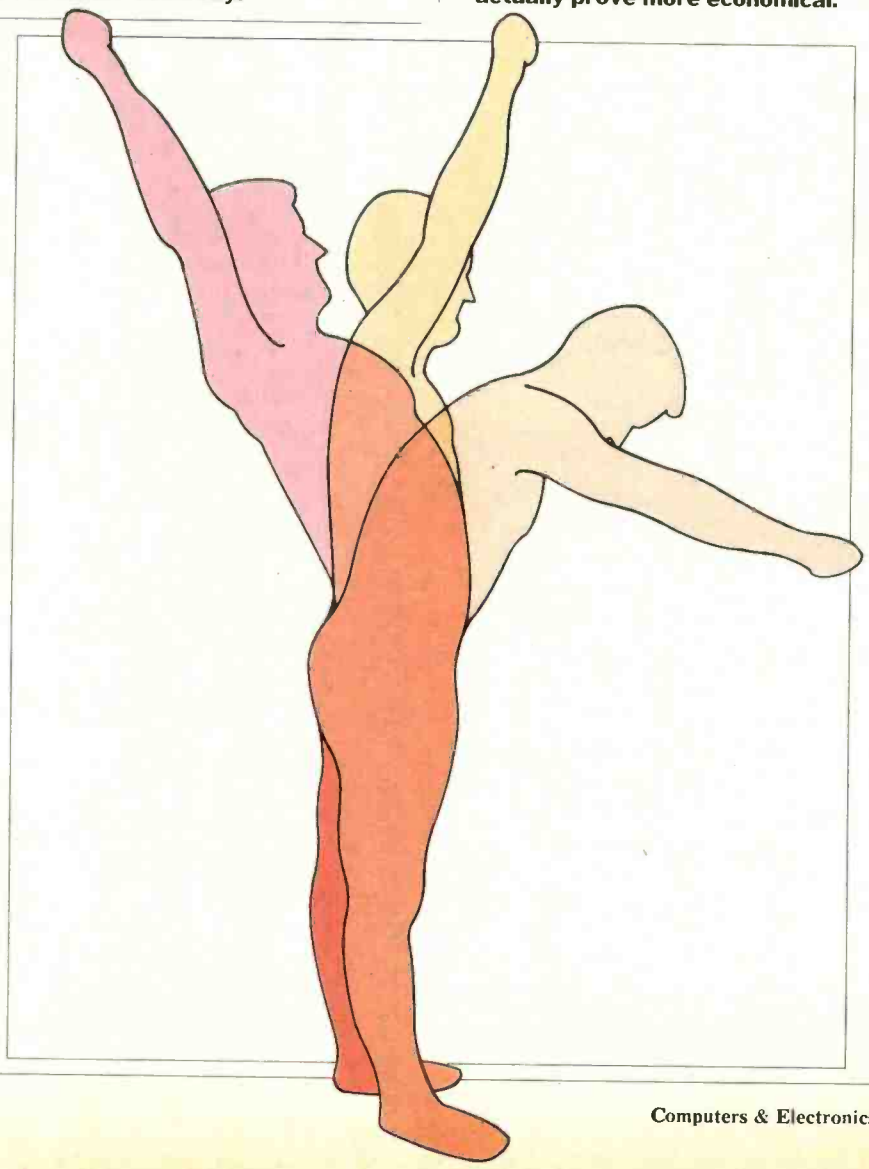
You've undoubtedly played a *Star Wars* type of game at least once in your life, either on a computer or an arcade machine. The object is to put the target and some sort of projectile on a collision course. The computer's job is to sense the collision as it occurs. With sprites this sensing is automatic. At the instant the two sprites overlap, a collision signal is generated. The computer can use this signal to remove the target from the screen and credit your score with the appropriate number of points.

The collision signal can also be handy if you are designing your own software. Placing a sprite-generated pointer in collision with a sprite-generated icon on a menu screen can generate a signal to select that menu choice. Unlike icon programs in which the graphic must occupy a rigidly defined position on the screen for proper identification, a sprite icon can be moved anywhere at any time with the same accurate results.

Animation

Sprite dynamics can be manipulated to give the illusion of motion by rapidly displaying different versions of the same sprite. Take the example of a bird in flight. For the sake of argument, let's say that we must use no fewer than five different versions of the bird, each with its

This "spritely" figure shows that the seemingly more complex can actually prove more economical.



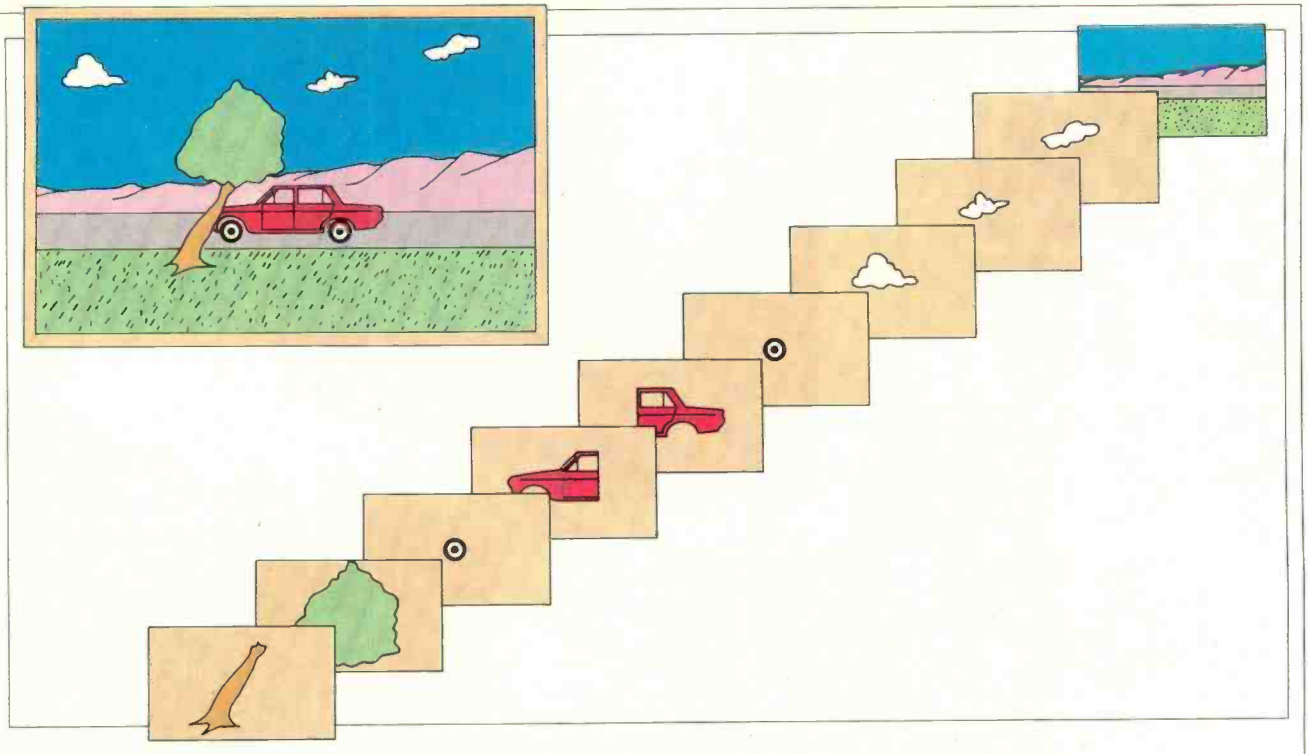


Fig. 2. Complex animation can be accomplished by using a number of sprite planes and changing their coordinates as necessary.

wings in a different position, to give the illusion of flight. With sprites, there are several ways to accomplish our goal.

The most obvious is to define five different sprites for the bird and recall them in order. Unfortunately, sprites, when first recalled from memory, tend to take a while to form on the screen. If the wings of the bird have to change rapidly through their five positions, there isn't enough time to paint five different sprites on the screen in succession.

It's much more efficient to place all five sprites on the screen at the same time and at the same spot, and to turn off all the sprites but one.

Disabling a sprite from view by switching it off doesn't remove it from the screen—it simply makes it invisible. By rapidly turning sprites on and off in sequence, we achieve animation.

The spritely athlete illustrated on the opposite page can also be generated in two ways. In the first, three entire sprites can be used, each activated in sequence. The second method uses four sprites. The first represents the stationary lower portion of the athlete's body; the other three depict the upper portion in various positions. The second method, in many instances, can save considerable memory and programming effort over the first.

Which is exactly what sprites are about. They enable users to create images with increased ease and flexibility. With them, we can portray many objects quite easily, manipulate them, and even surprise ourselves when they interact. ◇

SPRITES ON A CHIP

THE advent of VLSI (Very Large Scale Integration) video chips containing sprites is opening the way to high-quality computer graphics. What used to be done in software can now be done in single-chip hardware. The TMS9918, from Texas Instruments, is such a chip.

In the TI chip, the sprites come in two different sizes, 8 × 8 and 16 × 16 pixels. The smaller sprite is defined by 8 bytes of data. The sprite pixels are arranged in a bit-mapped grid measuring 8 × 8. The first byte defines the first pixel row; the second byte defines the second row; and so forth. A logic-0 bit makes a pixel transparent, while a logic-1 gives it substance. In the 16 × 16 mode, the grid rows are 16 pixels long. Therefore, 2 bytes are required to define each row.

The sprite-defining information is loaded into a *sprite generator table* and an 8-bit name is assigned to it. The name resides in the *sprite attribute table.* Altogether, the TMS9918 will support up to 32 different sprites, each on its own plane.

Retrieving a sprite is a simple matter of addressing the sprite attribute table and entering the name of the sprite desired. In addition to the 32 sprite planes, the TI chip includes a background plane, a solid color backdrop plane, and an external video plane, with their priorities falling in that order. The external plane is unique in that it can display such video information as that generated by a video camera. And because it has the lowest priority of all planes, sprites can be superimposed over the images on it.

In cases where two sprites on different planes occupy the same spot on the screen, the sprite on the plane closest to the viewer takes precedence and masks the spot behind it. At the same time, a coincidence flag is set in the *status register* identifying the collision.

TI sprites are expandable. In the magnification mode, the sprites double in size. An 8 × 8 sprite becomes 16 × 16, and the 16 × 16 becomes 32 × 32. The resolution of the sprite doesn't change, though, and the expanded sprites are graphed as 2 × 2 pixels instead of a single pixel. The sprite mapping, on the other hand, doesn't change; the sprite can still be moved 1 pixel at a time. ◇

NEW FLAT PANEL DISPLAYS

Gas plasma and vacuum fluorescent displays provide bright alternatives to LCDs as replacements for the traditional CRT

BY BOB MARGOLIN

If you were among the millions who watched the Olympic Games on television, you probably saw IBM's commercial. What made that commercial worth noting was that IBM prominently featured its Model 3290 Information Panel, an intelligent terminal with a large flat panel display. Apparently IBM is promoting its flat panel display as an important advancement towards the future of video display technology. And it may very well be right. Even now, flat panel displays offer better performance, greater reliability, and longer service life than the cathode ray tubes (CRT) in general use. Their only current drawbacks, higher initial cost and the lack of multicolor displays, will no doubt be solved with time. Moreover, flat panel displays are less costly to maintain.

Flat panel displays come in four basic varieties—liquid crystal (LCD), gas plasma (GPD), electroluminescent (ELD), and vacuum fluorescent (VFD).

LCDs are now in widespread use for everything from wrist watches to portable computers (see "Big Picture Displays," August 1984, COMPUTERS & ELECTRONICS). However, they require an external light source and cannot be read unless viewed nearly head-on. VFDs are also being used today, but they are relatively small and are not well suited to most computer applications. That currently leaves GPDs and ELDs as practical emissive flat panel alternatives to conventional CRTs in computer applications.

GPDs and ELDs are very similar, the major difference being the source of the emitted light. In GPDs, the light results from the ionization of a gas—usually neon or a mixture of neon and argon—between a pair of electrically charged electrodes. In ELDs, the light is produced from the stimulation of a luminescent material between a pair of electrically charged electrodes. In both types, the electrodes, insulators and spacers, and the light-emitting material are contained within sealed glass envelopes that are typically thinner than 0.5".

Making Them Work

Bare GPDs and ELDs are analogous to bare CRTs. To function as complete monitors, they must be supplemented with driving electronics that selectively energize the correct pixels in the display. In some cases, the electronics are stacked on the rear surface of the glass envelope. In others separate boards that plug into the host data source are used.

Just about all flat panel displays use row-and-column addressing schemes. With row-and-column addressing, any pixel can be lit by energizing the specific row-and-column electrode pair that intersect at its location. In this way, a relatively few driving circuits can address several hundred thousand pixels.

While row-and-column addressing can minimize the driver circuitry, it has a serious drawback. Light is emitted only so long as energizing power is maintained. To get around this problem, scanning circuitry is used that sequentially addresses the pixels in each row column by column in the same manner that the screen of a CRT is swept. Because each column electrode is energized for only a fraction of each horizontal scan, each pixel is on only as long as it is addressed. However, the pixels appear to be lit continuously because the scanning rate is so high that a human eye cannot detect the off-on-off cycling.

Unlike CRTs, however, GPDs and ELDs do not require ki-

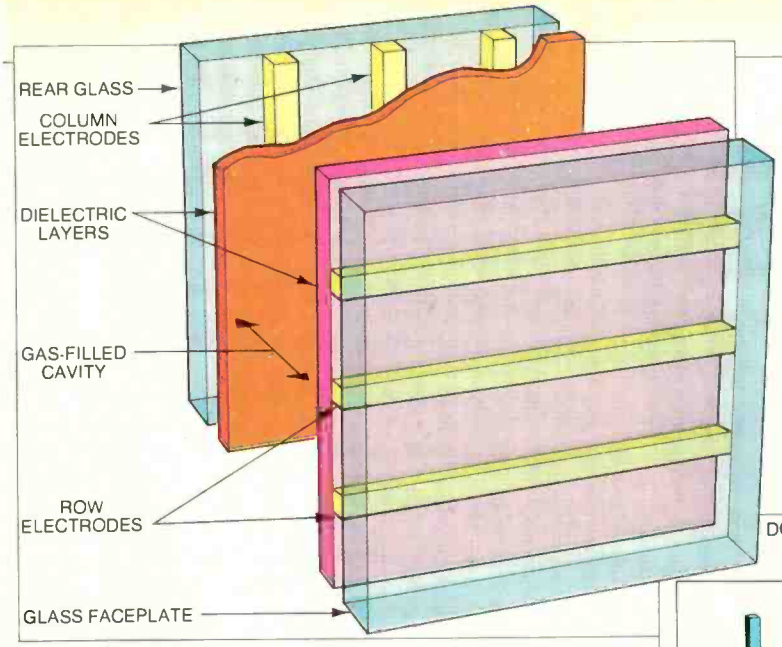
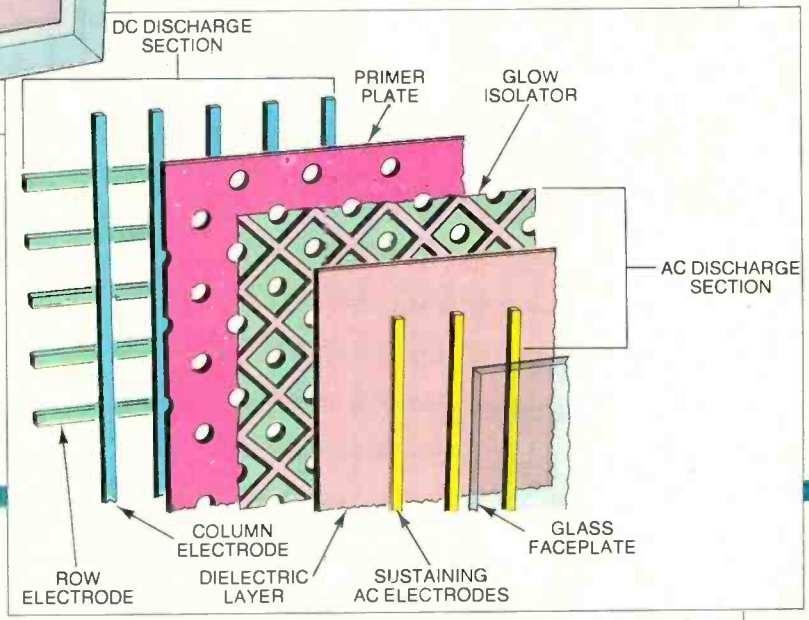


Fig. 1. (Left) Construction of a basic ac gas discharge display.

Fig. 2. (Below) Cross section of a hybrid gas discharge display.



Photos at left show Industrial Electronic Engineer's dot matrix dc gas discharge display (top) and Planar Systems 256 × 512 electroluminescent display.

lovolt power supplies; less than 200 V will do nicely. Moreover, many GPDs and ELDs contain built-in dc/dc converters that typically operate on 24 V or less.

Gas Plasma Displays

Gas plasma displays, also called gas discharge displays, operate like common neon lamps. Simply put, some of the electrons in gas atoms are stimulated to higher energy states by applying a voltage across them. This higher energy state is not maintained, however, even though the voltage remains applied. When the electrons drop back to their normal energy states, the energy lost in the decay process is converted into light.

The voltage at which light is first emitted—the firing voltage or potential—depends on the atomic structure of the gas being used. Neon-based gas mixtures are used in GPDs because they fire at relatively low voltages—typically between 130 and 185 V. Since the color of the light emitted by a gas also depends on its atomic structure, GPDs are inherently monochromatic. Fortunately, neon produces an orange light that is very close to the amber that some experts believe is the most comfortable to view.

Light can be obtained from a gas discharge with either ac or dc voltage applied across the gas. In fact, both ac and dc gas discharge displays are made. Although they produce the same kind of light, their construction and operating characteristics are quite different.

Dc gas discharge displays usually consist of rows and columns of solid electrodes, separated by spacers or isolators, within a gas-filled glass envelope. In most cases, the "front" electrode is actually a transparent conductive material painted on the inside of the display's faceplate. Less often metal electrodes are used. The "rear" electrode is often etched metal though occasionally a conductive coating is used.

Gas tends to fire very slowly when a direct current is applied across it. In fact, it can take as long as 15 seconds or more after a dc voltage is applied for all the gas between a pair of electrodes to begin emitting light. For a display to be useful, all the gas must fire within a fraction of a second. To obtain the required high-speed turn on, a portion of the gas in a dc display is kept ionized by continuously energized keep-alive electrodes. This ionized gas, acting as a primer, greatly shortens the time to fire all of the gas between a pair of energized electrodes by lowering the net resistance between them.

Because the applied dc voltage maintains a given polarity, current always flows through the gas in the same direction. Over a period of time, some of the gas forms molecules that have a much higher firing voltage than the free gas atoms alone. As a result, the concentration of usable gas drops and the amount of light generated decreases.

Of even greater consequence, however, is the slow deposition on the glass faceplate of metal atoms knocked off negatively charged electrodes by positively charged gas ions smashing into them. Eventually the increasingly opaque metallic film attenuates the light being emitted by the gas.

Finally, the combination of lowered concentrations of us-

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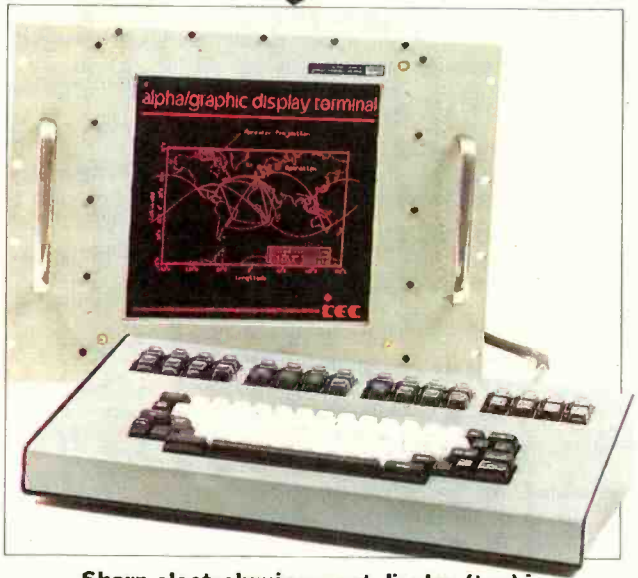

Sharp electroluminescent display (top) is used in the Grid Compass (center). Interstate Electronics ac gas discharge display (bottom).

able gas and metal deposition reduce the display's light output to a level that is no longer usable. How long it takes depends on many factors and varies from display to display, but typically runs between 20,000 and 30,000 hours. While this is 50% longer than the useful service life of a typical CRT, it is only about one-third the lifetime of ac gas discharge displays.

