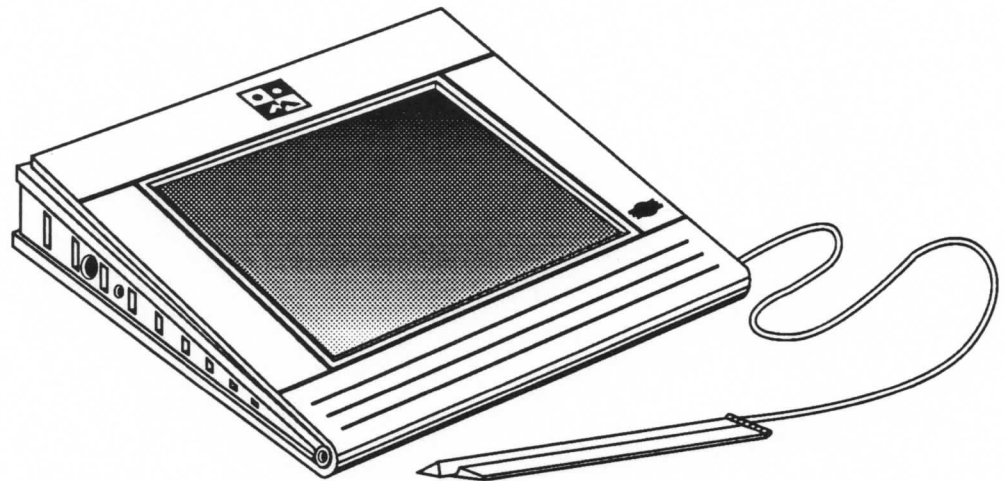




H E M O M E N T A

C O M P U T E R

Background Information



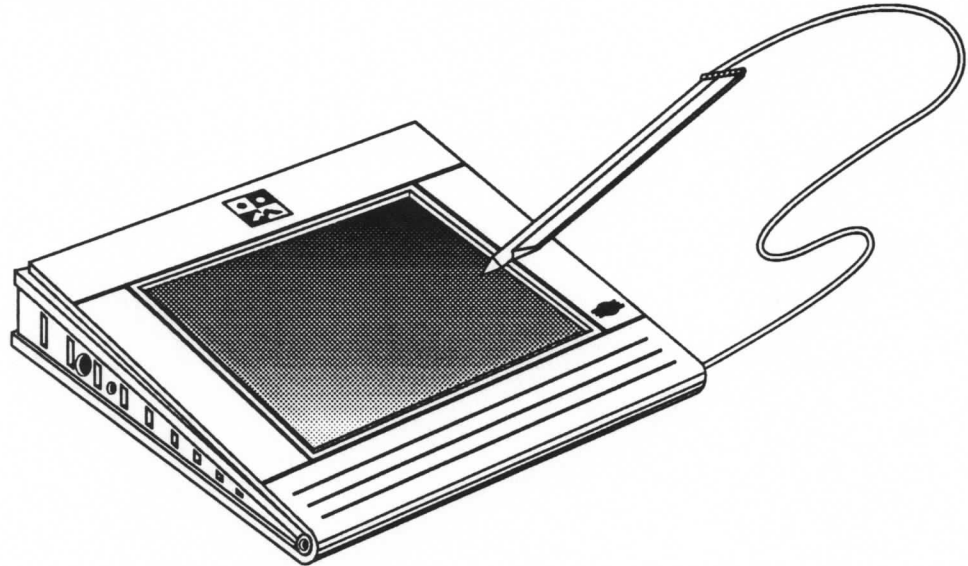
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THE MOMENTA

COMPUTER



Personal Computing Redefined

A group of people is meeting in a conference room. They page through documents, make notes on legal pads, consult their date books. All but one of them, that is. He has before him an object that looks vaguely like a three-ring notebook, except for its liquid crystal display and an attached device resembling a pen. It's a computer, but not like any seen before.

While his colleagues riffle through their documents in search of information, the computer user simply taps his "pen" on the display, and the information appears. While the others scribble on their pads, he jots his notes right on the computer screen. When the others reach for their appointment books, he calls up his own electronic engagement calendar. And when he needs some information from his database, he gets to it with a few motions of his pen. As the meeting ends and the others pause to gather up their paperwork, he picks up his "notebook" and exits.

This is no fantasy. The "notebook" is a Momenta Computer. You could say it redefines the *personal* in personal computing. It's what PCs were meant to

be but never were. The "Momenta" goes where you go and works the way you work. It is so convenient and adaptable, so companionable, that people will treat it almost as an extension of themselves.

Its pen—actually an electronic stylus—provides an alternative to the Momenta keyboard. It allows the computer to be used where a keyboard is unseemly or awkward: in meetings and interviews, while standing or with feet up. The Momenta consolidates a desk top full of office accessories—notepads, calendar, address book—and makes them accessible with a pen-stroke. It stores and organizes thousands of pages of documents and lets you keep vital information by your side wherever you go. It is also a communication tool. With its built-in fax and data modem, it provides a "mobile uplink" to distant colleagues and information nets.

Intelligent Compromises

The Momenta may be more personal than other computers, but it's no less a computer for all that. It's a bona-fide MS-DOS machine, capable of doing all the important things regular PCs do. It runs standard DOS and Windows application programs like Lotus 1-2-3 and WordPerfect. With its attachable keyboard and tilt-up screen, it can be used just like a traditional desktop or laptop/notebook system. And it can easily exchange information with standard computers and networks.

Its engine is a 386SX microprocessor, with extra muscle provided by a team of custom controllers. A high-capacity hard disk drive is built in. There are 4 megabytes of RAM and 1.25 of ROM, both expandable. Serial and parallel communication ports allow connection to PCs, peripheral devices and networks. The system will be offered in several configurations, differing mainly in the amount of storage and memory, at price points matched to a variety of users and market segments. A fully equipped system will sell for less than \$5,000.

It Is a Pentop

The Momenta Computer brings two worlds into one. On one hand, it qualifies as a desktop or laptop computer. On the other hand, it belongs to the emerging world of penpad computers (computers that can only be used with a pen). The fusion of these two categories can best be called "pentop" computing. The Momenta is the first pentop computer. It combines the benefits of a keyboard notebook computer (thousands of application software packages, high performance, large market) with all the advantages of a pen-based system.

Anytime, Anywhere

According to a recent report by Hewlett-Packard, 80 percent of all PCs get used less than an hour a day on average. That's less than 15 percent of a ten-hour workday. Most of the time, apparently, people aren't being served by their

computers. They're working away from their desks. They're in situations where even their laptop machines are inappropriate—meeting with coworkers, visiting customers. Or they're doing things for which other tools are better suited, tools like paper and pencil, address book and fax machine.

The Momenta greatly expands the role of computers, bringing processing power to a much wider range of endeavors. Its guiding principle is "anytime, anywhere." People can use it on a desk top, just as they would an ordinary PC, but that's only the beginning. Virtually no setting or situation is off-limits. With its electronic pen and graceful design, it's perfectly suited to meetings and other interpersonal encounters. Ditto for planes, trains and automobiles. It can be used while standing at a pay

phone, for that matter, or while reclining on a sofa. The Momenta has few of the physical or social constraints that limit conventional computers.

Mobility is only part of the story. The Momenta is also more versatile than any previous system. It's not just a computing machine, in the traditional sense of the word. Sure, it can run spreadsheets and do word processing, using pen-based programs or its attachable keyboard. But it is also an electronic pencil and paper, calendar, address book, fax machine, calculator and more. Though computers have offered "desk accessories" such as address books in the past, the nature of the machines make these tools inconvenient, if not altogether useless. With non-portable PCs, the tools are anchored to the desk top. With laptop and

GOING THE EXTRA MILE

People will rely on their Momenta Computers more often for more things than they do ordinary machines. And that means heavy demands will be made on the Momenta's battery system. Conventional power management technology, which requires laptop machines to use heavy batteries and to be recharged every few hours, won't do. Improved energy efficiency was one of the main goals of the Momenta hardware design, and the result is a technological milestone. In its full active state, the Momenta Computer draws about as much power as a keychain light. The benefit is smaller batteries and longer duty cycles. The Momenta uses AA (penlight size) batteries, which are about one-third the weight of the cells used by typical laptops, reducing the mass of both the computer and the back-up battery packs users may want to carry. And the Momenta runs significantly longer between recharges. In addition, users have the unique option of substituting ordinary alkaline batteries for the rechargeable cells. Alkalines can be purchased almost anywhere, providing a fall-back when recharging is inconvenient or impossible.

notebook systems, the problem is one of accessibility. Who wants to unfold a computer, power it up, wait for the software to load and type in the appropriate commands and information—just to take down a phone number or look up an address?

The Momenta gives users instant access to the tools they need. With a tap of the pen on the screen, the system is up and running, and users can jot down or retrieve information immediately.

The Pen as a Tool for Thought

It may be because we start using crayons and pencils even before we learn to walk, or it may have something to do with the structure of the human brain. Whatever the reason, there's no denying that pens have an intimacy and directness that traditional computer "input devices" can't match. We "think and draw

with our pens" in a way we could not very well with a keyboard and mouse. The electronic pen helps make the Momenta an aid to creativity and reflection. It's a way to catch a thought at the moment of inspiration, to collect and organize ideas—in effect, to converse with oneself. *The Momenta Computer is a tool for thought.*

A NEW KIND OF PEN

You use the Momenta's electronic pen much the way you'd use an ordinary pen, only you write directly on the computer screen, not paper. You can write and draw with all the freedom and spontaneity a pen allows. The Momenta can save the results in their original freehand form or modify them in a variety of ways. For instance, graphics software can transform a rough sketch into a precise diagram. Functions such as cut and paste can be used to edit handwritten notes.

Coating the screen is a thin film of tin oxide, across which a weak voltage gradient is distributed. When the pen touches the screen, the voltage is conducted back to the computer via the pen's "tether." The computer figures out the pen's position by measuring the voltage level, and directs the LCD to darken beneath the pen-tip. It's as if electronic ink were flowing from the pen onto the display.