Ac gas discharge displays are able to provide longer service life, in part, because the alternating polarity of the applied voltage minimizes the permanent formation of gas molecules. Moreover, since ac current can pass through a capacitor, the electrodes can be protected from ion bombardment with a dielectric coating (Fig. 1). Since the gas ions cannot reach the electrodes, no free metallic atoms are present in the gas to deposit on the glass faceplate. In addition, an oxide coating is often added to the dielectric layers to increase the number of free electrons in the gas mixture through secondary emissions, which increases the turn-on speed.

The internal construction of ac and dc gas discharge displays is very similar, except for the dielectric layers, which give ac displays an inherent memory. When a pair of electrodes in an ac display is energized, localized surface charges, sometimes called wall charges, develop in the dielectric. If a sustaining voltage of slightly less than the minimum needed to maintain the gas discharge is applied, the local surface charges in the dielectric will add enough voltage to raise it above that minimum. As a result, once the gas between a pair of electrodes is ionized and begins emitting light, the process continues as long as the sustaining voltage is present, even in the absence of firing potential.

In actual practice, the sustaining voltage is often applied across all of the electrode pairs in the display. Since this voltage is well below the firing potential, none of the gas ionizes and no light is emitted. When the gas between a specific pair of electrodes is to emit light, a firing pulse applied across them raises the net voltage to a level high enough to fire the gas. Although the time the pulse is present is very short, it is long enough for the wall charges to develop in the dielectric layers, sustaining the discharge process after the firing pulse is removed. When the light is no longer desired, a pulse of the opposite polarity is applied across the electrode pair to reduce the net voltage to a level below the minimum needed to maintain it. Once the gas discharge stops, the surface charge rapidly dissipates, and the net voltage remains below the minimum needed to sustain it, even after the turn-off pulse is removed. This memory effect enables simple row-and-column drivers to address individual pixels anywhere in the display selectively and directly.

Although ac gas discharge displays offer longer service life and have the added benefit of inherent memory, they are more costly to build than dc displays. In part, the added expense is due to extra dielectric coatings, tighter tolerances, and added circuitry needed to maintain sustaining voltages and turn-on and turn-off pulses.

Alphanumeric and Graphics Displays

Flat panel displays come formatted and unformatted. Formatted displays, with their electrodes arranged in a dot matrix pattern, can only reproduce alphanumeric characters within the predetermined dot cells. Unformatted displays, or fully populated displays as they are often called, have electrodes distributed uniformly over the entire active display area. As a result, they can display graphics as well as alphanumerics.

As a general rule, formatted GPDs make use of dc technol-

ogy, while fully populated GPDs use ac technology. The major reason is cost. Since formatted displays cannot reproduce graphics, their use is limited to such relatively simple alphanumeric applications as status monitors for industrial controls and automatic bank teller machines. In these applications, the inherent memory effects and graphics capabilities of the more costly ac displays are of no value. Moreover, the keep-alive electrodes in dc GPDs and the light produced by the gas ionized between them can be hidden behind opaque masking between the matrix cells. In fully populated displays, there is no way to hide the cells since the entire active area of the display is used.

The Argus line of dot matrix message panels manufactured by Industrial Electronic Engineers (Van Nuys, CA), better known as IEE, is a good example of formatted dc gas discharge displays. Currently, message panels displaying up to 960 characters are available, though IEE expects to offer larger panels later this year. Each cell contains 35 dots in a 5 × 7 matrix that, depending on model, can produce characters as high as 0.3". The message panels are offered not only with standard neon-orange displays, but also with red and green. The red display is produced by optically filtering the orange generated by neon. Green displays, on the other hand, are produced by coating the glass faceplate with a special phosphor material and replacing neon with xenon, which emits ultraviolet light.

Probably the best-known ac gas discharge display is the one used in the IBM Model 3290 Information Panel, which costs $7100. The display itself, the Model 580, is probably the most advanced GPD now available, providing, a display of 960 rows by 768 columns. Because it displays 737,280 pixels, it can reproduce up to 9920 characters, enough to display four full pages simultaneously. The high pixel count and a 14" wide × 11" high display area results in a 71.4 line-per-inch density, which provides very-high-resolution graphics.

The extremely large number of pixels requires very fast scanning to prevent visible flicker. To accomplish this, IBM created a new drive architecture that provides row-and-column addressing when the entire display must be refreshed, but which can also address specific groups of 64 pixels when only partial refreshes are needed. A single line of characters 16 pixels high can be written across the display in 3.6 milliseconds, and the entire display can be updated in less than 0.2 second. Even though IBM had to push the state of the display art to produce the Model 580, extensive life testing indicates that the average service life of these displays is about 350,000 hours. That works out to 132 working years!

Ac gas discharge displays are also finding their way into military applications. Interstate Electronics (Anaheim, CA), for example, offers an extensive line of militarized ac GPDs with alphanumeric units displaying 6 lines × 44 characters or 512 × 512-pixel graphics units. Although the basic display construction is straightforward, militarization, which includes protection against a variety of environmental conditions, significantly adds to the cost.

A Meshing of AC and DC Technology

PlasmaGraphics (Warren, NJ) produces a fully populated display of 250 rows and 480 columns that provides 25 lines × 80 characters in a 3.7" × 7.2" viewing area. The unit, the Model 120 Self-Scan Memory Display, makes use of technology pioneered by Burroughs Corporation to combine the best features of ac and dc gas discharge designs. This hybrid display contains separate ac and dc sections separated by a priming plate with holes through it at each pixel location. The dc

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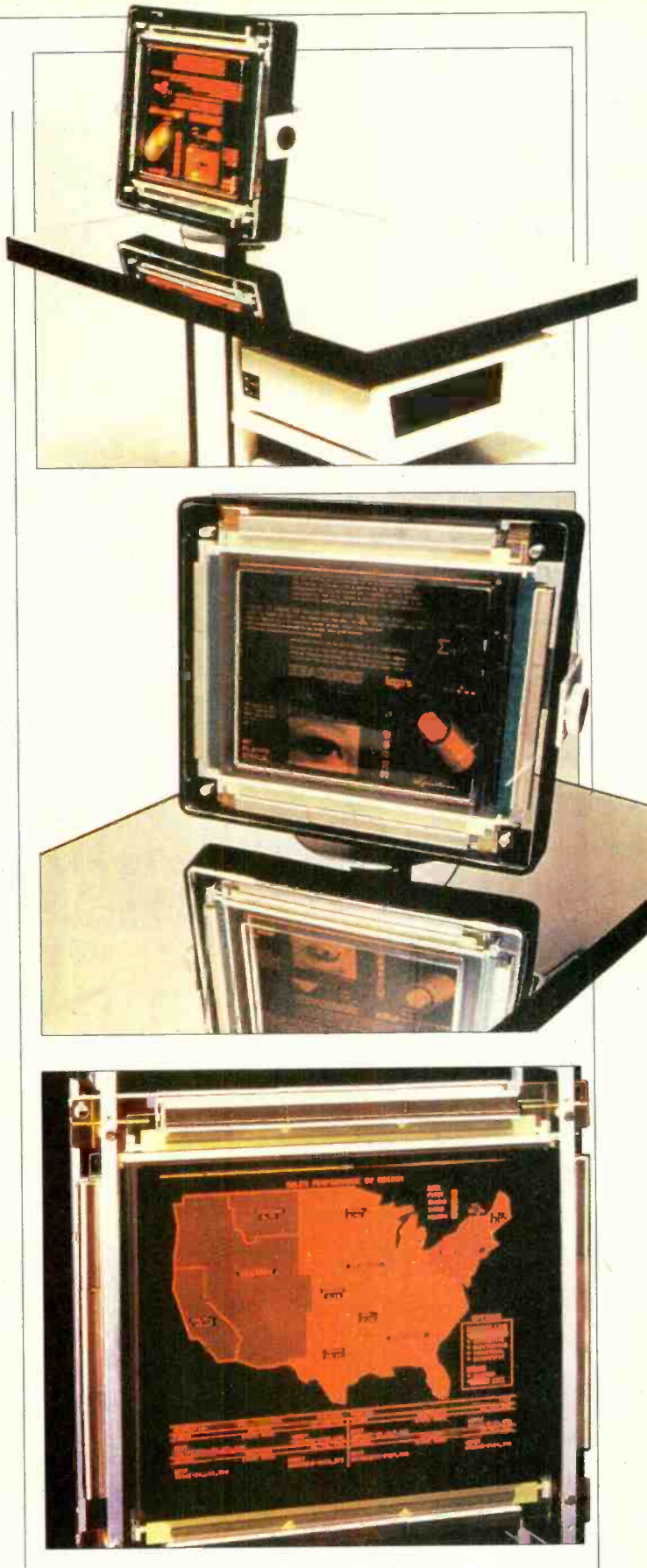

Three views of the IBM Model 581 gas plasma display.

MULTI-USER MICROS

Some applications simply can't be handled by a bunch of single-user micros

BY MICHAEL K. GUTTMAN

DESPITE what your friends tell you, a personal computer—even a very powerful one—may not be sufficient for your computing needs.

A personal computer may be too slow or unable to hold enough data, limitations that more than likely result from its very nature: A personal computer is made to be used by only one person at a time. While it is fine for some tasks, it isn't suited for many business applications that involve the simultaneous processing of a common collection of data by more than one person.

For example, a sales department might need a system for several salespersons that allows each to place orders against existing inventory. When an order is placed, the inventory figures must be updated, and the results must be immediately accessible to all other sellers.

If each salesperson had a personal computer, no one would ever be properly apprised of the true state of the company's inventory since the figures in each would not reflect the activities of the other salespersons. In fact, two clerks might sell the same stock.

Some New Solutions

Until recently, the solution to such problems usually was buying a relatively expensive mainframe or minicomputer that could support multiple users sharing a common database. Small organizations that could not afford such a costly purchase were left behind. Even when an organization could afford to buy a large computer, chances are it would be reserved for a few vital functions and generally unavailable for tasks of lower priority.

Fortunately, however, more manufacturers are applying microcomputer technology to the problem of providing relatively inexpensive hardware and software that supports multiple users. These solutions take one of two general forms—local area networks (LANs) or multi-user systems (MUSs).

LANs are used to hook together a number of independent personal computers so that they can share peripherals. Data transfer between the PCs and the peripherals takes place serially, generally over twisted pair or coaxial cable. This kind of configuration is gaining considerable popularity among PC users working mostly independently who want occasionally to share files and printers with other PC users or even link with mainframe computers.

But because LANs have low data transfer rates and lack dominant CPUs, they are slow doing tasks that require heavy use of common peripherals, particularly shared hard disks. Such tasks require a computer dedicated to managing users whose activities frequently interact. A MUS is just this sort of computer.

With a MUS, users are connected directly to a central processor via a high-speed system bus. They can transfer data to each other at high speeds using what are known as direct memory access (DMA) channels. In addition, because all tasks are tightly controlled by a central processor, users get optimal use of the common peripherals.

Much More Than One PC

At first glance a MUS appears to be merely a collection of personal computers or a single personal computer with more than one keyboard and monitor. Let's look more closely. Keeping track of all users and making sure all their tasks are properly processed is just part of what a MUS does. In addition, the MUS allows shared access to one or more hard disks, printers, modems, and other peripherals, putting these operations into sequence so that the often simultaneous demands of the users don't result in any damaging conflicts.

The accomplishments of MUSs are more impressive when you realize current and would-be MUS manufacturers must proceed without established standards. While personal computer manufacturers can mimic the single-user IBM PC, no leader has yet emerged to take clear control of the MUS market and provide a focused direction.

No matter what the difficulties may be, however, the market for microcomputer MUSs keeps growing, for there simply is no other reasonable cost-effective solution to the problems they address. These MUSs are much cheaper than mainframes or minis and much more powerful than PCs.

Hardware Architecture

In general, the various MUSs can be described by their architecture—the type of CPU used, the number and configuration of the system workstations, and the specific functioning of the operating system.

In general, MUS hardware can be divided into systems with a single CPU and those with one CPU and one or more slave processors. In a single-processor system, the CPU must handle every task itself, a situation that lends itself to tight control over system resources but also to system degradation as the number of users and tasks increases.

Multi-user systems with more than one processor can be further subdivided. In one form, the central processor spins off tasks to one or more slave coprocessors, but keeps a tight rein on their activities. A common example is a system that has a separate I/O processor to monitor interaction with each workstation. It allows the main processor to be free of various housekeeping tasks—such as waiting for user input and out-

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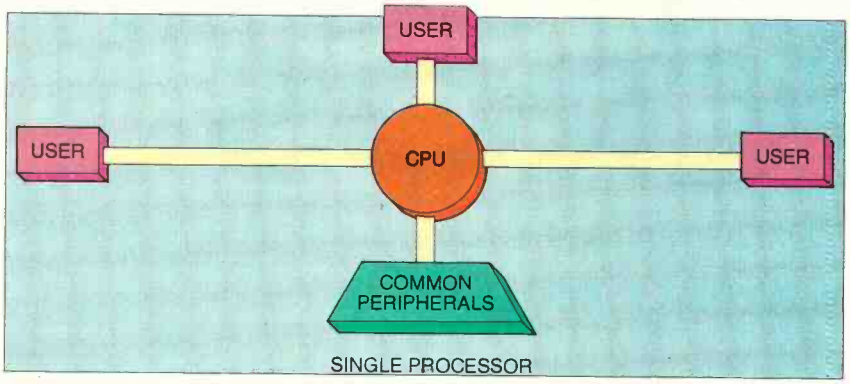
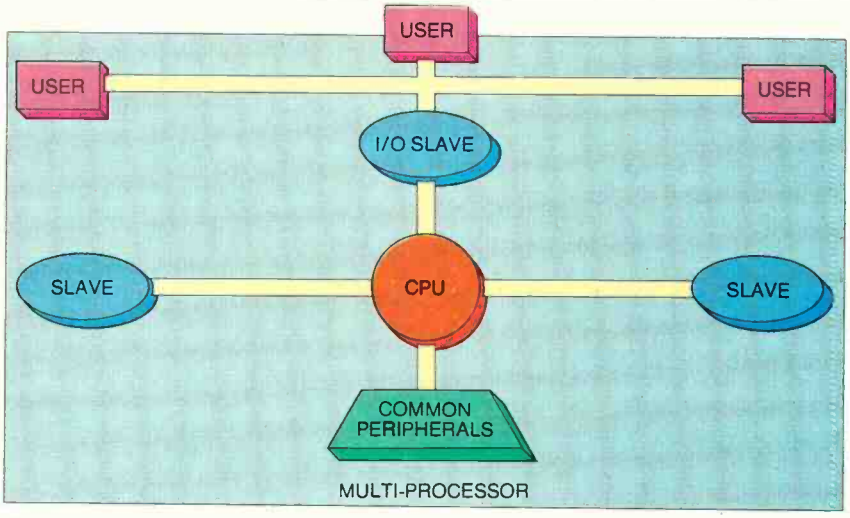
PHOTO BY ROBERTO BROSAN

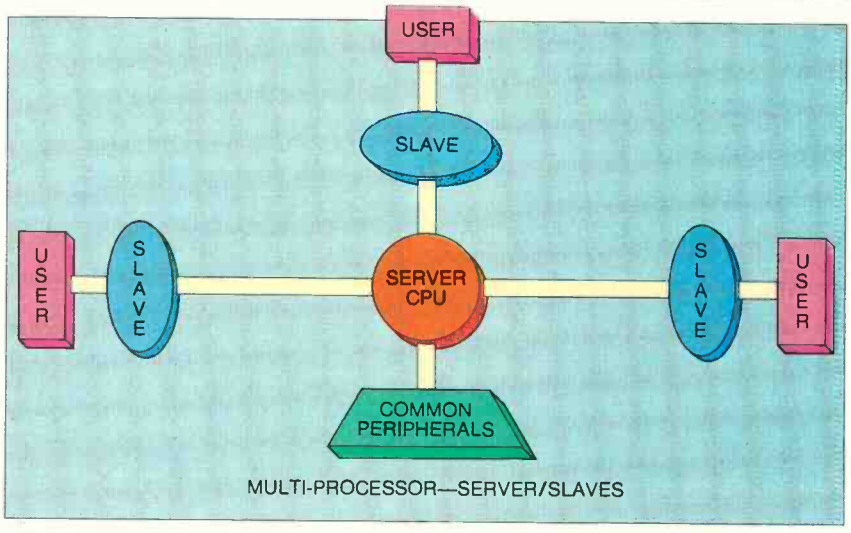
HARDWARE ARCHITECTURE



System in which users connect to a central processor; all have use of peripherals, but response degrades as number of users increases.



Multi-processor CPU spins off tasks to coprocessors, keeps tight rein on their activities. Main processor needn't wait for user input and output.



Multi-processor with server/slaves assigns users to a semi-independent coprocessor that does user's tasks locally until shared resource is needed.

put. In general, however, this form of multiprocessing is not much different from having just a single processor, except that overall performance is somewhat improved.

In the other form of multiprocessor system, each user is assigned to a semi-independent coprocessor. This coprocessor performs the user's tasks locally until a shared resource is required, at which point it requests action from the central processor.

In such a system, the central processor is almost a slave to the other components. In fact, it is generally referred to as a server. New users can be added to the system without reducing overall system performance, at least when local tasks are being executed. This configuration is similar to a LAN, but it is cheaper and faster because its design is more integrated.

Operating Systems

None of these hardware architectures is inherently better or worse than the others; all are attempts to provide the most performance for the price. How they actually execute tasks depends on their operating systems—the software of MUS architecture, which must not only perform the usual functions associated with disk, screen, and keyboard I/O, but must also keep track of the various users and their tasks. Most machines can run many different operating systems.

Operating systems themselves come in two types: user-oriented and task-oriented. User-oriented systems treat users as completely independent entities, each with a separate set of tasks. The users share common peripherals, of course, but never directly interrupt each others' jobs or co-ordinate each others' activities.

Task-oriented operating systems support multiple users, but the activity of any user is just another task that can be turned off or on or interrupted. In this kind of system, users can interact with each other, not just through the hard disk or other peripherals, but directly, sharing tasks and passing information among themselves.

In general, although task-oriented operating systems are in their infancy, they show promise for greater interaction among users. User-oriented systems are the current workhorses, allowing individual users to get on with their daily tasks without being interrupted by the activities of others. Many user-oriented systems, however, now offer a limited form of multitasking. These systems, letting each user spawn several concurrent tasks, allow for more efficient and flexible use of each workstation.

What's out There Now—MP/M and Unix

The first CPU to gain acceptance as the basis for a microcomputer MUS was the 8-bit Z80, the same chip used for many early PCs. Unlike most other 8-bit processors, its 64K memory addressing could be bank-switched up to 1M byte, which theoretically would provide a 64K workspace for up to 16 users. In reality, however, one Z80 CPU is generally too slow to support more than two or three users effectively. To improve performance most Z80-based vendors add additional coprocessors, usually other Z80s and/or Intel's 8/16-bit 8088.

Digital Research, which created CP/M for single-user computers, also created a multi-user version called MP/M. For many years, in fact until recently, MP/M on the Z80 or 8088 was the closest thing to a standard. As a result, most systems in use and most of the time-tested software is based around MP/M or TurboDOS, an MP/M clone. MP/M, which can be made to work on both single- and multiprocessor hardware, is a user-oriented operating system.

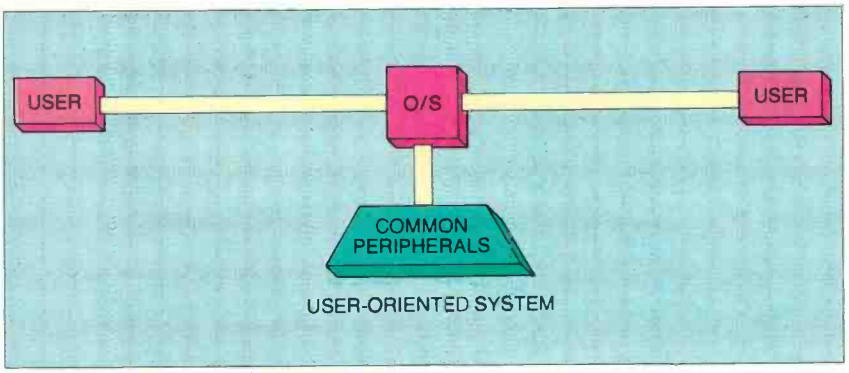
In the past year or two, however, the dominance of MP/M has been threatened by Unix, the operating system originally developed by Bell Labs for minicomputers.

Unix, a task-oriented system, allows users to create and even share tasks running concurrently. Unix has been around for a while, and many programmers are familiar with it and its various extensions and utilities. It's a strong contender because much of the software developed for Unix on minis can, with some modifications, be ported to Unix-based micros.

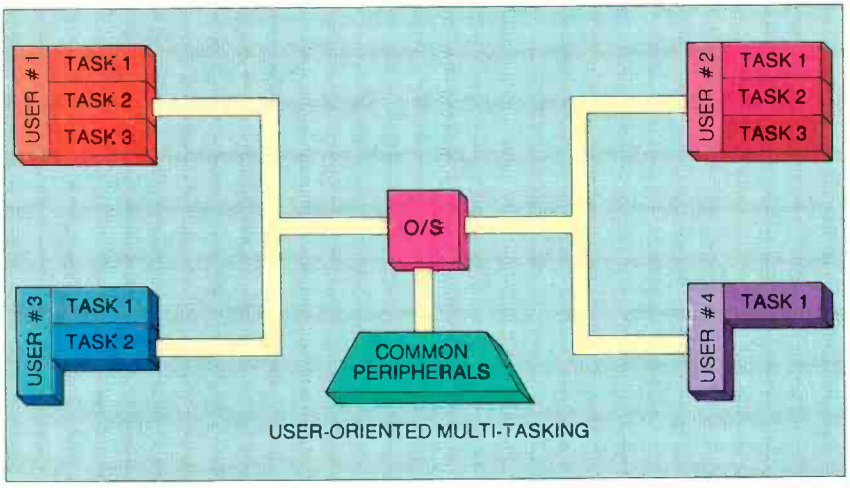
Because Unix was born in a 32-bit environment, manufacturers have generally picked 32-bit (registers) microchips, such as the Motorola 68000, as the CPU in Unix-based microcomputer MUSs. These chips are powerful enough to support a substantial number of users by themselves, and promise to rival minicomputer performance when mated with coprocessors.

For the next few years, prospective buyers of microcomputer MUSs not already biased toward MP/M or Unix will probably have trouble choosing between the two. MP/M-based systems have the general advantages of low cost, dependability, and a solid base of software.

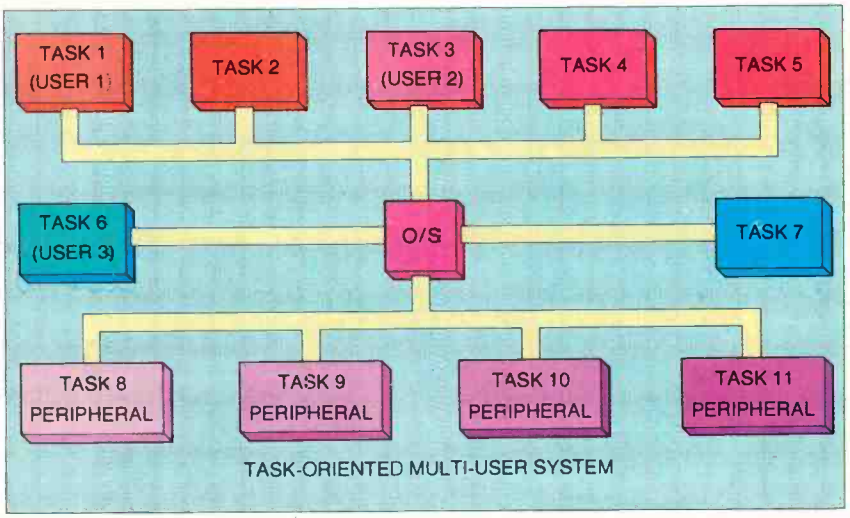
In comparison, Unix-based systems are still unproved and rather expensive. They benefit from neither a clear set of standards nor a base of truly portable applications software. In addition, the kind



Simple user-oriented multiuser system lets users share peripherals but not directly interrupt each other's jobs or coordinate other's activities.



A user-oriented system treats users as independent, with their individual sets of tasks. Network-like systems are generally user-oriented.



With task-oriented operating systems, users can interact with each other directly, sharing tasks and exchanging information.

Durango System's multi-user system.

of innovative applications that can take advantage of Unix's task-oriented approach may be as much as a generation away from development and general acceptance.

On the other hand, Unix has the support of such major players as ATT and Microsoft and at least nominal support from IBM. IBM's new AT, although not primarily designed as a multi-user system, runs Xenix, a Microsoft version of Unix, which in itself will create substantial interest. In addition, of course, Unix is well-known at colleges and universities, where many applications programmers learned the trade.

Even if Unix is the winner, however, it's not clear which version, with what extensions, will dominate. Unfortunately for consumers, it's still too early to tell who will be top in the MUS market tomorrow.

Other Alternatives

In the meantime, the market is still open to other aspiring entrants. Several have already entered it. One promising innovation comes from North Star Computers, which recently introduced a computer running a proprietary, multi-user version of MS-DOS 2.11. At least one other manufacturer, Corona, has announced a similar computer, the Mega PC, with a 10M-byte hard disk. Users of these systems can continue to use their familiar PC software while developing custom multi-user applications.

Another recent micro entrant, ported from minicomputer and mainframe environments, has been Pick, a multi-user operating system. Pick has recently been ported to the IBM-XT, and several versions exist on 68000-based machines. Pick comes with an array of features for developing multi-user applications and, in theory, offers compatibility with IBM products, from the PC up to a 4300 mainframe.

One particularly interesting approach to the problem of multi-user operating systems comes from Stride (formerly Sage) Computers, makers of a 68000-based MUS. The Stride 400 series computers feature a proprietary multitasking BIOS that allows one machine to run many different operating systems at the same time. This flexibility frees users from the limitations of any one operating system and its applications software. At present, Stride's approach is unique, but eventually we can expect imitators.

Choosing and Configuring a MUS

The most obvious question a prospective buyer should ask is "How many workstations will the MUS support?" Answering it is a little tricky because performance depends somewhat on what activities are typically performed. If the use of each workstation is relatively light, then more stations can be supported on the same system. If use is to be fairly heavy, then use patterns must be analyzed, to separate those that are input/output (I/O)-intensive from those that are processing-intensive.

Tasks that are processing-intensive are best handled by multiprocessor configurations, in which coprocessors can take some of the load off the CPUs. Systems primarily intended for scientific applications or computer-aided design for example, are processor-intensive.

A LAN can join 63 of the pictured MAI 2000 desktop units, each of which can handle 14 users.

If the tasks are mostly input/output-intensive—that is, if the I/O is mostly to and from each user's screen, keyboard, or other device—the best choice is a system that has either a supporting I/O coprocessor or a coprocessor for each user. Systems primarily doing word processing or spreadsheets are examples.

Many tasks make heavy use of a system's common hard disk storage. For example, an online inventory system might need constantly to update and reference a common set of files. In such cases, the size and speed of the hard disk, the speed of the disk controller, and the availability of special hardware and software to improve disk performance are extremely important. Such provisions might include a RAM disk for storage of commonly used programs and functions and/or fast cache memory to store the most recently and frequently accessed storage areas.

Other Issues

Even if the manufacturer is using a standard operating system, such as Unix or MP/M, chances are it has been customized to some extent. Hardware limitations might be the reason; a more likely cause is that many common features and functions are simply not standard. Pay attention to such problems.

Take print spooling. Nearly all machines make it possible for users to share a common printer. Since most printers are slow compared to other system resources, competition for the common printer may be considerable. Print spooling allows printing jobs to be spooled to disk files, to be printed as printer time becomes available. For a system used for word processing, for instance, efficient functioning of a print spooler may be one of the most important features.

As important as spooling may be, there is no spooling standard. Systems in other respects similar may vary widely in their spooling options. For example, a sophisticated spooler might allow users to print jobs on a special schedule or by priority, transmit specialized control commands to the printer, or alter the execution sequence or parameters of print jobs already spooled. On the other hand, a simple spooler might be crudely automatic, allowing almost no human control over spooling processes.

Other examples of important, but nonstandard, features include electronic mail, storage backup, background batch processing, damaged file and directory recovery, password security systems, shared modem facilities and, of course, networking to similar or different computers. It's important for prospective users to be aware that many features that may not at first seem important may suddenly become critical as use (and sophistication) increases.

Getting Ready for a New MUS

After selecting the equipment and a dealer/consultant, a new user must begin to make preparations for its installation. Those users who are accustomed to the *ad hoc* purchase and installation of personal computers will find they need careful planning because a new MUS is likely to have substantial impact on the organization.

Preparations generally take on two general forms: site preparation and organization preparation. Although MUS systems are not necessarily physically obtrusive, they do require proper siting to make it reasonably convenient to connect the various users and shared peripherals. In addition, users should make sure that the system will have adequate dedicated power and ventilation, since a power failure or overheating will affect every user on the system.

Organization preparation involves deciding who will have access to which system resources, who will be responsible for system maintenance and supervision, and how system-wide costs will be allocated among the various users. These decisions whic requires the involvement of everybody affected, should be worked

(Continued on page 99)

SOURCES OF MULTI-USER SYSTEMS

MP/M SYSTEMS

Altos Computer Systems
2641 Orchard Parkway
San Jose, CA 95134
408-946-6700

Compupro
3506 Breakwater Ct.
Hayward, CA 94545
415-786-0909

Micromation
165 Eighth St.
San Francisco, CA 94103
415-626-5960

Molecular Computer Corp.
251 River Oaks Parkway
San Jose, CA 95134
408-262-2122

UNIX SYSTEMS

Altos Computer Systems
(see above)

CIE Systems
C. Itoh
2505 McCabe Way
Irvine, CA 92714
714-660-1800

Convergent Technologies
2500 Augustine Dr.
Santa Clara, CA 95054
408-727-8830

Dual Systems Corp.
2530 San Pablo Ave.
Berkeley, CA 94702
415-549-3890

Durango Systems
3003 N. First St.
San Jose, CA 95134
408-946-5000

Hewlett-Packard
11000 Wolfe Rd.
Cupertino, CA 95014
408-725-8900

IBM (Xenix)
PO Box 1328
Boca Raton, FL 33432
800-447-4700

NCR
1700 S. Patterson Blvd.
Dayton, OH 45479
513-445-5000

Radio Shack
Tandy Corp.
1700 One Tandy Center
Ft. Worth, TX 76102
817-390-3011

MS-DOS

Corona Data Systems
275 E. Hillcrest Dr.
Thousand Oaks, CA 91360
805-495-5800

North Star Computers
14440 Catalina St.
San Leandro, CA 94577
415-357-8500

OTHER

Alpha Microsystems
17332 Von Karman
Irvine, CA 92714
714-641-5145

Anex Technology
151 N. Route 9W
Congers, NY 10920
914-268-2400

Computone Systems
1 Dunwoody Park
Atlanta, GA 30338
800-241-3946

Data General Corp.
4400 Computer Dr.
Westboro, MA 01580
617-366-8911

MAI/Basic Four Information Systems
14101 Myford Rd.
Tustin, CA 92680
714-731-5100

PC Technologies
704 Airport Blvd.
Ann Arbor, MI 48104
313-996-9690

Pick Systems
17851 F-Skypark Circle
Irvine, CA 92714
714-261-7425

The Software Link
Suite 336
8601 Dunwoody Place, NE
Atlanta, GA 30338
404-998-0700

Stride Micro
4905 Energy Way
Reno, NV 89502
702-322-6868

TANDY'S NEW MODEL 200 BRIEFCASE COMPUTER

Sixteen-line successor to popular Model 100 sports improved text editor and Multiplan

BY KERRY LEICHTMAN

ALTHOUGH sales of lapsize computers have yet to live up to industry expectations, manufacturers continue to offer upgraded versions with larger memories and more sophisticated software. Tandy, the leader in the lapsize field with its TRS-80 Model 100, has introduced its newest briefcase micro, the Model 200. Weighing 4½ lbs and incorporating many of the best features of the Model 100, the 200 adds a longer display and such software enhancements in ROM as an alarm function and a scaled-down version of Multiplan.

The Model 200, which lists for $999, features 72K of ROM expandable to 104K and 24K of RAM expandable, with two 24K banks, to a total RAM capacity of 72K. ROM firmware includes Microsoft BASIC, a simple word processor, a communications program, address book, appointment calendar, and note-taker features as well as Multiplan. The additional 32K of ROM provides space for a variety of "chipware" (software on a chip) plugged into a ROM socket on the machine's underside. According to Tandy, the first chipware program, a full-featured version of Multiplan, will arrive this summer.

While many of the Model 200's physical features recall its predecessor, there are some changes. The most noticeable is the new screen, a flip-up LCD with a 16-line by 40-character display, double the length of the Model 100's display. Nearly all of the other second-generation lapsize machines use 80-character-width screens; Tandy retains the 40-character width, which the company feels is consistent with its concept of a portable computer as a separate genre with its own functions and purposes. "Everyone's trying to sell their portables as portable PCs," said Stewart Weinstock, Tandy buyer for the two portables. "We're not."

"We didn't change the basic character of what we think a portable computer should be," said Ed Juge, Tandy's director of market planning. "For what it is used for, we didn't feel the wider screen was necessary." Similarly, while other portables, such as the DG One, offer longer screens, their character sets are appreciably smaller and can be less legible. With the Model 200, a full-size paragraph fits easily within the screen's parameters and the character set is easy to read. The display, like that of the Model 100, can be fine-tuned with an exterior dial.

PHOTOS BY RICK DYKES

Keyboard Improvements

The standard QWERTY keyboard arrangement has 10 special function keys, eight programmable function keys, and an arrow-key cluster at the top-right corner—a much more logical arrangement than the row of arrow keys on the Model 100. The other main difference in the new keyboard is the placement of the programmable function keys and the PASTE, LABEL, PRINT and BREAK keys. Reversing the earlier configuration of these keys, the Model 200 locates them at the leftmost side of the machine, almost directly under the LCD. When LABEL is invoked, the function key labels line up with the keys they reference.

The keyboard lies flat, which might seem awkward. Many people installed small legs on the bottom of the Model 100 to create a more natural typing slope and to improve the angle of the screen. The Model 200's flip-up screen solves the viewing problem, but creates another because the prop legs available for the Model 100 are too long and make screen viewing a bit difficult. Perhaps a third party will supply a smaller prop leg to solve the problem.

The power switch is located near the PASTE key. The machine is powered either by four AA batteries that fit into a compartment underneath the 200 or by a 6-volt adaptor that plugs into the side of the machine. The power adaptor is compatible with the one available for the Model 100. The ac current or batteries power a set of NiCd cells capable of holding RAM intact for up to 15 days. The AA batteries can provide 10-16 hours of use.

The CPU of the Model 200 is the same 80C85 CMOS microprocessor used in the Model 100. Tandy and Microsoft did have to rewrite the machine's coding to support the new features, and this rewriting makes Model 100 machine-language programs incompatible with the new computer. BASIC programs with ROM calls will also be unusable. On the up side, however, the ROM, unlike the 100's ROM, which was virtually custom-made, is a standard chip. As a result, it will be easier for third-party software developers to get PROMs and EPROMs for firmware programs.

The Tandy 200's RAM is divided into three 24K banks, each with menu slots for 46 files. You can switch from bank to bank by pressing F1 while in the main menu mode. Other functions accessible from the main menu mode let you kill files and copy files from one bank to another. To kill or copy a file, you place the cursor on the file name and press the appropriate key. The KILL function has a built-in confirmation feature to prevent unfortunate errors.

The built-in calculator can be accessed at any time by first invoking the 200's number pad, which turns a cluster of alphanumeric keys on the standard keyboard into numeric keys, then hitting a special function key. When this is done, the number pad becomes a calculator that uses the top line of the LCD screen to display the output. Although this feature is available in TELCOM mode, its use may interfere with online data communications, depending on the protocol used.

Built-in Software

Also accessible during any Tandy 200 operation is an alarm that works in much the same way as Tandy's DeskMate software (COMPUTERS & ELECTRONICS, December 1984, page 70) and other desk management software, (page 70). To operate the alarm, you enter the dates and times of appointments, along with any notes, into the NOTE.DO file created in TEXT, the Model 200's word processing program. When the preprogrammed time and date are reached, the 200 sounds an alarm and displays the NOTE.DO entry on the screen. The function provides space for up to 255 alarm entries and can recall the last four alarms. Alarms will sound and display even when the machine is turned off.

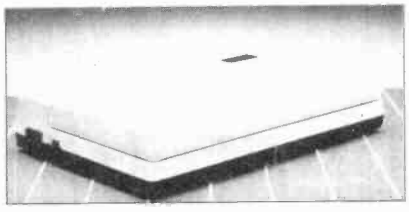
The Model 200 improves the word processor of the 100. New features include simple output formatting to control page width and length, left and top margins, number of lines per page, and a choice between nonstop printing or pausing between pages. Also new to TEXT is a LIST function that performs a repetitive string search within documents. TEXT, of course, retains the features present in the Model 100 version, including delete and insert, block delete and move (both within a file and between files), and the print screen function.

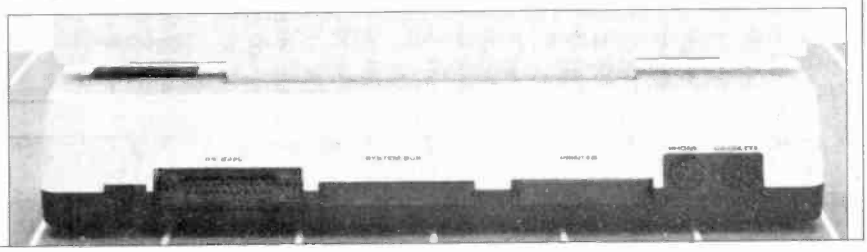
The scaled-down Tandy 200 Multiplan has a 63-column by 99-row capacity. Files created with a desktop version of Multiplan can be transferred to the 200 and vice versa.

Although the communications program, TELCOM, supports transfer rates as fast as 19,200 baud, the Model 200's built-in modem is only capable of 300-baud transmission. The originate/answer selection, which was controlled by an external switch on the Model 100, is now software controlled. A software toggle for a control character filter will ignore the ASCII codes 0-31, except those for carriage return and line feeds. This toggle can be set to ignore line feeds after a carriage return and will support the 10 pps rate of touch-tone phones.

The 200 comes with ports for connecting to a Centronics-standard parallel printer, RS-232 devices, cassette player, telephone, bar code reader, 6-volt ac adaptor, and disk/video interface.