But the Momenta pen is more than a writing and drawing instrument. It's also a control device, and a very powerful one at that. By pointing and tapping, using motions and written command symbols, you can turn on the machine, open and close files, edit documents and modify graphics. You

can do all the things you do with keyboard and mouse, but with some important differences. The hands aren't forced to move back and forth between an input device (keyboard) and a separate pointing device (mouse). Work is done on the screen, not at a distance.

This directness is critical for several reasons. For one, it frees the user from having to find the extra space to roll the mouse. Even more important is the absence of a cursor. The user need not hunt for a disappearing cursor (often dubbed "submarining"), a phenomenon that makes the use of the mouse with a liquid crystal display nearly impossible. On the Momenta, the cursor and the pointing device have merged into one. The pen-tip is right on top of the object being manipulated. Control is therefore immediate and precise.

Using the Command Compass to Move a Piece of Text

- Address book with automated sort functions.
- Appointment calendar, featuring daily, weekly and monthly views, recurring appointments, alarms and other automated functions.
- Calculators, both a simple four-function (1, 2, 3, 4) and a sophisticated financial calculator.
- Check Master. This allows pen-based creation of presentations and drawings.

1. **Select text to be moved. Compass icon appears in center.**

- Address book with automated sort functions.
- Appointment calendar, featuring daily, weekly and monthly views, recurring appointments, alarms and other automated functions.
- Calculators, both a simple four-function (1, 2, 3, 4) and a sophisticated financial calculator.
- Check Master. This allows pen-based creation of presentations and drawings.

2. **Touch the pen-tip to the icon, opening the compass.**

- Address book with automated sort functions.
- Appointment calendar, featuring daily, weekly and monthly views, recurring appointments, alarms and other automated functions.
- Calculators, both a simple four-function (1, 2, 3, 4) and a sophisticated financial calculator.
- Check Master. This allows pen-based creation of presentations and drawings.

3. **Stroke pen - tip to the right, invoking the move command, then continue tracing line to wherever you want the text moved.**

- Address book with automated sort functions.
- Appointment calendar, featuring daily, weekly and monthly views, recurring appointments, alarms and other automated functions.

4. **Lift the pen off the screen, causing text to be pasted into new spot.**

To alter a block of text or a graphic, for instance, you touch the pen to the object and simply stroke in a specified direction. Stroking to the right, for example, moves the object to a new location, while a stroke to the upper right deletes it. Different strokes are used to open and close documents, and to invoke

menus of other options. Whole series of operations, which used to require multiple keystrokes and mouse actions, can be accomplished with one smooth, continuous movement. This directional control is the result of an innovation Momenta calls the "command compass."

It is a much more direct and efficient way to operate. It does away with much of the tedium and artificiality of computing, so you can devote your undivided attention to the things that count: your work and the process of creation.

Consider the task of cutting and pasting text. With the Momenta's pen you simply select the text by circling it and insert it elsewhere by drawing a line to its destination. Two steps in all, second nature to anyone who's ever marked

up a document. The same operation takes six actions with a mouse: selecting the text with the mouse, pulling down an edit menu, choosing "cut," positioning the cursor to mark the insertion point, going back to the menu and then choosing "paste."

An additional advantage of the pen is that it frees the Momenta from the spatial and social restrictions of keyboard systems. It doesn't require a horizontal work surface, and it leaves a hand free to hold a phone or a book. The Momenta can go anywhere a pen can go. It is as at home in the board room as it is on the desk top.

Mightier than the Mouse

Of course there *is* one thing keyboards are very good at—entering large amounts of text quickly. That's where the Momenta's attachable keyboard comes in. By plugging in the keyboard and

A WORD ON RECOGNITION

A popular misconception holds that pentop computing is synonymous with handwriting recognition, understood as the ability to decipher connected cursive script. In reality, nothing that the Momenta does requires this kind of recognition—which is fortunate, since this capability remains well beyond the grasp of even the largest computers. Instead, the Momenta relies on other types of recognition, such as hand-printing recognition and shape recognition. The Momenta can identify a rough hand-drawn circle or square, for instance, and turn it into a perfect geometrical shape. It can understand and respond to handwritten command symbols, such as a carat (^) sign used to insert a piece of text. The computer can read hand-printed file names and key words used to tag documents. It will even convert neat, hand-printed notes into typescript.

Other pen-based functions require no symbol recognition whatsoever. Notes and drawings can be created and filed in longhand form, eliminating paper and making them easy to locate and retrieve. Freehand documents can be edited—words can be erased, blocks of writing moved, new lines inserted—all without a single character being recognized. And most command functions can be accomplished with a simple tap or stroke of the pen.