The basic 24K unit is priced at $999, the same introductory price of the 24K model almost two years ago. Additional RAM, in 24K segments, are $249.95 each. Options include: video/disk interface ($799 includes one 184K drive, second drive $239.95), bar code reader ($799), direct-connect modem cable ($19.95), acoustic coupler ($39.95), carrying case ($39.95), TRP-100 portable printer ($299.95), parallel printer cable ($14.94), ac adaptor ($5.95), and CCR-82 cassette recorder and cable ($49.95). ◇



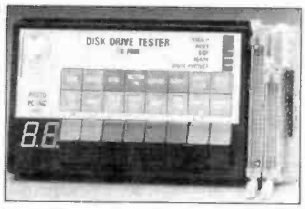


NEW PRODUCTS

DISK DRIVE TESTER

The EX2000 from Proto PC is a microprocessor-based test instrument used to repair and align floppy disk drives using SA400 and SA800 interfaces. It features test points for scope hookup, single keystroke for any alignment track, hysteresis check, speed check (both average and instantaneous), step rate select, and standard exerciser functions. Optional acessories include cables for 5¼" and 8" drives, alignment diskettes, and manuals for virtually every floppy disk drive. $299.

Circle No. 71 on Free Information Card



HEAVY-DUTY DAISY-WHEEL PRINTER

Data Terminals & Communications' DTC 450Z can run at a 100% duty cycle and is designed for heavy-duty use in a commercial setting. It prints at 45 cps, producing one-eighth the noise of a standard office typewriter. With 100-character printwheels, it can print in 30 word-processing and 28 data-processing type styles. It does sub- and superscripts as well as automatic underlining, double striking and shadow printing. It utilizes standard Diablo 630 command codes. $15.95.

Circle No. 72 on Free Information Card

5M-BYTE HARD DISK SYTEM UNDER $2000

Morrow has introduced a hard disk computer system with 5.4M bytes of storage capacity for less than $2000. The MD5-E uses a 5¼" Seagate Winchester drive capable of storing 2800 pages of text and also includes a double-sided double-density 5¼" floppy disk drive with a capacity of 384K bytes. The system, based on a 4-MHz Z80A, comes with 128K of RAM, keyboard, and terminal. It uses the CP/M Plus operating system, and NewWord and Correct-It software are included. $1999.

Circle No. 73 on Free Information Card

SOFTWARE SOURCES

Art on the IBM PC. With Dr. HALO, from Lifeboat Associates, your IBM PC can paint like an Apple Macintosh—in color. Dr. HALO lets you and your mouse create color images on the screen and print them out on a color printer, such as the IDS Prism. You can draw, paint, move, cut and paste, vary the width of the screen "brush" and copy one section of the screen to another, creating combinations of filled and unfilled rectangles, circles, squares and ellipses. Included in the package are six type fonts—including italic, script, Old English and Greek—with which you can label your drawings. The program also edits images created with other software, such as graphs from Lotus' Symphony. Dr. HALO is compatible with any Microsoft, Mouse Systems and Summagraphics mouse, as well as with many digitizers. It requires an IBM-PC-compatible color graphics board. If your PC doesn't have a mouse, you can still paint with keyboard commands. $99.

Circle No. 83 on Free Information Card

Apple Drum. For percussionists now there's Drum-Key, an electronic music interface card and software for the Apple II+ and IIe. The sounds from Drum-Key are digital recordings of percussion instruments, including bass drum, snare, tom-toms, cymbals, cowbell and tambourine. You can compose, play and record your own patterns or play along with some 100 patterns and 26 songs built into the system. Musical notes appear on the screen during composition. You can set the tempo and the meter and store the patterns to disk. $139. **Address:** Ensoniq, 1 Great Valley Parkway East, Suite 10, Malvern, PA 19355.

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PHONE _____

SOURCES OF INFORMATION ABOUT ONLINE DATABASES

Magazines and Periodicals

Directory of Online Databases
Cuadra Associates
2001 Wilshire Blvd., Suite 305
Santa Monica, CA 90403
213-829-9972
Quarterly publication. Publishes two main volumes per year, plus two supplement/updates, listing over 2000 databases.
$75/year

Online Today: The Videotex/Computer Magazine
CompuServe
PO Box 20212
Columbus, OH 43220
614-457-8600
Monthly, $24/year

Online: The Magazine of Online Information Systems
Online
11 Tannery Ln.
Weston, CT 06883
203-227-8466
Monthly, $78/year

Database: The Magazine of Database Reference and Review
Online
11 Tannery Ln.
Weston, CT 06883
203-227-8466
Monthly, $56/year

Database Informer: The Newsletter of Information USA's Computer Data Service
Information USA
4701 Willard Ave.
Suite 1707
Chevy Chase, MD 20815
301-657-1200
Monthly, $78/year

Online Review: The International Journal of Online Information Systems
Learned Information
143 Old Marlton Pike
Medford, NJ 08055
609-654-6266
Monthly, $70/year

Electronic Publishing Review: The International Journal for the Transfer of Published Information Via Videotex and Online Media
Learned Information
143 Old Marlton Pike
Medford, NJ 08055
609-654-6266
Monthly, $66/year.

Books

Online Bibliographic Searching: A Learning Manual
by Ching-Chih Chen and Susanna Schweizer
(Neal-Schuman Publishers
New York, NY 10014)
$24.95

Get Connected: A Guide to Telecommunications
by Tom Kieffer and Terry Hansen
(Ashton-Tate Publishing Group
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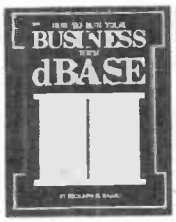

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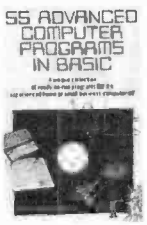

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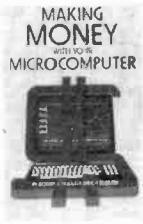

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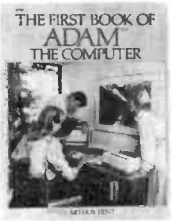

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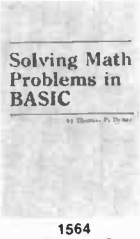

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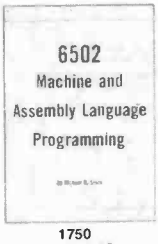

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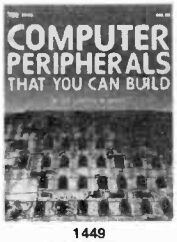

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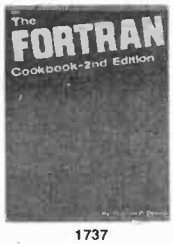

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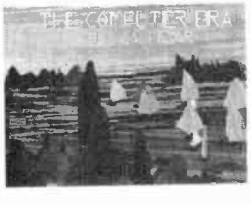

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ITT Xtra

(Continued from page 32)

ed by ITT, I succeeded in creating and manipulating dBase files. There was no problem with version 2.41 of dBase II under ITT-DOS or PC-DOS on the Xtra.

Other IBM format programs that worked normally on the Xtra included WordStar, Flight Simulator, Borland International's Sidekick, the Crosstalk communications program, and miscellaneous public domain software packages.

ITT VisuALL Shells

One extra that the Xtra does offer to users is a special "VisuALL" menu system supplied with all ITT-label software (currently WordStar, Easywriter I, and Multiplan). Unfortunately, the main VisuALL program, called ITT.PRO, was not being shipped at the time of this review so I couldn't get any hands-on experience of the ITT versions of this product. However, I am familiar with the generic VisuALL product, a pseudo-windowing system for a wide range of MS-DOS machines.

The notion behind VisuALL is that instead of requiring users to learn all the major MS-DOS commands before they can efficiently use an IBM PC or similar machine, the program provides a user-friendly software "layer" on top of MS-DOS. This layer, or shell, allows you to select various commands or program names from a window-like menu that can be displayed at any time.

So, if you want to use the Edlin line editor, you would bring up the VisuALL MS-DOS menu, place the cursor under the "Edlin" entry and press the return key. Since Edlin always needs to be given a filename to work on when it is first invoked, VisuALL would then prompt for a filename before loading the program.

Typically, a VisuALL shell will provide a variety of task-specific menus. Within a word processor there might be one menu for text editing functions and another for document printing, for example. Commands can be entered via keyboard function and cursor control keys or, preferably, by means of an attached mouse.

There is no doubt that the VisuALL shells can help you learn about a new program fairly quickly and painlessly. However, the application shells do tend to occupy large amounts of disk space (since there must be a statement accounting for each and every menu selection). Many users will find that, after a month or so, they can use most programs quite happily without VisuALL.

Specifications

Product: ITT Xtra
Mfr: ITT Information Systems,
1455 W. 12 Place,
Tempe, AZ 85281
Dimensions: 15¾" × 14" × 5½"
Price: $3425
Features: 8088 CPU, 256K bytes of RAM, dual 360K half-height floppy disks, video adapter card, serial and parallel ports, color monitor

Conclusion

Those hoping that the ITT Xtra will provide new, sophisticated features above and beyond those available with the IBM PC will be disappointed. The Xtra does have some plus points: It comes standard with both a serial and a parallel port and it has a slightly smaller footprint than the IBM PC. Internally, it is well designed, and all the accompanying documentation is professionally produced and quite thorough.

In its current form, the ITT Xtra only ranks as a "good" IBM-type personal computer. ITT must put much more effort into the development of ITT-specific hardware and software products if the Xtra is ever to stand above the rest of the compatible crowd. ◇

Editor's Note: ITT has announced three new products to be released in March, 1985. These are a voice communications system, a micro-to-mainframe communications link, and a graphics board. The voice communications system consists of a plug-in board for speech recognition, digitization, and playback, with telephone capabilities. With the board are a speaker enclosure, microphone and software. The two boards for micro-to-mainframe communications are: one for emulating an IBM 3278 or 3279 display terminal, and another that supports IBM 3270 PC emulation. An adaptor board provides text and graphics on a variety of ITT monitors.

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(Continued from page 24)

about 120, I used WINDOW to establish *xy* coordinates having ±60 units.

Lines 60–150 establish a loop that draws the progressively smaller boxes and plots on the screen the joystick-controlled dot. Line 130 draws the box having dimensions given by the FOR statement in line 70. Line 80 assigns variables to the joystick outputs, and line 90 applies a correction factor so that the joystick values range from −60 to +60 in both the *x* and *y* directions.

Line 100 lights up the pixel at the corrected joystick *xy* values. Line 110 removes the negative sign from the joystick values. And line 120 detects when the joystick coordinates exceed those of the box. When this occurs, the computer beeps and the remaining score is decreased.

After the shrinking box disappears into the center of the screen, the final score is printed on the monitor. Lines 170–190 permit the user to try again by pressing one of the joystick buttons.

The program in Listing 3 can be modified in several ways. For instance, the rate at which the box shrinks can be slowed down or speeded up by changing the step value in line 70. Keep in mind that this will also change the maximum possible score and will therefore require that line 50 be revised accordingly. In any case, this program may require more modification for use with computers other than the PC*jr* than do the previous programs.

Centering Ability Test

How many times have you tried to place a dot at the exact center of a circle? This task isn't as easy as it might first appear, as you will quickly learn by trying the program in Listing 4.

This program draws a circle on the screen and then starts a timer. The object is to use a joystick to move a dot on the screen until it's located precisely at the center of the circle. The computer will then beep and the elapsed time will be displayed on the screen (Fig. 2).

Like the program in Listing 3, this program uses a few PC*jr* statements that are not available with all computers. Nevertheless, it should be possible to adapt the general ideas to other machines without major difficulty.

In operation, line 50 sets the clock to 00:00:00 hours. As in Listing 3, lines 60–100 establish custom screen coordinates of from −60 to +60 for both the *x* and *y* axes and apply an appropriate correction factor to the joystick readings. The loop formed by lines 80–140 monitors the movement of the joystick until its *x,y* values equal the coordinates at the exact center of the circle (0,0). When this occurs, the computer beeps, and the elapsed time is displayed on the screen. Lines 160–180 permit the program to be run again simply by pressing one of the joystick buttons.

This program can be modified to present the average elapsed time of a sequence of runs. One modification I tried

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that at first seemed interesting was to cause the joystick to draw a continuous track on the screen. Unfortunately, the continuous line soon merged into a blob near the center of the screen as the search for the exact center progressed. Since it was impossible to find the moving dot within the blob, I eliminated this feature from the final program

Hi-Lo Game

Computers are well suited for presenting many kinds of logic tests that, while simple, are too complex for presenting on paper. The Hi-Lo game in Listing 5 is a typical example.

The object of this game is to guess in as few tries as possible a number between 0 and 100 randomly selected by the computer. The computer informs the player whether the guess is too high or too low, and the player is then allowed another guess. When the guess is correct, the computer informs the player and gives the total number of guesses.

The program in Listing 5 is straightforward and self-explanatory. It should run on most computers, though the random number statement in line 10 may require revision. As for additional revisions, you might better spend your time devising other logic games. The possibilities are endless.

Optical Illusion Test

Figure 3 shows how a very well-known optical illusion appears on a computer screen. Many other optical illusions can be replicated this way.

The program used to produce the image in Fig. 3, which is given in Listing 6, is straightforward and easily modified for use with most computers. Lines 60–170 draw the two figures on the screen using the PC*jr*'s medium-resolution coordinates. If you have a different computer, determine the proper coordinates by sketching the image on a grid marked with your machine's *xy* coordinates.

Going Further

Though the tests described above are presented on an individual basis, they can be merged into a single program. A few extra instructions would enable the program to present a cumulative score for all six tests.

Some of these tests, particularly those that measure reaction time and memory, might make interesting subjects for research studies. For instance, subjects could be tested before and after strenuous physical activity or consuming a drug like alcohol.

Keep in mind that the six programs

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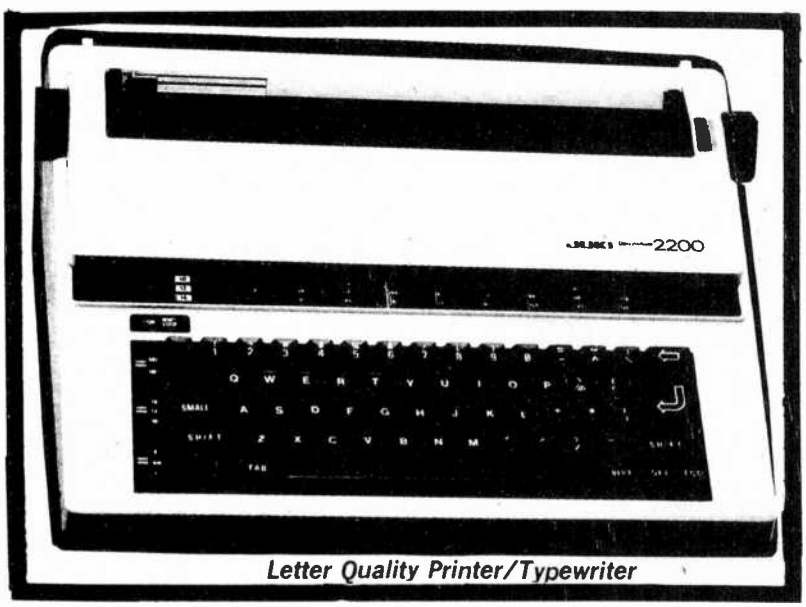

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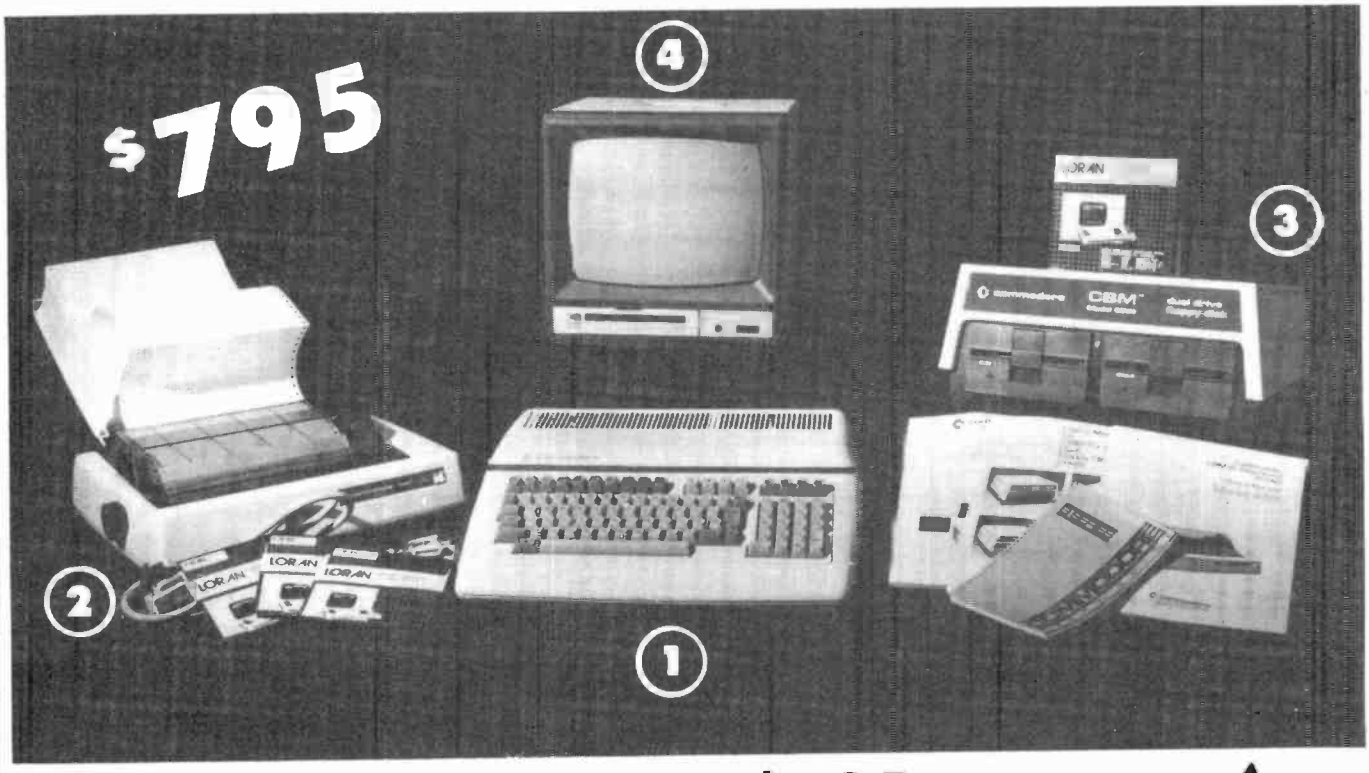

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described above are merely representative of the many kinds of psychological and physiological tests that can be administered with the help of a personal computer. If you want to develop your own tests, consider creating computerized versions of standard paper and ink tests, such as those that measure visual acuity and detect color blindness. Computers with joystick ports can be used to detect galvanic skin response, thereby providing an additional input.

Finally, it's important to realize that psychological and physiological testing are specialized fields. Before using a computer to perform such tests for a fee, you should be aware that federal, state and local regulations may apply. ◇

HP Unix

(Continued from page 45)

Performance

I wrote two short programs to test the speed and multitasking performance of the HP-IPC. The first, in which I compared the HP-IPC to the IBM-PC and IBM-PC/AT, was a C language version of Sieve of Eratosthenes. The execution times were:

HP-IPC	4.30 sec
IBM-PC	9.14 sec
IBM-PC/AT	7.31 sec

The second program was a short one that simply loops on a counter and periodically displays the current count to the screen. I wrote this program in order to load multiple copies to test the multitasking performance of the HP-IPC. The final result is that, with six different copies of the loop program loaded, plus the three tasks already running (PAM, the time and date display, and the window management), I encountered no noticeable delay when I entered additional keyboard commands to PAM. However, a curious phenomenon occurred.

Lest I mislead anyone with the following discussion, let me say that, to HP's credit, it has provided the most flexibility possible for the window management/keyboard entry environment.

When you give PAM a command to load a program, that program becomes the active window. Thus, subsequent keyboard entries will go to the loaded program's window. To make PAM the active window again, you reselect PAM by simultaneously pressing SHIFT/SELECT (or by pressing the left button on the mouse).