Ten Things You Can Do with the Pen

- 1** Take handwritten notes in meetings, quietly and unobtrusively. Leave the notes as is, or clean them up using pen-based editing software.
- 2** Store your notes on the Momenta's hard disk. Tag them with a name or some key words.
- 3** Use the key words to retrieve a document or group of documents.
- 4** Handprint some notes, have the Momenta recognize your writing and display it in any font you choose.
- 5** Receive a paperless fax, mark it up on screen, send it back—without touching paper.
- 6** Create a word-processed document. Insert, delete, move and reformat text.
- 7** Run a spreadsheet. Write formulas directly in cells instead of in an edit box.
- 8** Create high-quality graphics. The Momenta converts your freehand sketch into a precise diagram.
- 9** Create a business presentation, complete with charts, graphs, tables and captions.
- 10** Use pen-strokes as shorthand commands. Start up the system, open a document or delete a word—all with a flick of the pen.
- 11** Manage your calendar. Move appointments around, have recurring appointments scheduled automatically, set alarms.

tilting up the screen, you convert the Momenta into a conventional laptop machine. Actually a superior laptop, since by using the pen in place of a mouse you can take better advantage of graphical user interfaces. The migration of such interfaces to laptops has been hampered by the difficulty of using a mouse with LCD-based systems. The slow response rate of such displays causes the mouse-driven cursor to disappear, or “submarine,” when moved—an irritating and disorienting effect. This has led some laptop manufacturers to adopt faster “active matrix” screens, but these are several times as expensive as ordinary LCDs and consume more than three times the power. The Momenta sidesteps this dilemma, because the pen works directly on the screen and does not use a cursor for navigation. So even when the Momenta is used like a conventional computer, the pen still gives it a distinct advantage.

An Information Companion

The Momenta stores and organizes a diverse array of personal and work-related information: notes, memos, charts, schedules, to-do lists, spreadsheets, directories, expense reports. No longer are they scattered among various pieces of paper and notebooks, stashed away in a file drawer or a desktop computer’s hard disk. They’re by your side, available when you need them. You’re better organized, and better informed. You can keep track of where you’ve been and where you’re going. The Momenta is a window on the past and the future—it serves as a dynamic record of past meetings, appointments and work completed, and as a planning tool, with its automated calendars, to-do lists and reminders.

Staying Plugged In: the Momenta Computer as Communication Link

Travel is essential to modern business life, but it comes at a significant cost. When people go on the road, they lose touch with their organizations. They’re forced to operate outside of their usual decision support apparatus: colleagues, computer networks and information resources. That means winging it, or begging off (“Sorry, I’ll have to get back to you on that.”). Meanwhile, back at the office, the traveler is left out of the loop, unable to participate in key decisions. Or the decisions are postponed pending his return. Projects get put on hold. Deadlines slip. Productivity suffers.

The Momenta solves the problem in two ways. It puts a battery of decision-support tools at the user’s fingertips, and it acts as a communication portal, providing nearly continuous access to distant colleagues and networks. With the built-in fax and modem, you can send and receive facsimiles and call into remote

databases, computer nets or electronic mail systems simply by plugging into a telephone wall jack. You can prepare a fax, place it in a computerized "out box" and have it sent automatically the next time you connect to a phone line. When no wall jack is available, the Momenta can go wireless by hooking up to a cellular phone, enabling faxes and e-mail to be sent and received anywhere. Future versions of the Momenta will be designed to take advantage of the new wireless networks anticipated in the next few years.

BRIDGING TWO WORLDS

For most of us, work is divided between two very different media. On the one side are hand-written, paper documents. That's where ideas are first captured, where concepts are roughed out and transactions noted. On the other side are computers, where tasks are automated and work is formalized.

Two worlds, separate and incompatible. Until now. The Momenta is a single workspace where handwriting and computation converge. It is a tool for spontaneous, freehand improvisation and for no-nonsense information processing. The two not only take place side-by-side on the same platform, simplifying life and eliminating a lot of clutter, but they are synergistic. The computer transforms the age-old activity of longhand, making it possible to edit, outline, store and retrieve hand-written information in new, more efficient ways (no handwriting recognition needed). And the pen is a faster, more powerful means of controlling traditional computer operations.

Faxing with the Momenta can be paperless if you want it to be. You can send a fax to another Momenta or receive one without ever touching paper. Or, you can send a fax directly to a fax machine. In fact, the quality of faxes sent by the Momenta is superior to conventional faxes and approaches that of a laser printer. That's because the image is electronic from start to finish and never passes through a low-resolution scanning device such as those used by fax machines.

The Momenta's fax capability has an additional benefit: it lets facsimile machines serve as printers and scanners. For example, if you need to print out a document but no printer is available, you can plug the Momenta into a phone jack, dial up a nearby fax machine and have *it* print out the hard copy (at near laser quality). Or you can reverse the process, feeding hard copy into the fax machine and sending it to the Momenta. Documents can be scanned in and filed on the hard disk. A drawing or photograph can be scanned in and re-touched with the Momenta's pen.