However, since the program running displays to the screen, when it's ready to display it shifts that window back to the top of the display, and the HP-IPC *does not shift the PAM window back to the top again* until you press another key. Thus, when you type the next keystroke, it looks like the character will go to the program's window, when, in fact, it is *then* that the window manager shifts PAM back on top to accept the character.

By the time you've loaded a few more programs (reselecting PAM as the active window each time), trying to determine which window your keyboard entry is going to gets confusing. The problem is that the on-screen indicator is not as obvious as the window itself and this should be pointed out in the documentation.

The solution HP provides is to allow you to "hide" windows: When you load a program, you can hide it, and no window swapping will occur. When you unhide the window, it comes back, complete with any screen displays generated. I think I would prefer either an automatic swapping back or a more obvious screen indication of which window is scheduled to receive keyboard input over being forced to hide windows. The flexibility is there.

Summary

The Hewlett-Packard Integral Personal Computer is well-thought-out, solidly built, and well-presented. The relation of its performance to its price amounts to an exciting technological breakthrough. I suspect that the initial buyers will be members of the academic and scientific communities who are already experienced with Unix and who will welcome a low-cost system from a major vendor as well as system developers who are willing to gamble that Unix is, in fact, on its way (and in a big way) into the end-user community.

The problem for system developers is that the basic HP-IPC, as it is shipped (with its low price), simply cannot be used for system development. I could not write the simplest program without an additional 512K-byte RAM card, and I cannot imagine trying to do development without one of the optional hard disk attachments. Although prices are not yet firm, those two items are going to raise the price to around $8000.

My conclusion is when the system is available, I will look for a client who wants some system work done for an installation using the HP-IPC. Then I will be able to justify purchasing one to do the development. I want one. ◇

Online
(Continued from page 53)

scribers to the Dow Jones Information Service have access to data from corporate disclosure statements filed with the Securities and Exchange Commission, weekly economic data, tables of stock prices and earnings, and projections of major corporation earnings, all for typical prices of $0.60 to $1.20 per minute. Other business and economic databases are available through such services as Chase Econometrics.

Online references offer other advantages besides timeline. A crucial one for engineers and scientists is the ability to search data tabulations for properties of materials that meet their requirements. For example, an engineer might need to know what plastics have tensile strengths above a certain level and can withstand temperatures above 250°C. In place of a tedious search through long, printed tabulations, a database search routine could do the job and get results back much faster.

Another type of reference now appearing online is the industry directory, a listing of companies in a particular field, like the *Yellow Pages* classified by their products. Printed versions issued by specialized publishers are widely used, but often the data they contain are months old by the time they are printed, and updates are issued only once a year. Online versions can be updated more often and more quickly. In addition, users can search the online version to find products that meet such requirements as operating power, something impossible or impractical with printed directories.

One new service, VideoLog, offered by VideoLog Communications of Norwalk CT, can be searched for 15 types of data, and covers 2000 product categories in electronics manufactured by over 14,000 companies. Commercial microcomputer software is tabulated online in the Online Microcomputer Software Guide and Directory, produced by Online of Georgetown, CT, and offered on BRS. However, so far no one has taken the seemingly obvious step of producing an online directory of online databases.

Job Listings

Online employment ads also are becoming popular. A fairly typical approach is taken by CLEO, the Computer Listing of Employment Opportunities, based in Torrance, CA. Companies with openings pay to have descriptions listed. Job-hunters can use their personal computers to browse through the database, at no cost other than that of the communication link. If they find something they like, they can fill out online resumes and dispatch them via electronic mail to the companies.

Founded in 83, CLEO expanded quickly from its initial California base to cover parts of the East Coast. Job listings tend to be for high-technology professionals, the type of people who would rather search a database than read newspaper help-wanted ads. One big benefit of the online approach is the ease of searching out openings that meet specific criteria. For example, a job-hunter could find the one opening for a radar-systems engineering manager in the Los Angeles area by an online search, without having to check 40 pages of ads in Sunday newspapers.

Serving Up the Databases

Typically, organizations that compile databases are not the ones that offer them online. Services such as Dialog and

Online

BRS do produce a few databases, but most of the databases they offer are produced by others, private companies, professional societies, and government organizations. Some of the private database suppliers build in elaborate indexing mechanisms to aid specialists using them. For example, IFI/Plenum and Derwent incorporate indexing and reference systems into their patent databases, while the Institute for Scientific Information includes elaborate cross-referencing schemes for scientists trying to identify research trends.

Online services select databases and provide software that handles user requests. Many databases show up on two or more online services—sometimes in different forms. Some services do not keep online all of such gigantic databases as Inspec , for example. Or they break them into two or more files to be searched separately. In some cases the same database goes by different names on different services, which has confused more than one directory compiler. Some compilers of databases also function as online services offering a single database; examples include CLEO and VideoLog.

Major online services tend to fall into two broad categories: general-purpose and professional. The Source, CompuServe, and Delphi are designed as "information utilities," accessible and usable by almost anyone with a computer. They contain much more than standard databases. Their electronic mail, computer conferencing, and messaging services are very popular. They also offer computer shopping, restaurant reviews, and other consumer information.

Most other online services are intended to serve professional users, and typically require more sophistication and effort—and cost more—than The Source, CompuServe, and Delphi. Major professional services do not concentrate on single areas, but they do tend to have strong points. BRS, Dialog, Pergamon InfoLine, and Orbit from SDC (Santa Monica, CA) are heavy on bibliographic databases. Dow Jones and Chase Econometrics are strong on business and financial reference databases. Mead Data Central concentrates on full-text databases.

The borders between professional and general-purpose online services also are blurring. Both BRS and Dialog offer reduced-price services aimed at somewhat less demanding audiences than their daytime counterparts. And Delphi permits the general-purpose user access to Dialog without having to sign up with Dialog.

The online services world is a small one. Only a fraction of personal computer users is hooked up to even The Source or CompuServe, and the Delphi subscriber list only recently passed 5000. But the field is growing and maturing. Cuadra Associates estimates that the number of databases online is growing 35% a year, while the number of online services is increasing 40% annually. Third-party software vendors are widening the avenues to online services. The Menlo Corp. of Santa Clara, CA, is offering software designed to simplify database access from personal computers. New types of databases are also appearing. One promising one contains software that users can download into their own computers. ◇

Big Four

(Continued from page 51)

and Investment Services and Dow Jones Quotes. Also invaluable are historical stock quotes, corporate reports for major businesses, and government regulatory information.

Dialog Information Services, 3460 Hillview Ave., Palo Alto, CA 94304, 800-227-1927 (in California, 800-982-5838). One of the least expensive databanks available, it's also the world's largest. It has over 200 bases featuring more than 100 publications and 100 *million* items of information in a virtual sea of disk drives. Dialog features abstracts of articles on every topic from art history to zoology. It's used mostly by businesses and professionals, the single largest member group being librarians. Once you've found the bibliographic reference you want, you can request a copy of the complete article at a nominal charge, although, according to spokesperson Barbara Gersh, "often the information wanted is already in the abstract."

The company suggests new members enroll in a $1^1/_2$-day seminar to learn how to use Dialog, a good idea that will pay dividends in reduced access charges.

A second service available is Knowledge Index, online from 6 p.m. to 5 a.m. weekdays (6 p.m. to midnight Fridays) and 8 a.m. to midnight Saturday, 3 p.m. to 5 p.m. Sunday. A scaled-down version of Dialog, Knowledge Index, features 25 popular databases. Although it's less comprehensive than Dialog, it's also cheaper and easier to call up. Users are mostly professionals with computers at home to peruse professional journals.

Full-text articles by both the Associated Press and United Press International are available. Coming soon is an electronic mail system, which will be a convenience to users of both Dialog and Knowledge Index. ◇

Videotex

(Continued from page 53)

Why so few subscribers? At current prices, videotex services have little appeal to consumers, suggests Steve Weissman, assistant publisher of *Videoprint,* a newsletter published by International Resource Development of Norwalk, CT. Viewtron subscribers must pay $39.95 a month for a package that includes rental of the Sceptre terminal from AT&T Consumer Products. The Sceptre includes a videotex decoder and a "chicklet" keyboard of the type made infamous by the IBM PC*jr.*

For about half the purchase price of Sceptre (it sells for $600-$800), you can buy a Commodore 64 computer *plus* a modem to communicate with online services such as CompuServe, Delphi, and The Source. But Viewtron can't talk with personal computers—it sends signals in the North American Presentation Level Protocol Syntax (NAPLPS), not in the ASCII format used for computer communication. AT&T Consumer Products makes a videotex adapter for personal computers, but it costs as much as Sceptre.

Sceptre terminals also are used by the Gateway videotex system, which Times-Mirror Newspapers began last September in Orange County, a suburb of Los Angeles. Gateway subscriptions cost $29.95 a month, including terminal rental and 20 hours of service. No subscriber count was available, but it evidently is well under 2000; the $29.95 price only applies to the first 2000 subscribers, and the company has yet to announce a price for subsequent subscribers.

The latest commercial videotex system in the United States, Keyfax, in the Chicago area, is unique because it can communicate with personal computers as well as with custom-built television-adapter terminals that sell for $349.95.

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404/461 Pub. Pr., $76.95 Club Pr., $57.95

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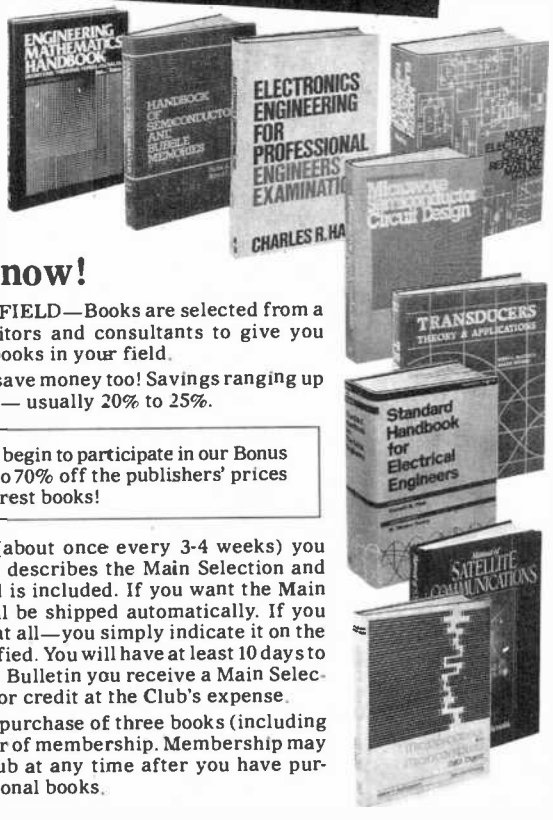

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Videotex

Personal-computer users can access the videotex database with a $59.95 software package, but they will get only ASCII text, not the full-color graphics in the NAPLPS format. Subscribers can buy a $14.95 basic package that includes 5 hours of online time, or a more inclusive $29.95 package with 15 hours online; neither includes terminal rental. No subscriber count was available for the system, which only began November 1. It is operated by Keycom Electronic Publishing of Schaumburg, IL, a joint venture of Centel (the former Central Telephone Co.) and Honeywell.

What's in Store

Other videotex systems are in the planning stages, and videotex developers are maintaining a brave public front. One skeptical observer is Weissman, who predicts, "Viewtron, as it currently exists, won't last into 1986". Gary Arlen, publisher of the Washington-based newsletter, *International Videotex/ Teletext* News, is more optimistic, but he believes a mass market for videotex is still two years away. He also points out that the definition of videotex is changing to include online information services, such as CompuServe, which make no pretense at offering graphics and are aimed at users of personal computers.

Some signs of change already are clear. A Viewtron spokeswoman said, "Knight-Ridder is committed in 1985 to explore the personal computer market and to develop applications for Viewtron in the business community." AT&T has sold several videotex systems for business use, including one that will serve as a directory to a 50-story office building under construction in Dallas and another that Monmouth County, NJ, realtors will use to show houses.

Videotex may never fulfill the visions of the early developers, who saw it as a tool to make it easy for anybody to use the power of the computer. Menu-driven services and flashy color graphics have yet to demonstrate a compelling appeal. The coming of the microcomputer has made obsolete visions of vast networks of dumb terminals tapping into mainframe. Yet the microcomputer is also creating a demand for interactive information services, not just online databases, but also electronic messaging and other interactive communication services. As new software makes micro computers easier to use—without hobbling their efficiency—some of the goals of early videotex developers may be met in ways far different from what they had imagined, and the "videotex" label may take on a much different meaning. ◇

Jane

(Continued from page 37)

The few times that I was stumped I found quick relief in Jane's 236-page manual. When I needed to look up the meaning of a particular icon, I found fast help in the Picture Index section in the back of the book. Indeed, the manual is well-done, although it tends to oversimplify. But the writing is kept to a concise minimum, and an ample number of screen shots is provided.

When the manual isn't near, you can use Jane's built-in help feature. Just click the large question mark located in the top menu bar, and you're asked what subject you need help in. As usual, you use the mouse to click on the subject you want covered. To find out more about the camera icon, for instance, position the pointer over it and click the mouse button. The help program is on a separate disk, so you're asked to swap disks. After a moment, the tutorial begins.

What's unique about Jane's help feature is that you're not given a dry dissertation of the facts, but an enjoyable animated show. With the camera as an example again, the tutorial begins by moving the image of the camera around the screen as text appears describing the purpose of the camera—as a tool to copy text to other parts of the document. It then explains how to use the camera.

Jane's help feature is context-sensitive. Let's say you choose help while using the Janecalc application. The discussion of the camera is limited to duplicating cells in the worksheet. Ask for help about the camera while using the Janewrite application, and Jane shows you how to cut and paste text in a word processing document.

Jane sounds like an ideal personal productivity program, and in many ways it is. But, alas, in many ways it isn't. Jane suffers in many ways that may or may not be critical, depending on your application and needs.

Where Jane Falls Short

Everything Jane displays on the screen is a graphic image, even text (which the program shows in pseudo 80-column format, even with a 40-column Apple). Needless to say, this can slow down any program. To move from the top of a 1-page word processing document to the bottom, for example, can take as long as 20 seconds. The screen, or at least a part of it, is redrawn each time you scroll up, down, right, or left.

Jane's help feature can be handy and informative, but it often gets in the way. Whenever you ask for help on a particular subject, you must sit through the cute animation. If what you want to know is at the end of the movie, you may have to

wait a minute or two for it to roll around. Too bad there's no speed key so you can put Jane into super-drive and go fast-forward through the parts of the help presentation that you aren't interested in. Arktronics claims that the Commodore 64 version, which should be out by the time you read this, will have this feature.

Although Jane will work with a one-drive Apple, it's best to use two drives. With a single-drive Apple IIc I had to start the program with the grey program disk (all of Jane's disks are color coded), then swap in the black data disk when I opened one of the documents. Jane had me juggle the two disks back and forth a few more times as it loaded the document and started word processing.

When it came time to get help, I inserted the yellow help disk. When I finished with the help session, I had to swap the black and grey disks into the drive a few more times. In short, I found that Jane is a little rough on patience when it is used with a single-drive computer. A two-drive system makes life with Jane much more palatable.

Perhaps Jane's most serious shortcoming is its general lack of power; the program isn't meant for large jobs. Jane's word processor, for example, which has most of the standard word processing features, like right and left justification, boldfacing, underlining, and search and replace, can't handle documents larger than about 25 pages. You'll have to break up longer documents into several pieces.

The largest worksheet you can build with Jane is 20 columns wide by 24 rows deep, barely enough for a typical personal loan analysis or income tax spreadsheet. Janecalc, unlike many available spreadsheet programs, doesn't use column and row numbers, which, of course, limits its versatility. Editing a worksheet becomes difficult.

Jane's list management application, Janelist, is an electronic version of a Rolodex file. While it is perfect for keeping track of names or the items in a household inventory, this approach to computerized list management is limited. It might be easier and cheaper to spend $2 on a 3 × 5" index file and jot down names and addresses the old-fashioned way.

Specifications

Product: Jane
Mfr: Arktronics Corp
PO Box 4190
Ann Arbor, MI 48106
313-769-7253
Price: $125
Requirements: Apple II+, IIe, or IIc; 64k memory; Apple-Mouse II, Koala Pad or joystick. Two drives, printer recommended.

All in All

Jane is a welterweight personal productivity tool that's designed to be easy to learn and use. Its sophistication lies not in computing power, but in its design, based on the metaphor of a desktop. If you need greater power, don't bother with Jane. You need something like a 1-2-3 or a Context MBA. If, however, you need a handy, easy-to-read program and don't require lots of computing muscle, Jane could answer your needs. ◇

ProKey
(Continued from page 36)

nient to have a single-key macro or redefine a key, you simply go ahead and do it without leaving that program.

To program a key on the fly you need only depress the ALT and "=" keys, which blocks keyboard entry to the applications program while opening ProKey's definition function. A reverse video prompt line indicates the selected key and its new definition. Anything entered on the keyboard is stored as a macro or a new key function until the ALT and "—" keys are depressed, which closes the definition function, removes the prompt line, and opens the path from the keyboard to the applications program.

If you want to clear a definition or restore a previous definition, you simply enter the old definition or a null through the ALT=/ALT— procedure. If you want to save the redefined layout for use at another time, you easily can save it to disk as a "definition file."

The only keys that cannot be defined directly through ProKey are ALT, CTRL, SHIFT, NUM LOCK, CAPS LOCK, SCROLL LOCK, and the "`" (back apostrophe, which is ProKey's escape key). However, even these keys can be redefined with a utility called Layout that's supplied with the program.

Layout

Layout presents a labeled pictorial of the keyboard on the screen. Pressing a key highlights the matching screen symbol and causes its label to blink; pressing a second key substitutes it for the first key and causes it to appear in the pictorial. Layout permits any key to be redefined as any other key.

In this way the PC's unusually placed left SHIFT can be interchanged with the adjacent "vertical line/reverse slash" key to provide the standard U.S. left and right shift locations. Unlike ProKey, Layout redefines the entire key; the key functions cannot be split between lower- and uppercase.

Layout keyboard definitions can also be saved as disk files that can be automatically installed at bootup or called up whenever needed.

Although Layout is an extremely powerful utility, it has a major limitation that, to RoseSoft's credit, is clearly spelled out in the documentation: Layout must be the first program loaded into RAM; if it isn't, it doesn't work. For example, if Quadram's RAMdisk software is loaded first, Layout won't be able to load its definition file. If Layout is loaded first, Quadram's RAMdisk software will erase the program from memory because it causes a reboot. The only exception we've found so far is Tecmar's Memdisk (RAMdisk) program, which is transparent to Layout. Memdisk can be loaded first to create a disk emulator without interfering with Layout.

Layout is also dependent on the computer's ROM and will not work with the ROMs used in some IBM clones and compatibles. It is also sensitive to the particular version of the ROM used in the IBM computers. Because of these limitations, RoseSoft provides the program not as a part of ProKey, but as an extra convenience. The company will provide IBM PC users with the correct version of ProKey for their computers if the original fails to work, but does not guarantee that the Layout utility can be used with IBM clones and compatibles.

Another unusual utility supplied with ProKey creates a "one-finger mode," which permits you to press any of the "shift" keys (CTRL, ALT or SHIFT) and another key in sequence rather than simultaneously. For example, instead of interrupting a program by depressing the CTRL and C keys together or CTRL and BREAK, you could press CTRL first and then C or BREAK. Even ProKey's ALT= command could be entered as ALT followed by "=."

The recommended way to use ProKey and its utilities is to create an AUTOEXEC.BAT (batch) file that automatically loads the software when the computer is booted. The autoload can also include definition files for Layout and ProKey so that the computer comes up fully configured to run the applications software.

ProKey is provided with a set of well-prepared macro "starter sets" for WordStar, dBase II, 1-2-3 and VisiCalc that are not only useful in themselves but can serve as excellent guides to what you can do on your own. The Layout utility has pre-defined files for a Dvorak keyboard, a standard IBM PC keyboard, and a standard Eagle keyboard—which covers most types you might use.

The documentation is sparse, but well prepared. It's short and to the point.

Though ProKey is initially supplied on a copy-protected disk, RoseSoft will substitute an unprotected copy to registered users.

Overall, the package is excellent. It is unusually easy to use, doesn't get in the way of the applications software, and doesn't seem to have any bugs, other than the possible ROM incompatibility of the Layout utility. We like it. ◇

Turbo Pascal
(Continued from page 38)

tiveness of the language, it can be a disadvantage for commercial software developers. They might find it troublesome to sell sets of procedures and functions that they have created as language extensions or program development tools, such as data access techniques or screen generators. Since precompiled modules cannot be "linked" to user applications with Turbo, developers would have to supply source code, something they may be unwilling to do.

Another problem we noted is that Turbo sometimes identifies programming errors inaccurately. The cursor on occasion moved to a point that did not correspond to the error. It doesn't happen very often, but it is disconcerting.

In addition, the error-trapping feature at run-time may frustrate someone who is accustomed to handling scores of errors within the program. A programmer cannot stop execution of a program and print the contents of variables and then resume execution, as in interpretive BASIC. Some versions of Pascal, such as Digital Research's Pascal MT+, let you do this type of debugging. Turbo would be much improved if later versions offered such a feature.

Other Features

Turbo comes with a comprehensive reference manual. Although the layout of the manual is rather ordinary, the text is clear and usable, and the table of contents and index are complete. While it is instructive, it is not really a tutorial. It assumes some knowledge of Pascal and explains only the major features of the language. Someone who knows BASIC or some other programming language could learn a great deal by reading this manual and studying the sample Turbo programs.

Turbo Pascal has other ways to make life easier for the programmer. Their convenience, however, is at the expense of significant deviation from standard Pascal, which compromises the user's ability to port programs to other operating systems. But, since there are Turbo versions for CP/M-80, CP/M-86, MS-DOS, and PC-DOS, most, but not all, Turbo features can be ported across these operating systems.

Borland International also distributes

Turbo Pascal

a set of procedures, called the Tool Box, for file indexing, sorting, and the like. These are distributed in uncompiled source code. Not only are these useful tools, but their distribution as source code makes them both instructive and modifiable.

While the Tool Box came in too late for us to evaluate it thoroughly, we did notice that the file-indexing features seem complete and up-to-date. In particular, the file indexing could be very useful for creating database applications. Indexing allows the programmer to access data in predetermined sequences, such as in alphabetical or code number order, without the need for sorting. The Tool Box manual contains a lucid introduction to file indexing. The explanations, along with the source code, should prove valuable to persons seeking to learn how indexing works.

Turbo in Real Life

We purchased Turbo Pascal and used it to fulfill a contract to write a set of programs. It was a great experience. We did a lot of programming in a short time even though we were learning Turbo's nuances as we went along. In addition to executing normal programming functions, we were able to make operating system calls easily and utilize inline assembly code. The compiled code executed fast and flawlessly. Some reviewers have implied that Turbo is not a good language for large or complex applications because a compiled program can only occupy 64K bytes. We, however, didn't find this limitation significant. Turbo supports chaining with common variables and has the most easy to use overlay system we have seen. In addition, Turbo's procedures for dynamic allocation of variable space allow all of available memory to be used for application data. The result is that Turbo is adequate for such memory-intensive applications as spreadsheets and word processors.

What It All Means

Fast compilers have been a standard feature of mainframe computers for years. Borland International has brought similar power to microcomputers and has integrated it into a complete interactive programming system. Turbo will not be the only interactive compiled language for microcomputers, but its arrival has eliminated forever the inverse relationship between speed of execution and speed of programming. Whether or not Turbo Pascal ends up a dominant language, we think it has lifted microcomputer programming languages to a new level. ◇

Ultraterm

(Continued from page 33)

revisions of older software have parameters that allow them to be configured for Ultraterm. Just as they did with Videoterm, Videx sells special preboot disks for AppleWriter and VisiCalc, to take advantage of all Ultraterm's extended display capability.

A Bit about the Hardware

Much thought has gone into the design of both the hardware and firmware on Ultraterm. Anyone who's familiar with Videoterm will be happy to hear that one of the annoying features of that card's firmware has been corrected. Both Videoterm and Ultraterm use CONTROL-A as a soft toggle for upper/lower case and convert CONTROL-K to a "[." While this change is useful for the uppercase-only keyboards of the Apple II and II+, it causes trouble with a program like WordStar, for example, which makes extensive use of both CONTROL-A and CONTROL-K. Short of burning a new EPROM or rewriting the BIOS for the software, there was nothing to do with Videoterm.

In Ultraterm, the same traps are in the firmware, but a back door has been added. If the card sees a lower-case character, both character filters are branched around since the card assumes you have a lower-case keyboard.

Documentation

The manual gives you all the information you could possibly want about the operation of Ultraterm. There are a listing of the firmware, a complete schematic drawing of the circuit, and detailed explanations of the various jumpers and switch settings. One novel feature of the card is that you can set a series of dip switches to control the default setting for modes and attributes.

The manual has instructions for using the card with DOS, CP/M, and Pascal. Moreover, if you request it, Videx will send you a programmer's guide that tells exactly how to address the various registers in the CRTC (Cathode Ray Tube Controller), the special microprocessor at the heart of the card.

Conclusions

Videx is a small company that cares. If you contact them with any problem or question, you'll find they go out of their way to be helpful. In this case, I feel that satisfaction is guaranteed—the Ultraterm display is incredible.

Although the card carries a list price of $379, it can be found discounted by as much as 50%. As the most advanced video display available for the Apple II+, it is one of the best deals in town. ◇

Multi-User Micros
(Continued from page 75)

out in advance. The importance of this process cannot be overemphasized, since it can seriously affect the acceptance of the new system within the organization and hence the degree to which the system enhances organizational productivity and efficiency.

With so many complicated issues at stake, new MUS users can hardly be expected to anticipate every potential problem, particularly should their needs expand and change.

In the face of so many factors, comprehensive support from both manufacturers and dealers should be a prime concern.

The support from the manufacturer should include a committment to supply replacement and upgrade hardware at reasonable prices for the life expectancey of the machine. An extended warranty program is usually a good indication of long-term support. The manufacturer also provides effective training for dealers so that they can make necessary repairs and be aware of changes and improvements in the equipment.

The next level of support comes from the dealer. The dealer's role is so critical that some manufacturers strictly limit dealerships to only those who meet rigorous standards and undergo comprehensive training.

Although these standards will protect both the manufacturer and the user, they can tend to limit sales and necessitate higher pricing.

In general, a good MUS dealer should not only have expert knowledge of the workings of the product but also considerable experience in selecting, customizing and creating application software for a MUS environment.

One very important area that should not be ignored is training. Many dealer/consultants may be excellent technicians and run reputable businesses, but they may not be very good at training new users in the intricacies of managing a complicated MUS. New users hould make sure that adequate training is available and that the dealer has a reputation for providing it.

Toward the Future

What's coming up for the multi-user microcomputer industry? The big story is, of course, the impending entry of the giants into the marketplace. A major move by IBM or ATT to attack the growing demand for low-cost, effective MUSs would revolutionize and legitimize the market and probably impose some *de facto* standards. We can almost certainly look forward to some relevant announcements soon. ◇

7400

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SN7405N	14	.49
SN7406N	14	.59
SN7407N	14	.59
SN7408N	14	.29
SN7409N	14	.35
SN7410N	14	.29
SN7411N	14	.29
SN7412N	14	.49
SN7413N	14	.39
SN7414N	14	.49
SN7416N	14	.49
SN7417N	14	.59
SN7420N	14	.19
SN7421N	14	.59
SN7422N	14	.59
SN7423N	16	.69
SN7425N	14	.39
SN7426N	14	.39
SN7427N	14	.25
SN7428N	14	.59
SN7430N	14	.35
SN7432N	14	.39
SN7433N	14	.49
SN7437N	14	.25
SN7438N	14	.49
SN7439N	14	.79
SN7440N	14	.19
SN7441N	16	.89
SN7442N	16	.45
SN7443N	16	1.25
SN7444N	16	1.25
SN7445N	16	.69
SN7446N	16	.75
SN7447N	16	.75
SN7448N	16	.75
SN7454N	14	.19
SN7459N	14	.39
SN7460N	14	.39
SN7470N	14	.39
SN7472N	14	.39
SN7473N	14	.39
SN7474N	14	.39
SN7475N	16	.45
SN7476N	16	.39
SN7479N	14	4.95
SN7480N	14	.89
SN7482N	14	1.49
SN7483N	16	.55
SN7485N	16	.59
SN7486N	14	.39
SN7489N	16	2.25
SN7490N	14	.49
SN7491N	14	.79
SN7492N	14	.45
SN7493N	14	.45
SN7494N	14	.89
SN7495N	14	.49
SN7496N	16	.49
SN7497N	16	3.25
SN74100N	24	1.95
SN74105N	14	1.19
SN74107N	14	.29
SN74109N	16	.39
SN74116N	24	1.49
SN74121N	14	.45
SN74122N	14	.69
SN74123N	16	.55
SN74125N	14	.49
SN74126N	14	.49
SN74128N	14	.79
SN74132N	14	.59
SN74136N	14	.69
SN74141N	16	.89
SN74142N	16	3.95
SN74143N	24	3.95
SN74144N	24	3.95
SN74145N	16	.65
SN74147N	16	1.29
SN74148N	16	.89
SN74150N	24	1.39
SN74151N	16	.49
SN74152N	14	.49
SN74153N	16	.99
SN74154N	24	1.49
SN74155N	16	.49
SN74156N	16	.49
SN74157N	16	.49
SN74159N	24	1.95
SN74160N	16	.59
SN74161N	16	.59
SN74162N	16	.59
SN74163N	16	.59
SN74164N	14	.69
SN74165N	16	.69
SN74166N	16	.69
SN74167N	16	2.95
SN74170N	16	1.59
SN74172N	24	4.95
SN74173N	16	.85
SN74174N	16	.59
SN74175N	16	.59
SN74176N	14	.79
SN74177N	14	.79
SN74179N	16	1.49
SN74180N	14	.69
SN74181N	24	1.95
SN74182N	16	1.05
SN74184N	16	2.29
SN74185N	16	2.29
SN74190N	16	.69
SN74191N	16	.69
SN74192N	16	.69
SN74193N	16	.69
SN74194N	16	.69
SN74195N	16	.49
SN74196N	14	.75
SN74197N	14	.75
SN74198N	24	1.19
SN74199N	24	1.19
SN74221N	16	1.19
SN74251N	16	.79
SN74273N	20	1.95
SN74276N	20	2.49
SN74279N	16	.79
SN74283N	16	1.39
SN74284N	16	2.95
SN74285N	16	2.95
SN74365N	16	.55
SN74366N	16	.55
SN74367N	16	.55
SN74368N	16	.55
SN74390N	16	1.49
SN74393N	14	1.49

74LS

Part No.	Pins	Price
74LS00	14	.29
74LS01	14	.29
74LS02	14	.35
74LS03	14	.35
74LS04	14	.39
74LS05	14	.35
74LS08	14	.35
74LS09	14	.35
74LS10	14	.35
74LS11	14	.35
74LS14	14	.59
74LS15	14	.35
74LS20	14	.29
74LS21	14	.35
74LS26	14	.29
74LS27	14	.35
74LS28	14	.39
74LS30	14	.39
74LS32	14	.39
74LS37	14	.39
74LS38	14	.35
74LS42	16	.49
74LS47	16	.89
74LS51	14	.29
74LS73	14	.39
74LS74	14	.49
74LS75	16	.45
74LS76	16	.39
74LS85	16	.89
74LS86	14	.39
74LS90	14	.55
74LS92	14	.55
74LS93	14	.55
74LS96	16	.89
74LS107	14	.39
74LS109	16	.39
74LS112	16	.45
74LS114	14	.39
74LS122	14	.49
74LS123	16	.79
74LS125	14	.59
74LS126	14	.59
74LS132	14	.65
74LS133	16	.59
74LS136	14	.39
74LS138	16	.59
74LS139	16	.59
74LS145	16	1.19
74LS147	16	1.95
74LS148	16	1.79
74LS151	16	.59
74LS153	16	.59
74LS154	24	1.49
74LS155	16	.69
74LS156	16	.69
74LS157	16	.69
74LS158	16	.59
74LS160	16	.69
74LS161	16	.69
74LS162	16	.69
74LS163	16	.69
74LS164	14	.69
74LS165	16	.89
74LS168	16	1.19
74LS169	16	1.49
74LS170	16	1.49
74LS173	16	.69
74LS174	16	.69
74LS175	16	.69
74LS181	24	2.49
74LS190	16	.79
74LS191	16	.89
74LS192	16	.79
74LS193	16	.79
74LS194	16	.69
74LS195	16	.59
74LS196	14	.89
74LS197	14	.89
74LS221	16	1.09
74LS240	20	1.09
74LS241	20	.99
74LS243	14	1.09
74LS244	20	1.29
74LS245	20	1.49
74LS251	16	.59
74LS253	16	.59
74LS257	16	.59
74LS258	16	.59
74LS260	14	.59
74LS266	14	.59
74LS273	20	1.49
74LS279	16	.49
74LS280	14	1.95
74LS299	20	2.95
74LS322	20	3.95
74LS323	20	3.95
74LS347	16	.79
74LS353	16	1.09
74LS364	20	1.95
74LS365	16	.49
74LS366	16	.49
74LS367	16	.49
74LS368	16	.49
74LS373	20	1.49
74LS374	20	1.49
74LS375	16	.69
74LS386	14	.39
74LS393	14	1.19
74LS399	16	1.49
74LS490	16	1.95
74LS533	20	1.95
74LS534	20	1.95
74LS540	20	1.49
74LS541	20	1.49
74LS640	20	2.19
74LS641	20	2.19
74LS644	20	2.19
74LS645	20	2.19
74LS670	16	1.49
74LS688	20	2.95
81LS95	20	1.49
81LS96	20	1.49
81LS97	20	1.49
81LS98	20	1.49

74S/PROMS*

Part No.	Pins	Price
74S00	14	.35
74S02	14	.35
74S03	14	.35
74S04	14	.45
74S05	14	.45
74S08	14	.45
74S09	14	.39
74S10	14	.35
74S11	14	.35
74S15	14	.35
74S20	14	.35
74S22	14	.35
74S30	14	.35
74S32	14	.45
74S37	14	.99
74S38	14	.89
74S51	14	.35
74S64	14	.39
74S65	14	.39
74S74	14	.55
74S85	16	1.99
74S86	14	.55
74S112	16	.55
74S113	14	.55
74S114	14	.55
74S124	16	2.75
74S132	14	1.89
74S133	16	.45
74S135	16	.89
74S136	14	1.39
74S138	16	.89
74S139	16	.89
74S140	14	.69
74S151	16	.99
74S153	16	.99
74S157	16	.99
74S158	16	.99
74S160	16	2.29
74S169	16	4.29
74S174	16	1.09
74S175	16	1.09
74S188*	16	1.75
74S194	16	1.49
74S195	16	1.49
74S196	14	1.49
74S240	20	1.95
74S241	20	1.95
74S242	14	2.19
74S243	14	2.19
74S244	20	2.19
74S251	16	.99
74S253	16	.99
74S257	16	.99
74S258	16	.99
74S260	14	.79
74S273	20	2.39
74S280	14	1.89
74S287*	16	1.79
74S288*	16	1.79
74S299	20	5.95
74S373	20	2.49
74S374	20	2.49
74S387*	16	1.95
74S471*	20	4.95
74S472*	20	4.95
74S473*	20	4.95
74S570*	16	2.95
74S571*	16	2.95
74S572*	18	4.95
74S573*	18	4.95

CA—LINEAR

Part No.	Pins	Price
CA3010H		1.09
CA3039H		1.25
CA3046N	14	.99
CA3059N	14	2.95
CA3060N	16	2.95
CA3065E	14	1.49
CA3080E	8	.99
CA3081N	16	1.15
CA3082N	16	1.15
CA3083N	16	1.15
CA3086N	14	.85
CA3089N	16	1.95
CA3096N	16	1.75
CA3130E	8	1.19
CA3140E	8	1.15
CA3160H		1.79
CA3160E	8	1.49
CA3161E	16	1.79
CA3162E	16	6.95
CA3189E	16	2.79
CA3401N	14	.59

CD—CMOS

Part No.	Pins	Price
CD4001	14	.29
CD4002	14	.29
CD4006	14	.89
CD4007	14	.29
CD4008	16	.89
CD4009	16	.59
CD4010	16	.49
CD4011	14	.29
CD4012	14	.29
CD4013	14	.39
CD4014	16	.89
CD4015	16	.39
CD4016	14	.39
CD4017	16	.79
CD4018	16	.79
CD4019	16	.49
CD4020	16	.75
CD4021	16	.75
CD4022	16	.75
CD4023	14	.29
CD4024	14	.69
CD4025	14	.29
CD4026	16	1.59
CD4027	16	.45
CD4028	16	.69
CD4029	16	.75
CD4030	14	.39
CD4034	24	1.79
CD4035	16	.79
CD4040	16	.75
CD4041	14	.69
CD4042	16	.69
CD4043	16	.79
CD4044	16	.79
CD4046	16	.79
CD4047	14	.89
CD4048	16	.59
CD4049	16	.39
CD4050	16	.39
CD4051	16	.79
CD4052	16	.79
CD4053	16	.79
CD4056	16	2.95
CD4059	24	3.95
CD4060	16	.89
CD4066	14	.45
CD4068	14	.39
CD4069	14	.35
CD4070	14	.29
CD4071	14	.29
CD4072	14	.29
CD4073	14	.29
CD4077	14	.35
CD4078	14	.29
CD4081	14	.29
CD4093	14	.49
CD4094	16	1.95
CD4098	16	1.95
CD4099	16	1.89
CD4503	16	.69
CD4506	16	1.29
CD4507	14	1.19
CD4508	24	1.95
CD4510	16	.85
CD4511	16	.85
CD4512	16	.85
CD4514	24	1.49
CD4515	24	1.49
CD4516	16	.89
CD4518	16	.89
CD4519	16	.59
CD4520	16	.89
CD4526	16	1.19
CD4528	16	1.19
CD4529	16	1.69
CD4531	16	.89
CD4538	16	1.49
CD4541	14	1.49
CD4543	16	1.19
CD4562	14	6.95
CD4566	16	2.95
CD4583	16	2.49
CD4584	14	.59
CD4723	16	1.19
CD4724	16	1.19
MC14410	16	8.95
MC14411	24	11.95
MC14412	16	7.95
MC14433	24	17.95
MC14572	16	1.19

[More in Catalog]

74F00 NEW

Part No.	Pins	Function	Price
74F00	14	Quad 2-Input NAND Gate	.69
74F02	14	Quad 2-Input NOR Gate	.75
74F04	14	Hex Inverter	.89
74F08	14	Quad 2-Input AND Gate	.75
74F10	14	Triple 3-Input NAND Gate	.75
74F32	14	Quad 2-Input OR Gate	.75
74F74	14	Dual D Flip-Flop	.85
74F86	14	Quad Exclusive OR Gate	1.15
74F109	16	Dual JK Positive Edge Flip-Flop	.95
74F138	16	Expandable 3/8 Decoder	1.69
74F157	16	Quad 2-Input Multiplexer	1.69
74F158	16	Quad 2-Input Multiplexer (Inv.)	1.69
74F193	16	4-Bit Up/Down Binary Counter	5.29
74F240	20	Tri-State Octal Line Driver (Inverting)	3.75
74F244	20	Tri-State Octal Line Driver	3.49
74F257	16	Tri-State Quad 2-Input Multiplexer	1.79
74F373	20	Tri-State Octal Latch	4.89
74F374	20	Tri-State Octal D Flip-Flop	4.59