Users and Market

The target buyer for the Momenta Computer is a person who works with information, who is mobile (or wants to be) and who deals with other people. "Working with information" means actively analyzing or managing it; workers who simply collect or enter information may be better served by traditional data terminals or simple pen-based "electronic clipboards." "Mobile" is used here in the broadest sense and does not necessarily imply travel. Anyone whose work involves leaving the desk—to attend office meetings, for example—can benefit from the Momenta. "Dealing with people" refers to any collaborative or managerial enterprise, where the Momenta's social appropriateness sets it apart from other portable computers.

The quintessential user is the business manager or executive, whose job typically revolves around the management of people and information in a variety of locations and settings. Of course, many other professions and fields also fit the profile. The Momenta will be used by consultants, accountants, financial analysts, journalists, students, doctors, lawyers, salespeople, graphic designers, educators and administrators, to name a few.

Most early adopters of the Momenta will already own conventional computers. They'll buy the Momenta as a kind of mobile companion to their deskbound PC, though with time they may come to regard the Momenta machine as their primary computer and relegate their desktop systems to a supporting role. Others will purchase the Momenta as their one and only computer.

The Momenta will capture portions of the existing desktop and laptop computer markets, as well as a slice of the market for electronic organizers (the hand-held devices known as personal information managers, or PIMs). Additional long-term sales will come from people formerly excluded from the ranks of computer owners—people who can't or won't use keyboards, for instance.

The overall business opportunity is substantial. Estimates of the exact market size vary, but analysts are agreed that pen-based systems will claim a significant and growing share of the portable computer market, which is itself the fastest-growing segment of the PC business. International Data Corp. (IDC) predicts that 28,000 pen-based systems will be sold in the U.S. this year and that annual sales will reach 840,000 units by 1995. *The Lempeis Report on Personal Computing* forecasts 1991 sales of 45,000 pen-based units, growing to 1.25 million annually by 1995, while Infocorp puts the 1995 market at 2 million

units. The total US market for battery-operated notebook and laptop computers is estimated at 1.2 million units in 1991 and 2.3 million units in 1995.

Software

The Momenta Computer runs two basic classes of software: 1) programs written especially for the machine and optimized for pen-based operation, and 2) native DOS programs, including MS-DOS and Windows applications. This latter category will also include Microsoft's Pen Windows graphical environment (itself an extension of DOS and Windows) when it becomes available.

It's as though the computer contained two machines side-by-side. One is a standard desktop DOS system, the other a breakthrough portable computer that can operate exclusively with a pen. In other words, users *can* have their cake and eat it, too. They can continue to capitalize on their DOS software *and* can take full advantage of the pen. They are the fortunate users of the very first *pentop* computer.

The Momenta Computer as MS-DOS Machine

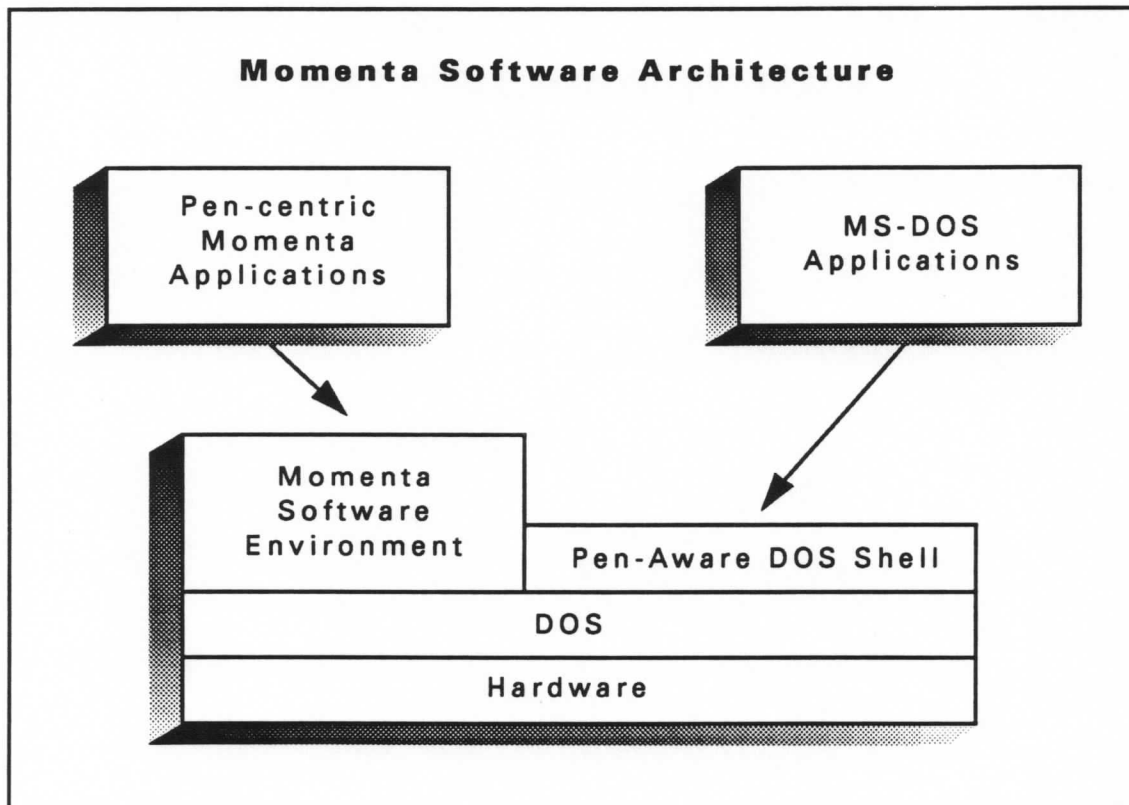
DOS-based applications run on the Momenta as they would on any PC-compatible system. Their functionality, their look and feel, is unchanged. Application programs run "off the shelf," without modification. Users can choose from a galaxy of existing software and preserve their considerable investments in MS-DOS and Windows products. That's because the Momenta's underlying operating system, managing disk resources and performing the customary "traffic cop" functions, is DOS. The latest version of DOS (version 5) is built into the system ROM. Unlike garden-variety PC-compatibles, however, the Momenta Computer can run MS-DOS in either a keyboard or a special pen-only mode. The computer switches automatically into keyboard mode when the keyboard is plugged in and back into pen mode when it's detached.