74ALS00

Part No.	Pins	Function	Price
74ALS00	14	Quad 2-Input NAND Gate	.59
74ALS02	14	Quad 2-Input NOR Gate	.59
74ALS04	14	Hex Inverter	.59
74ALS08	14	Quad 2-Input AND Gate	.59
74ALS10	14	Triple 3-Input NAND Gate	.59
74ALS30	14	8-Input NAND Gate	.59
74ALS32	14	Quad 2-Input OR Gate	.65
74ALS74	14	Dual D Flip-Flop	.79
74ALS109	16	Dual JK Pos. Edge Flip-Flop	.79
74ALS138	16	Expandable 3/8 Decoder	1.25
74ALS240	20	Tri-State Octal Line Driver (Inverting)	2.25
74ALS244	20	Tri-State Octal Line Driver	2.25
74ALS245	20	Octal Bus Transceiver (Non-Inv.)	2.59
74ALS373	20	Tri-State Octal Latch	2.59
74ALS374	20	Tri-State Octal D Flip-Flop	2.59

MICROPROCESSOR COMPONENTS

MICROPROCESSOR CHIPS

Part No.	Pins	Function	Price
D765AC	40	Floppy Disk Controller	19.95
D3242	28	Addr. Multiplexer & Refresh Counter	7.95
TMS5501	40	Synchronous Data Interface (SIRC)	14.95

Z80, Z80A, Z80B, Z8000 SERIES

Part No.	Pins	Function	Price
Z80	40	CPU (MK3880N) (780C) 2.5MHz	2.95
Z80-CTC	28	Counter Timer Circuit	3.49
Z80-DART	40	Dual Asynchronous Rec./Trans.	8.95
Z80-DMA	40	Direct Memory Access Circuit	12.49
Z80-PIO	40	Parallel I/O Interface Controller	3.49
Z80-SIO/0	40	Serial I/O (TxCB and RxCB Bonded)	11.49
Z80-SIO/1	40	Serial I/O (Lacks DTRB)	11.49
Z80-SIO/2	40	Serial I/O (Lacks SYNCB)	11.49
Z80-SIO/9	40	Serial I/O	11.49
Z80A	40	CPU (MK3880N-4) (780C-1) 4MHz	3.49
Z80A-CTC	28	Counter Timer Circuit	4.49
Z80A-DART	40	Dual Asynchronous Rec./Trans.	9.95
Z80A-DMA	40	Direct Memory Access Circuit	12.95
Z80A-PIO	40	Parallel I/O Interface Controller	4.49
Z80A-SIO/0	40	Serial I/O (TxCB and RxCB Bonded)	11.95
Z80A-SIO/1	40	Serial I/O (Lacks DTRB)	11.95
Z80A-SIO/2	40	Serial I/O (Lacks SYNCB)	11.95
Z80A-SIO/9	40	Serial I/O	11.95
Z80B	40	CPU (MK3880N-6) 6MHz	8.95
Z80B-CTC	28	Counter Timer Circuit	11.95
Z80B-DART	40	Dual Asynchronous Rec./Trans.	19.95
Z80B-PIO	40	Parallel I/O Interface Controller	10.95
Z8001B	48	CPU Segmented (10MHz)	79.95
Z8002B	40	CPU Non-Segmented (10MHz)	59.95

6500/6800/68000 SERIES

Part No.	Pins	Function	Price
6502	40	MPU with Clock (1MHz)	4.95
6502A	40	MPU with Clock (2MHz)	4.95
6502B	40	MPU with Clock (3MHz)	8.95
6520	40	Peripheral Inter. Adapter	3.95
6522	40	Peripheral Inter. Adapter	5.49
6551	28	Async. Comm. Interface Adapter	10.95
6800	40	MPU	2.95
6802CP	40	MPU with Clock and RAM	7.95
6809	40	CPU – 8-Bit (On-Chip Oscillator)	8.95
6809E	40	CPU – 8-Bit (External Clocking)	9.95
68B09E	40	CPU – 8-Bit (Ext. Clocking) 2MHz	14.95
68B10	24	128x8 Static RAM (2MHz)	5.95
6821	40	Peripheral Inter. Adapt. (MC6820)	2.95
68B21	40	Peripheral Interface Adapter (2MHz)	5.95
6845	40	CRT Controller (CRTC)	14.95
68B45	40	CRT Controller (CRTC) 2MHz	19.95
6850	24	Asynchronous Comm. Adapter	3.95
6860	24	0-600bps Digital MODEM	7.95
68000L8	64	MPU 16-Bit (8MHz)	39.95
68488P	40	General Purpose Int. Adapter	9.95

8000/80000 SERIES

Part No.	Pins	Function	Price
8031	40	Control Oriented CPU w/RAM & I/O	14.95
8035	40	MPU – 8-Bit	5.95
8039	40	CPU—Sgl. Chip 8-Bit (128bts. RAM)	5.95
8040N-6	40	CPU (256 bytes RAM)	9.95
8060	40	CPU – 8-Bit NMOS	14.95
8073N	40	CPU w/Basic Micro Interpreter	29.95
8080A	40	CPU	3.95
8085A	40	CPU	3.95
8085A-2	40	CPU – 8-Bit N-Channel (5MHz)	11.95
8086-2	40	CPU 16-bit 8MHz	24.95
8087	40	Arithmetic Processor	189.95
8088	40	CPU 8/16-Bit	19.95
8155	40	HMOS RAM I/O Port-Timer	6.95
8156	40	RAM with I/O Port and Timer	6.95
8205	16	Hi Speed 1 out of 8 Binary Decoder	3.95
8212	24	8-Bit Input/Output (74S412)	2.95
8224	16	Clock Generator/Driver	2.95
8228	28	System Cont./Bus Driver (74S428)	4.95
8237-5	40	High Perf. Prog. DMA Cont. (5MHz)	19.95
8238	28	System Controller (74S438)	4.95
8243	24	I/O Expander for 48 Series	4.95
8250N	40	Async. Comm. Element	10.95
8251	28	Prog. Comm. I/O (USART)	4.95
8251A	28	Prog. Comm. Interface (USART)	6.95
8253	24	Prog. Interval Timer	6.95
8255	40	Prog. Peripheral I/O (PPI)	4.95
8255A-5	40	Prog. Peripheral I/O (PPI) 5MHz	5.95
8259	28	Prog. Interrupt Control	5.95
8272	40	Single/Dble Density Floppy Disk Cont.	19.95
8274	40	Multi-Protocol Serial Cont. (7201)	29.95
8279	40	Prog. Keyboard/Display Interface	6.95
8282	20	Octal Latch	6.95
8284	18	Clock Generator/Driver	5.95
8286	20	Octal Bus Transceiver	7.95
8287	20	Octal Bus Transceiver (Inverted)	7.95
8288	20	Bus Controller	19.95
8303	20	8-Bit Tri-State Bi-Directional Trans.	3.49
8304	20	8-Bit Bi-Directional Receiver	3.49
8310	20	Octal Latched Peripheral Driver	3.95
8741	40	8-Bit Univ. Peripheral Interface	29.95
8748	40	HMOS EPROM MPU	39.95
8749	40	MPU 8-Bit (EPROM Version of 8049)	39.95
8755	40	16K EPROM with I/O	39.95
80186-6	68	High Integration 16-Bit MPU	99.95
80188	68	High Integra. 16-Bit MPU (8-Bit Data Bus)	89.95

DISK CONTROLLERS

Part No.	Pins	Function	Price
INS1771-1	40	Single Density	16.95
FD1791	40	Single/Dual Density (Inv.)	24.95
FD1793	40	Single/Double Density (True)	26.95
FD1795	40	Dual Density/Side Select (Inv.)	26.95
FD1797	40	Dual Density/Side Select (True)	29.95

SPECIAL FUNCTION

Part No.	Pins	Function	Price
DS0026CN	8	Dual MOS Clock Driver (5MHz)	1.95
INS2651	28	Communication Chip	7.95
MC3470P	18	Floppy Disk Read Amp System	4.95
MM5321N	16	TV Camera Sync. Generator	9.95
MM54240N	24	Asynchronous Transmitter/Receiver	5.95
MM58167AN	24	Microprocessor Real Time Clock	8.95
MM58174AN	16	Micro. Compatible Time Clock	8.95
MM5369AA/N	8	Prog. Oscillator/Divider (60Hz)	1.79
MM5369EST	8	Prog. Oscillator/Divider (100Hz)	1.95

DYNAMIC RAMS

Part No.	Pins	Function	Price
1103	18	1024x1 (300ns)	.99
4027	16	4096x1 (250ns)	1.49
4116N-2	16	16,384x1 (150ns)	1.39 — 8/10.95
4116N-3	16	16,384x1 (200ns)	1.15 — 8/8.95
4116N-4	16	16,384x1 (250ns)	.89 — 8/6.95
4164N-150	16	65,536x1 (150ns)	5.19 — 8/40.95
4164N-200	16	65,536x1 (200ns)	4.95 — 8/38.95
MM5261	18	1024x1 (300ns)	.35 — 8/1.95
MM5262	22	2048x1 (365ns)	.35 — 8/1.95
MM5270	18	4096x1 (250ns) MK4096	4.95
MM5280	22	4096x1 (200ns) 2107	3.95
MM5298-3	18	8192x1 (200ns)	.59
41256-150	16	262,144x1 (150ns)	34.95
41256-200	16	262,144x1 (200ns)	31.95
48128	16	131,072x1 (200ns)	24.95

STATIC RAMS

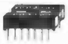
Part No.	Pins	Function	Price
2101	22	256x4 (450ns) 8101	1.95
2102	16	1024x1 (350ns)	.89
2102-2L	16	1024x1 (250ns) L.P. (91L02)	1.49
2111	18	256x4 (450ns) 8111	2.49
2112	16	256x4 (450ns) MOS	2.49
2114N	18	1024x4 (450ns)	1.29 — 8/9.95
2114N-L	18	1024x4 (450ns) L.P.	1.95 — 8/13.95
2114N-2	18	1024x4 (200ns)	1.39 — 8/10.95
2114N-2L	18	1024x4 (200ns) L.P.	1.69 — 8/13.49
2147HN	18	4096x1 (70ns)	4.49
2148HN	18	1024x4 (70ns)	4.95
TMS4045	18	1024x4 (450ns)	3.95
TMS40L47-45	20	1024x4 (450ns)	1.95
5101	22	256x4 (450ns) CMOS	3.95
MM5257	18	4096x1 (450ns) 4044	4.95
HM6116P-2	24	2048x8 (120ns) CMOS	7.95
HM6116LP-2	24	2048x8 (120ns) L.P. CMOS	8.95
HM6116P-3	24	2048x8 (150ns) CMOS	4.95
HM6116LP-3	24	2048x8 (150ns) L.P. CMOS	6.49
HM6116P-4	24	2048x8 (200ns) CMOS	4.75
HM6116LP-4	24	2048x8 (200ns) L.P. CMOS	5.49
HM6264P-12	28	8192x8 (120ns) CMOS	37.95
HM6264LP-12	28	8192x8 (120ns) L.P. CMOS	39.95
HM6264P-15	28	8192x8 (150ns) CMOS	34.95
HM6264LP-15	28	8192x8 (150ns) L.P. CMOS	37.95
27LS00	16	256x1 (80ns) L.P.	3.95
7489	16	16x4 (50ns) 3101	2.25
74C921	18	256x4 (250ns) CMOS	5.95
74C930	18	1024x1 (250ns) CMOS (6518)	5.95
74S189	16	16x4 (35ns) 93405	2.95
74S289	16	16x4 (35ns) 3101	2.95
82S10	16	1024x1 (50ns) O.C. (93415)	3.95
82S25	16	16x4 (50ns) O.C. (74S289)	2.25

PROMS/EPROMS

Part No.	Pins	Function	Price
1702A	24	256x8 (1µs)	3.95
2708	24	1024x8 (450ns)	3.95
TMS2516	24	2048x8 (450ns) 2716	4.95
TMS2532	24	4096x8 (450ns) NMC2532	5.49
TMS2564	28	8192x8 (450ns)	10.95
TMS2716	24	2048x8 (450ns) 3 voltage	7.95
2716	24	2048x8 (450ns)	3.95
27C16	24	2048x8 CMOS	14.95
2716-1	24	2048x8 (350ns)	5.49
2716Q-5	24	2048x8 (550ns)	3.75
2732	24	4096x8 (450ns)	4.95
2732A-20	24	4096x8 (200ns) 21V	11.49
2732A-25	24	4096x8 (250ns) 21V	7.19
2732A-45	24	4096x8 (450ns) 21V	6.49
27C32	24	4096x8 CMOS	19.95
27C32A-30	24	4096x8 (300ns) 21V (CMOS)	22.95
2764-20	28	8192x8 (200ns) 21V	14.95
2764-25	28	8192x8 (250ns) 21V	7.19
2764-45	28	8192x8 (450ns) 21V	6.49
27C64	28	8192x8 CMOS 21V	22.95
MCM68764	24	8192x8 (450ns) 21V	24.95
27128-25	28	16,384x8 (250ns) 128K Eprom 21V	21.95
27256-25	28	32,768x8 (250ns) 256K Eprom (14V)	99.95
74S188	16	32x8 PROM O.C. (6330-1)	1.75
74S287	16	256x4 PROM T.S. (6301-1)	1.79
74S288	16	32x8 PROM T.S. (6331-1)	1.79
74S387	16	256x4 PROM O.C. (6300-1)	1.95
74S471	20	256x8 PROM T.S. (6309-1)	4.95
74S472	20	512x8 PROM T.S. (6349-1)	4.95
74S473	20	512x8 PROM O.C. (6348)	4.95
74S474	24	512x8 PROM T.S. (DM87S296N)	4.95
74S475	24	512x8 PROM O.C. (6340)	4.95
74S476	18	1024x4 PROM T.S.	6.95
74S478	24	1024x8 PROM T.S.	9.95
74S570	16	512x4 PROM O.C. (6305)	2.95
74S571	16	512x4 PROM T.S. (6306)	2.95
74S572	18	1024x4 PROM O.C. (6352)	4.95
74S573	18	1024x4 PROM T.S. (82S137)	4.95
82S23	16	32x8 PROM O.C. (27S18)	2.95
82S115	24	512x8 PROM T.S. (27S15)	9.95
82S123	16	32x8 PROM T.S. (27S19)	2.95
82S126	16	256x4 PROM O.C. (27S20)	2.95
82S129	16	256x4 PROM T.S. (27S21)	2.95
82S130	16	512x4 PROM O.C. (27S12)	3.95
82S185	18	2048x4 PROM T.S. (TBP24S81)	9.95
82S191	24	2048x8 (80ns)	14.95
DM87S181N	24	1024x8 PROM T.S. (82S181)	9.95
DM87S184N	18	2048x4 PROM O.C. (82S184)	9.95
DM87S185N	18	2048x4 PROM T.S. (82S185)	9.95
DM87S191N	24	2048x8 PROM T.S. (82S191)	14.95

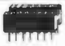
DATA ACQUISITION

Part No.	Pins	Function	Price
DC10		Mostek DC/DC Converter +5V to −9V	2.95
ADC0801	20	8-Bit A/D Converter (1/4LSB)	14.95
ADC0803	20	8-Bit A/D Converter (±1/2LSB)	4.95
ADC0804	20	8-Bit A/D Converter (1LSB)	3.49
ADC0808	28	8-Bit A/D Conv. w/8-Channel Analog	9.95
ADC0809	28	8-Bit A/D Converter (8-Ch. Multi.)	4.49
ADC0816	40	8-Bit A/D Conv. w/16-Channel Analog	14.95
ADC0817	40	8-Bit A/D Converter (16-Ch. Multi.)	9.49
DAC0806	16	8-Bit D/A Converter (0.78% Lin.)	1.95
DAC0807	16	8-Bit D/A Converter (MC1408-7)	1.49
DAC0808	16	8-Bit D/A Converter (MC1408-8)	2.25
DAC0830	20	8-Bit Up D/A Conv. (.05% Lin.)	5.95
DAC0831	20	8-Bit Up D/A Conv. (.10% Lin.)	4.49
DAC1000	24	10-Bit D/A Conv. Micro. Comp. (0.05%)	7.95
DAC1008	20	10-Bit D/A Conv. Micro. Comp. (0.20%)	6.95
DAC1020	16	10-Bit D/A Conv. (0.05% Lin.)	7.95
DAC1022	16	10-Bit D/A Conv. (0.20% Lin.)	5.95
DAC1222	18	12-Bit D/A Conv. (0.20% Lin.)	6.95
DAC1230	20	12-Bit Up D/A Conv. (.05% Lin.)	14.95
DAC1231	20	12-Bit Up D/A Conv. (.10% Lin.)	13.95
AY-5-1013A	40	30K Baud UART (TR1602)	3.95



Low Profile (Tin) Sockets

Part No.	1-9	10-99	100-up
8 pin LP	.16	.14	.13
14 pin LP	.17	.15	.14
16 pin LP	.19	.17	.16
18 pin LP	.26	.24	.23
20 pin LP	.30	.27	.25
22 pin LP	.31	.28	.26
24 pin LP	.33	.30	.28
28 pin LP	.40	.37	.35
40 pin LP	.49	.46	.43



Soldertail (Gold) Standard

Part No.	1-9	10-99	100-up
8 pin SG	.39	.35	.29
14 pin SG	.49	.45	.39
16 pin SG	.55	.49	.45
18 pin SG	.65	.59	.51
20 pin SG	.75	.65	.59
22 pin SG	.79	.69	.65
24 pin SG	.79	.69	.66
28 pin SG	.95	.85	.75
36 pin SG	1.25	1.15	.99
40 pin SG	1.39	1.25	1.15

Wire Wrap Sockets (Gold) Level #3

Part No.	1-9	10-99	100-up
8 pin WW	.55	.49	.45
10 pin WW	.69	.65	.59
14 pin WW	.75	.69	.65
16 pin WW	.79	.72	.65
18 pin WW	.95	.85	.75
20 pin WW	1.19	1.09	.95
22 pin WW	1.29	1.19	1.05
24 pin WW	1.35	1.19	1.09
28 pin WW	1.69	1.55	1.39
36 pin WW	1.89	1.79	1.69
40 pin WW	2.29	1.95	1.79

Header Plugs (Gold)

Part No.	1-9	10-99	100-up
14 pin HP	.65	.59	.55
16 pin HP	.69	.65	.59
24 pin HP	1.15	.99	.89

Header Covers

Part No.	1-9	10-99	100-up
14 pin HC	.15	.13	.12
16 pin HC	.19	.17	.15
24 pin HC	.29	.25	.22

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DT1050 — Applications: Teaching aids, appliances, clocks, automotive, telecommunications, language translations, etc.

The DT1050 is a standard DIGITALKER kit encoded with 137 separate and useful words, 2 tones, and 5 different silence durations. The words and tones have been assigned discrete addresses, making it possible to output single words or words concatenated into phrases or even sentences. The "voice" output of the DT1050 is a highly intelligible male voice. Female and children's voices can be synthesized. The vocabulary is chosen so that it is applicable to many products and markets.

The DT1050 consists of a Speech Processor Chip, MM54104 (40-pin) and two (2) Speech ROMs MM52164SSR1 and MM52164SSR2 (24-pin) along with a Master Word list and a recommended schematic diagram on the application sheet.

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MM54104 Processor Chip .... $14.95 ea.

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INTERSIL

Part No.	Pins	Function	Price
7045IPI	28	CMOS Precision Timer	14.95
7045EV/Kit	28	Stopwatch Chip, XTL (Evaluation Kit)	19.95
7106CPL	40	3½ Digit A/D (LCD Drive)	10.49
FE0202D	40	4 Digit LCD Display for 7106 & 7116	14.95
FE0203D		3½ Digit LCD Display for 7106 & 7116	14.95
7106EV/Kit	40	IC, Circuit Board, Display (Evaluation Kit)	46.95
7107CPL	40	3½ Digit A/D (LED Drive)	10.95
7107EV/Kit	40	IC, Circuit Board, Display (Evaluation Kit)	46.95
7116CPL	40	3½ Digit A/D LCD Dis. HLD	10.95
7201IJS		Low Battery Volt. Indicator	2.25
7205IPG	24	CMOS LED Stopwatch/Timer	14.95
7205EV/Kit	24	Stopwatch Chip, XTL (Evaluation Kit)	16.95
7206CJPE	16	Tone Generator	4.95
7206CEV/Kit	16	Tone Generator Chip, XTL (Evaluation Kit)	7.95
7207AIPD	14	Oscillator Controller	5.95
7207AEV/Kit	14	Freq. Counter Chip, XTL (Evaluation Kit)	8.49
7215IPG	24	4 Func. CMOS Stopwatch CKT	16.95
7215EV/Kit	24	4 Func. Stopwatch Chip, XTL (Evaluation Kit)	19.49
7216AIJI	28	8 Digit Univ. Counter C.A.	31.49
7216DIPI	28	8 Digit Freq. Counter C.C.	21.49
7217IJI	28	4 Digit LED Up/Down Counter C.A.	10.95
7217AIPI	28	4 Digit LED Up/Down Counter C.C.	9.95
7224IPL	40	LCD 4½ Digit Up Counter DRI	10.95
7226AEV/Kit	40	5 Function Counter Chip, XTL (Evaluation Kit)	99.95

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74HC High Speed CMOS

Part No.	Pins	Price
74HC00	14	.59
74HC02	14	.59
74HC03	14	.89
74HC04	14	.59
74HCU04	14	.69
74HC08	14	.59
74HC10	14	.59
74HC11	14	.69
74HC14	14	.89
74HC20	14	.59
74HC27	14	.59
74HC30	14	.69
74HC32	14	.79
74HC42	16	1.09
74HC51	14	.89
74HC58	14	.89
74HC73	14	.79
74HC74	14	.79
74HC75	16	.99
74HC76	16	.79
74HC85	16	1.69
74HC86	14	.75
74HC107	14	.79
74HC109	16	.79
74HC112	16	.79
74HC123	16	2.29
74HC125	14	1.75
74HC132	14	1.29
74HC137	16	1.59
74HC138	16	1.19
74HC139	16	1.05
74HC147	16	1.29
74HC151	16	.99
74HC153	16	1.09
74HC154	24	2.65
74HC157	16	.99
74HC158	16	.99
74HC160	16	1.39
74HC161	16	1.39
74HC162	16	1.39
74HC163	16	1.39
74HC164	14	1.35
74HC165	16	2.15
74HC166	16	2.49
74HC173	16	1.29
74HC174	16	1.09
74HC175	16	1.09
74HC190	16	1.59
74HC191	16	1.59
74HC192	16	1.49
74HC193	16	1.49
74HC194	16	1.19
74HC195	16	1.19
74HC221	16	2.95
74HC237	16	1.49
74HC240	20	2.29
74HC241	20	2.29
74HC242	14	2.15
74HC243	14	2.15
74HC244	20	2.29
74HC245	20	2.59
74HC251	16	.99
74HC253	16	1.09
74HC257	16	.99
74HC259	16	1.69
74HC266	14	.89
74HC273	20	2.79
74HC280	14	4.59
74HC299	20	5.59
74HC366	16	2.59
74HC367	16	2.59
74HC373	20	2.69
74HC374	20	2.69
74HC390	16	1.59
74HC393	14	1.59
74HC533	20	2.69
74HC534	20	2.69
74HC595	16	3.19
74HC688	20	3.59
74HC4024	14	1.75
74HC4040	16	1.49
74HC4060	16	1.49
74HC4075	14	.59
74HC4078	14	.59
74HC4511	16	1.95
74HC4514	24	4.19
74HC4538	16	2.59
74HC4543	16	3.75

74HCU04 is unbuffered. All others are buffered.

74C—C/MOS

Part No.	Pins	Price
74C00	14	.29
74C02	14	.35
74C04	14	.35
74C08	14	.35
74C10	14	.35
74C14	14	.59
74C20	14	.35
74C30	14	.35
74C32	14	.39
74C42	16	1.19
74C48	16	1.79
74C73	14	.69
74C74	14	.59
74C85	16	1.39
74C86	14	.29
74C89	16	5.95
74C90	14	1.09
74C93	14	1.09
74C95	14	1.19
74C107	14	.79
74C151	16	2.19
74C154	24	3.25
74C157	16	1.75
74C160	16	1.19
74C161	16	1.19
74C162	16	1.19
74C163	16	1.19
74C164	14	1.29
74C165	16	1.29
74C173	16	.89
74C174	16	1.19
74C175	16	1.19
74C192	16	1.39
74C193	16	1.39
74C195	16	1.29
74C221	16	1.75
74C240	20	1.95
74C244	20	1.95
74C373	20	2.29
74C374	20	2.29
74C901	14	.59
74C902	14	.79
74C903	14	.59
74C906	14	.59
74C907	14	.89
74C911	28	8.95
74C912	28	8.95
74C915	18	1.19
74C917	28	8.95
74C922	18	4.49
74C923	20	4.95
74C925	16	5.95
74C926	18	5.95
80C95	16	.69
80C97	16	.69

LINEAR

Part No.	Pins	Price
TL071CP	8	.79
TL072CP	8	1.09
TL074CN	14	1.95
TL081CP	8	.59
TL082CP	8	1.19
TL084CN	14	1.95
LM109K		5.95
LM301CN	8	.39
LM302H		2.49
LM304H		1.95
LM305H		.99
LM307CN	8	.49
LM308CN	8	.69
LM309K		1.25
LM310CN	8	1.95
LM311CN	8	.59
LM312H		2.79
LM317T		1.19
LM317K		3.49
LM318CN	8	1.59
LM319N	14	1.49
LM320K-5		1.35
LM320K-12		1.35
LM320K-15		1.35
LM320K-24		1.35
LM320T-5		.85
LM320T-12		.85
LM320T-15		.85
LM320T-24		.85
LM322N	14	1.49
LM323K		4.95
LM324N	14	.59
LM329DZ		.65
LM331N	8	3.95
LM334Z		1.19
LM335Z		1.29
LM336Z		1.09
LM337MP		1.15
LM337T		1.89
LM338K		6.95
LM339N	14	.69
LM340K-5		1.35
LM340K-12		1.35
LM340K-15		1.35
LM340K-24		1.35
LM340T-5		.75
LM340T-12		.75
LM340T-15		.75
LM340T-24		.75
LF347N	14	1.49
LM348N	14	.89
LM350K		4.79
LF351N	8	.59
LF353N	8	.89
LF355N	8	1.09
LF356N	8	1.09
LM358N	8	.59
LM359N	14	1.79
LM370N	14	4.95
LM373N	14	4.95
LM377N	14	1.95
LM380CN	8	1.09
LM380N	14	.89
LM381N	14	1.79
LM382N	14	1.49
LM384N	14	1.95
LM386N-3	8	.89
LM387N	8	1.39
LM389N	18	1.19
LM391N-80	16	1.19
LM392N	8	.59
LM393N	8	.45
LF398N	8	3.95
LM399H		5.95
LF412CN	8	1.95
TL494CN	16	2.79
TL496CP	8	1.59
NE531V	8	1.79
NE544N	14	1.95
NE550A	14	1.95
NE555V	8	.35
XR-L555	8	.69
LM556N	14	.79
NE558N	16	1.59
NE564N	16	1.95
LM565N	14	.99
LM566CN	8	1.49
LM567V	8	.99
NE570N	16	2.95
NE571N	16	2.49
NE592N	14	1.19
LM703CN	8	1.49
LM710N	14	.69
LM711N	14	.79
LM723N	14	.49
LM733N	14	.89
LM739N	14	1.95
LM741CN	8	.39
LM747N	14	.69
LM748N	8	.59
UA760HC		9.95
LM1456V	8	1.95
LM1458CN	8	.59
LM1488N	14	.69
LM1489N	14	.69
LM1496N	14	.99
LM1605CK		9.95
LM1800N	16	2.49
LM1871N	18	2.95
LM1872N	18	3.25
LM1877N-9	14	2.95
LM1889N	18	1.95
LM1896N	14	1.59
LM2002T		1.95
ULN2003A	16	1.49
XR2206	16	3.95
XR2207	14	2.49
XR2208	16	1.79
XR2211	14	2.95
LM2877P		1.95
LM2878P		2.95
LM2901N	14	.79
LM2902N	14	.89
LM2907N	14	2.49
LM2917N	8	1.95
LM3900N	14	.59
LM3905CN	8	1.19
LM3909N	8	.89
LM3914N	18	2.39
LM3915N	18	2.39
LM3916N	18	2.39
RC4136N	14	1.25
RC4151NB	8	1.95
RC4195TK		5.95
LM4250CN	8	1.49
LM4500A	16	2.95
NE5532	8	1.69
NE5534	8	1.39
79M05AK		1.29
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LM13600N	16	1.19
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TMM2016-200	2048x8	(200ns)	4.15
TMM2016-150	2048x8	(150ns)	4.95
TMM2016-100	2048x8	(100ns)	6.15
HM6116-4	2048x8	(200ns)(cmos)	4.75
HM6116-3	2048x8	(150ns)(cmos)	4.95
HM6116LP-4	2048x8	(200ns)(cmos)(LP)	4.95
HM6116LP-3	2048x8	(150ns)(cmos)(LP)	5.95
HM6264P-15	8192x8	(150ns)(cmos)	24.95

LP=Low Power

DYNAMIC RAMS

4116-250	16384x1	(250ns)	8/6.95
4116-200	16384x1	(200ns)	8/8.95
4116-150	16384x1	(150ns)	8/10.95
4164-200	65536x1	(200ns)(5V)	9/39.95
4164-150	65536x1	(150ns)(5V)	9/44.95
TMS4164-15	65536x1	(150ns)(5V)	7.95

5V=Single 5 Volt Supply

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7410	.19	7492	.50
7411	.25	7493	.35
7414	.49	74121	.29
7416	.25	74123	.49
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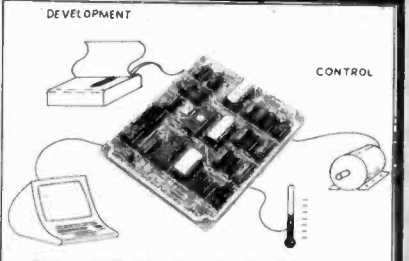

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Flat Panel Displays

(Continued from page 69)

side, which is in the rear of the display, contains rows and columns of electrodes that are sequentially scanned and energized. However, on the front side of the priming plate are a transparent dielectric layer and transparent ac sustaining electrodes, which are pulsed in synchronism with the dc column electrodes (Fig. 2).

When the gas between an energized row and column electrode pair fires on the dc side, some of the ionized gas moves through the corresponding hole in the priming plate and fires the gas on the ac side. Due to the surface charge that builds up in the dielectric layer, the gas on the ac side is sustained even after the gas on the dc side is extinguished. The advantage of the PlasmaGraphics approach over conventional ac gas discharge displays is that it uses much simpler drive circuits: Only 40 drivers and 132 panel-to-driver connections are required to address 120,000 individual pixels.

With rare exceptions, if a GPD works at all, every pixel will light

Nippon Electric Company (NEC) has an interesting fully populated gas discharge display that combines the long life and graphics capabilities of ac technology with the simple addressing of dc displays. Like the PlasmaGraphics hybrids, NEC's displays use a simple X/Y addressing scheme in which a row is energized and the columns sequentially scanned. Currently, World Products (Sonoma, CA), which is the exclusive U.S. distributor, offers NEC displays in a 256 × 512-pixel format that's ideal for a standard 25-line × 80-column computer display. However, within a few months, 640 × 200, 640 × 400, and 350 × 720 formats should also be available.

The Electroluminescent Alternative

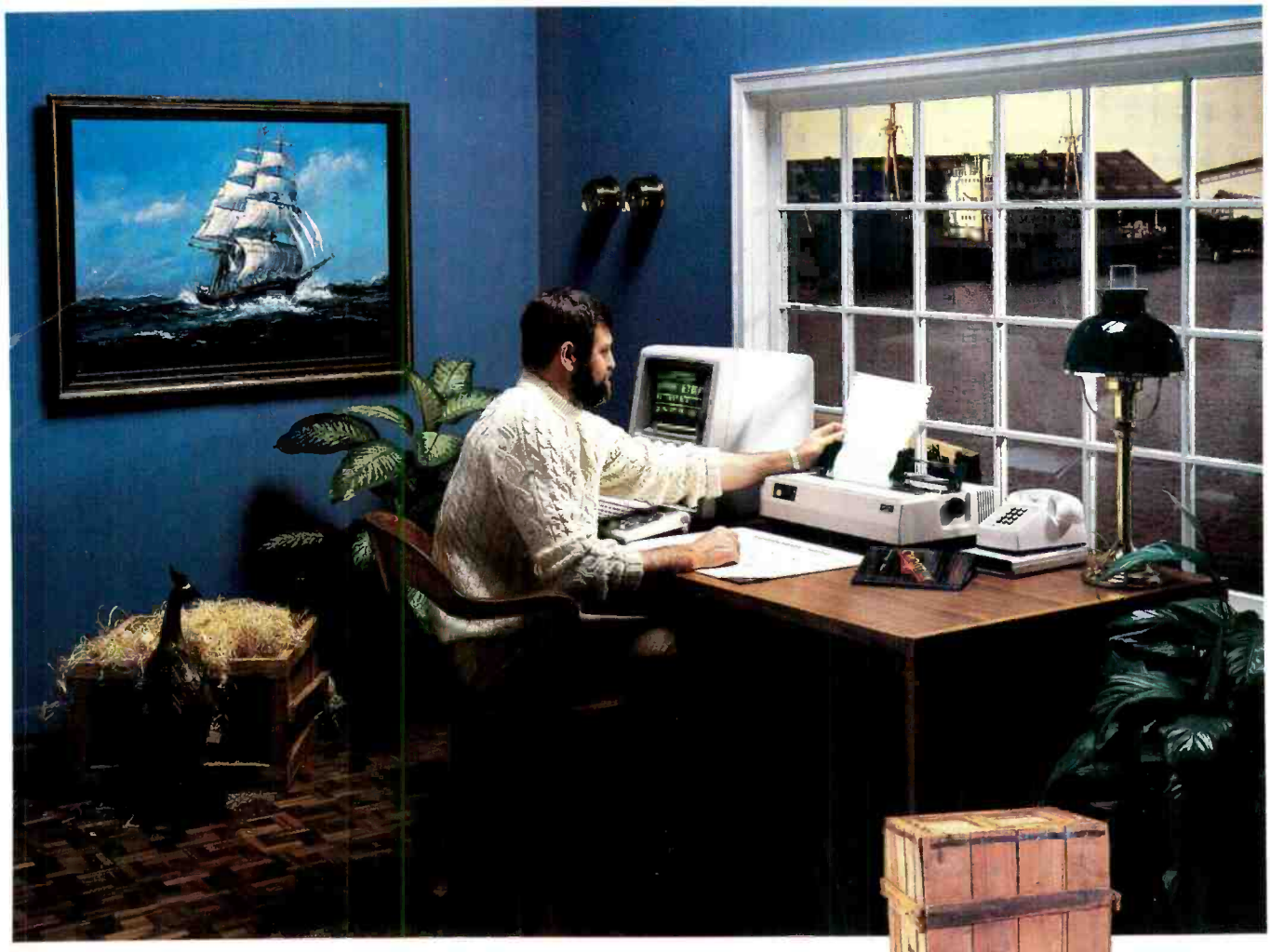
ELDs are based on the Destriau effect, named for its French discoverer, G. Destriau. In essence, light can be generated by suspending phosphor materials—usually zinc sulphide doped with copper or manganese—in an insulator and placing it in an intense ac field between a pair of capacitor-like electrodes. The voltage required to generate light depends on the material and its thickness, but can be as little as 20 V for very thin film phosphors. A typical monochrome ELD consists of the active phosphor layer sandwiched between a pair of insulating layers, which are in turn sandwiched between a pair of electrodes. As with GPDs, the front electrode is usually a transparent coating, and the rear electrode is usually etched metal.

The color of the light generated depends, of course, on the phosphor material used. Green and yellow are the most common. Amber is also produced. Multicolor displays can be fabricated by adding more sections of electrode-insulator active layers with phosphors that emit different colors. In fact, Planar Systems (Beaverton, OR) has already developed the necessary phosphor materials for a full-color ELD and is now developing a full-color monitor for the U.S. Army.

Planar Systems also offers in its Model EL 6648M the only large fully populated ELD that is readily available, although Sharp and Lohja, a Finnish company, have announced similar products. The EL 6648M generates 131,072 pixels, arranged in a 256 × 512 format, and can display 25 lines × 80 characters or high-resolution graphics in a 3.84″ × 7.68″ active area.

The choice between gas discharge and electroluminescence depends on the application. Both offer thin cross sections and displays with pixels in fixed locations that eliminate the geometric distortion common to CRTs. Also, GPDs and ELDs are always in focus. With rare exceptions, if a GPD works at all, every pixel in it will light. Because the light from an ELD depends on a very thin phosphor layer, the display's performance depends on the uniformity of the layer's thickness and the absence of pin holes or contaminates that result in dark spots. But while GPDs produce only one color, ELDs can be made to produce multiple colors. Moreover, ELDs tend to weigh less than GPDs.

GPDs currently "own" the market for emissive flat panels, but ELDs should capture a large share of it in just a few years. According to a study from Arthur D. Little, the compound growth rate through 1992 for ELDs will be 81%, while for GPDs it will be only 53%. Part of that growth will be due to ELD's multi-color capabilities, and part to a lowering of prices. Right now, ELD technology is in its infancy. Manufacturing capacity and know-how are much more limited than for GPDs. With time, however, both will expand and the price gap will close. Planar System's EL 6648M, for example, is expected to cost $775 in quantity late this year, but only about $200 by the end of 1987. Which of the methods will win out in the end is still uncertain, but one thing is clear. The future of display technology belongs to flat panels. ◇



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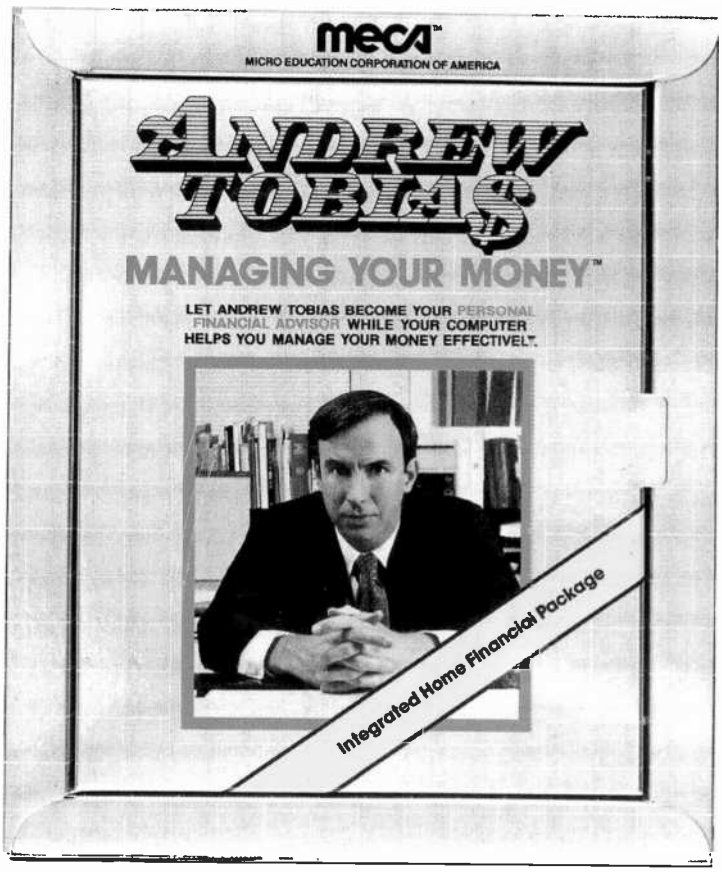

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