In the DOS keyboard mode, the machine resembles a typical laptop or desktop PC. The screen swings up for easy viewing, the keyboard is connected for extensive text input and, where applicable, the pen or optional mouse acts as a pointing device. In pen mode, the pen serves in place of both mouse and keyboard. The pen can choose commands from menus in the fashion of a mouse and enter data by tapping a "soft keyboard" displayed on the screen. Above the soft keyboard, a screen image of the application is displayed.

Pen mode is implemented by a special layer of software built into the system that translates pen inputs into standard DOS commands. From the user's vantage, the application looks and behaves exactly as it would on a keyboard computer, but without the drawbacks—the spatial and social limitations—of keyboards. This pen-only mode of running DOS applications is suitable for tasks that don't require a lot of typing, tasks such as editing a document, running a spreadsheet or polishing up a presentation. For example, a lawyer could edit a long brief or multiple versions of a contract directly on the screen with the pen without having to first print it on paper.

Pen-Centric Applications and the Momenta Software Environment

Of course, there will also be a number of entirely new application programs designed to exploit the full potential of the Momenta Computer and its pen. Momenta has itself created some of these programs (described below), which are included with the system. Independent developers will provide the rest, with support from Momenta.



Two kinds of application program run on the Momenta Computer: 1) Pen-based programs written for Momenta's software environment 2) Standard DOS (and Windows) programs. MS-DOS programs can run in either a keyboard mode or a pen-only mode.

Unlike standard DOS applications, the new "pen-centric" programs do not run directly on top of the DOS foundation, but operate instead in a special software environment designed by Momenta. The Momenta Software Environment is designed expressly for pentop computing, and Momenta believes it will set the standard for the industry. It's based on the Smalltalk object-oriented programming language and provides a new user interface that is at once highly efficient and remarkably simple to operate.

From the user's perspective, the interface is a model of clarity. Many elements will be immediately familiar. Documents, for instance, behave in many ways like sheets of paper, which can be written on, overlapped, pasted together, discarded or filed. Various kinds of paper can be combined to create mixed-media documents. The user can enter some text on word processing paper, then pull a piece of spreadsheet paper from a "pad," position it within the text and create a table. A piece of graphical paper can be pulled from another pad and pasted in the document to create a drawing or graph. There are no separate windows to open and close, and no tedious "import and export" or "subscribe and publish" procedures are needed to mingle information from various application programs. Applications mix seamlessly, a long-sought goal of the computing industry.

Applications Included

The Momenta Computer will be sold with a number of essential programs included. These are all pen-optimized Momenta programs. That is, they are controlled completely by the pen and take advantage of the Momenta user interface. A partial list includes:

- Address book with automated sort functions.
- Spreadsheet.
- Appointment calendar, featuring daily, weekly and monthly views, recurring appointments, alarms and other automated functions.
- Presentation Maker. This allows pen-based creation of presentations and drawings.
- Personal journal for freehand notetaking. With editing functions such as delete, copy, paste and drag.
- Chart Maker. This enables pen-based creation of charts and graphs.
- Faxer. This allows users to send, receive and mark up faxes with a pen.
- Markup. Use the pen to write comments on existing faxes and documents.
- Memo. For pen-based word processing.

- On-line tutorial.
- Utilities (application installer, file transfer, password, etc.).
- Calculators, both a simple four-function (+, -, x, /) and a sophisticated financial calculator.
- Hand printing recognition trainer. Teaches system to recognize user's own hand printing.

Software Strategy and Development Environment

Beyond these core applications provided by Momenta, most pen-optimized applications will be written by independent software developers. Development projects are currently under way at a number of leading firms. Momenta is

supporting these efforts with training, technical assistance and a powerful new software development environment that the company believes is the best in the business.

The Momenta Application Development Environment, or MADE, is a computerized workbench and toolkit for the creation of application programs. It supplies all the tools needed to build the software, along with many ready-made building blocks that can be incorporated into programs. These prefab modules include text fonts, graphics functions, spell-checking, database management functions, and much more.

The development environment, like the Momenta operating environment, is object oriented. It's based on the Smalltalk programming language. Object-oriented programming is a technology that many

A BIT OF SMALLTALK HISTORY

The learning Research Group, led by Alan Kay, at the Xerox Palo Alto Research Center (XEROX PARC) designed Smalltalk in the early 1970's. The language was intended to be the prototype software component of the Dynabook. Smalltalk later provided the complete operating environment for the Xerox Alto computer. The Alto was the first workstation as we define it today: a small, high-performance computer with a large graphic screen, a network connection and a mouse. Byte devoted an entire issue to Smalltalk in August of 1981 and the reputation of the language as a well-designed object-oriented system grew.

In 1983, Xerox introduced Smalltalk-80 to become the generally available commercial version of Smalltalk. Digital Inc. of Los Angeles introduced a version of Smalltalk specifically for the IBM PC in 1985. Parc-Place Systems, a Xerox spinoff, also markets Smalltalk-80. These commercial versions of Smalltalk have made possible its use in viable production projects. And, with the mounting interest in object-oriented programming in recent years, Smalltalk has obtained a prominent place in the world of programming environments as one that dramatically increases programmer efficiency and consequently decreases programming time and expenditure.

experts see as the future of software development. It makes the development process more manageable and controllable. It can greatly enhance programmer productivity and shorten development cycles. It results in software that is more dependable and easier to upgrade and update. And it produces software components that can be reused in a variety of new contexts, enabling vendors to amortize their R&D costs over multiple products.

In essence, object-oriented programming takes a modular approach to software construction. Programs as a whole are assembled from various building blocks, called objects, that can be plugged together in myriad ways. Building blocks written for one program can be reused and recombined in other programs. They can be independently modified without changing the program as a whole, making it easier to debug and upgrade software. In addition, a property called dynamic binding allows one object-oriented program to call on objects from other programs. In this way, different applications can share properties and interact dynamically.

Overall, these object-oriented techniques and other features of the MADE environment will help developers create Momenta Computer application software swiftly and economically.

Hardware

System Description: The Momenta Computer has the dimensions of a three-ring notebook and weighs approximately six pounds. It is controlled by the movements of the electronic pen on the screen. The screen lies flat during normal pen-based operation, but can be tilted up when the attachable keyboard is used. Communication ports are concealed behind a drop panel on the back of the system.

A "tether" attaches the pen to the system and can be plugged into either side for right- or left-handed users. The tether encloses a wire by which the pen communicates with the computer. This provides the user with several benefits. Because it's usually attached to the system, the tethered pen is not easily misplaced. And because it's just a passive conductor of electrical signals, the tethered pen is not very expensive to replace if lost. Finally, the tethered pen permits high resolution capture of pen inputs and high digitizer sampling rates, which in turn enable superior character recognition and excellent image and hard copy quality.

Memory and Storage: A standard Momenta system has 4 megabytes of RAM, which can be expanded to 8 MB, and 1.25 megabytes of ROM, expandable to 5 MB. A quarter-megabyte of reprogrammable "flash" memory makes it easy to change basic system software if upgrades are needed. New program information

HUMAN FACTORS

Ergonomics take on special significance with a machine like the Momenta Computer. Intended for long hours of continuous use, the Momenta had to be made as comfortable and effortless to operate as possible. The inclined screen makes it easier to write on, like a drawing table, and the pen is crafted to minimize user fatigue. In fact, the Momenta's industrial design is optimized to provide a slope of just the right angle for extended use and comfort. The user interface, on the other hand, is designed for the easy execution of pen-based operations. In using the Momenta, commands are truly at the tip of the pen. The screen is readable in a range of light conditions. Its surface is coated to cut out glare, to mimic a pen-and-paper feel and to mute the annoying click of pen-tip on glass. Noise from the Momenta's hard disk drive has been hushed to the barest whisper.

can even be transmitted to the system over a phone line. The built-in 2-1/2-inch hard disk comes in options from 20 megabytes and up. Disks exceeding 100 MB are expected to become available within the next year.

Because of the integrated hard disk, users will need floppy disks infrequently. When it comes to loading in software or backing up data, users have several options. They can use a standard 3.5" external floppy drive. Or, they can connect the Momenta directly to a PC, to a stand-alone hard drive or tape drive, or they can tie into a network, either directly, through the Momenta's parallel port and network adaptor, or via a phone line by plugging into a wall jack.

Processing: The main processor is a 20 megahertz 386SX. Additional computing power is provided by four custom controllers. The controllers handle input/output, video processing, memory control, communications, capture of digitizer inputs and power management. They are sophisticated, highly integrated chips, and they are critical to the computer's unique capabilities. In fact, they contain as much circuitry as the 386 itself.

Miniaturization: The Momenta packs more functionality in less space than previous laptop computers, thanks to high chip integration and space-saving technologies such as surface mounting and multilayer circuit boards. Overall, its central system functions consume about two-thirds the circuit board space used in a typical 386SX laptop. Chip integration has the additional benefits of slashing power consumption and boosting reliability (because there are fewer chips to fail).

Fax Modem: The integrated fax works just like an everyday fax machine, transmitting and receiving at 9600 baud (bits per second). The modem operates at 2400 baud and meets the new MNP 5 and V.42 bis communications standards. These standards provide data compression, which speeds up communications and saves on long-distance transmission costs, and data correction, which prevents corruption of data from transmission errors.

For wireless fax and modem transmission, the computer can attach to popular portable and car phones via a cellular connection cable. The Momenta has built-in support for the new SPCL protocol, which provides data compression and correction for cellular phone transmissions.

Display: The Momenta's liquid crystal display screen measures 6 by 8 inches (10 inches diagonally). It provides VGA resolution for Windows and Momenta applications. The screen is superior in both viewability and responsiveness to previous LCDs. The Momenta's high-performance graphics controller speeds up display functions such as scrolling and drawing. And as far as lighting, the user can choose between a screen that does not rely on a backlight, thus saving battery power. Or, he can choose a backlit screen for better viewing in low light situations.

Digitizer: The Momenta's digitizer has been crafted for high resolution and low power usage. (The digitizer is the mechanism that captures pen inputs.) It has a resolution of 400 dots per inch resolution and a fast processing rate of over 200 points per second. These capabilities are necessary for the digitizer to accurately and quickly process input from the pen, and to produce crisp, high-quality printouts and faxes of handwritten or hand-drawn documents.

Communication Ports: Several communication ports are provided. The PS/2-compatible serial port allows attachment of keyboards or other input devices. The standard RS232 serial port can be used to connect the Momenta to other computers or to peripheral devices such as scanners and bar code readers. The parallel port provides a connection for printers, external hard disk drives, tape drives and network adapters. The parallel port has a faster data rate than comparable ports on many PCs, speeding up data exchange with peripherals and networks. A compact, easy-to-attach network adaptor manufactured by Xircom, Inc. connects the Momenta to standard computer networks such as Ethernet, Token Ring and Arcnet. An external SCSI adaptor is also available for connecting the Momenta to standard SCSI peripherals such as hard disks and tape drives. A standard RJ-11 connector—the kind used by telephone cords—enables the Momenta to be plugged into wall jacks and cellular phones for fax or data transmission. An RJ45 connector provides for European phone connection.

Speaker and Microphone: The Momenta has an integrated voice-quality speaker, and a built-in microphone. The microphone can be used to record conversations, for voice mail and for voice annotation of documents.

Power Management: Reduced power consumption is an imperative in all portable computer design, and nowhere more so than in the Momenta Computer, whose “anywhere, anytime” work ethic requires it to get the most out of its batteries. The computer is the most energy-efficient machine in its class. Several factors are responsible: The system’s circuits are highly integrated, reducing the number of chips, and fewer chips draw less power. A high percentage of components use CMOS and other low-power technologies. And the computer’s energy usage is regulated by a highly intelligent power management system that can activate and throttle back various parts of the machine as needed. The computer has been partitioned to permit this kind of independent control. For instance, the hard disk can be activated to fetch or store data, then switched into a standby or sleep mode until next needed. The computer as a whole will go into standby mode if idle for a certain interval, ready to awaken the instant the user touches the pen to the screen.

The combined result of these innovations is a computer that runs longer on a charge than previous systems. And when it’s time to refill the tanks, the Momenta’s fast charge mode fully recharges the batteries in an hour and a half. Users can perform a fast charge while continuing to work with their Momenta. Other computers can sustain only a slow charge rate—taking 10 hours or more to fully replenish the batteries—or, if they do offer fast charging, they can do it only when the machine is not being used.

The Momenta Computer uses rechargeable nickel-cadmium batteries. Alternatively, users may substitute ten non-rechargeable AA-size alkaline batteries when recharging is impossible or inconvenient. The system uses an additional, 9-volt battery to preserve RAM-resident data while the main battery pack is being changed.

Peripherals and Accessories

A variety of peripheral devices and accessories will be provided by Momenta or third-party suppliers.

Item	Included	Who Provides
Portable Keyboard	Yes	Momenta
File Transfer Cable: connects Momenta Computer to standard PCs	Yes	Momenta
RJ-11 cable: connects Momenta to modular phone jack	Yes	Momenta
Carrying Jacket	Basic model included, others optional	Momenta
Network Adaptor	Optional	XIRCOM
Compact Portable Printer	Optional	Numerous Third Parties
Portable SCSI Disk Drive: plugs into parallel port without need for SCSI adapter	Optional	Liberty Systems
SCSI Adaptor: For connecting Momenta to standard SCSI devices	Optional	Trantor Systems
AT Keyboard Adaptor: allows use of standard PC AT keyboard with Momenta	Optional	Genovation
Car Adaptor: plugs into cigarette lighter, allows Momenta Computer to operate or recharge from car's power supply	Optional	ZIRCO
Digital Camera: snap a picture, display or modify the image on the Momenta	Optional	Dycam
Numeric Keypad	Optional	Genovation