Shugart and several media manufacturers.
The mini floppy drive employs the same proprietary glass bonded ferrite and ceramic head technology and reliable performance as proven in the SA800.

No preventive maintenance is required on the unit, an important consideration for personal computing systems. It has the lowest power consumption of any floppy drive (15 W continuous duty, 7.5 W standby) with the important benefit of exceptionally low heat generation and thereby no requirement for a cooling fan in most customer applications. This allows ultraquiet operation which is ideal in office environments where word processing equipment would normally be installed. The drive is designed to minimize diskette damage through the use of a positive media interlock, preventing the door from closing without complete diskette insertion. The mini floppy drive will be equipped with a unique

State of the Art Disk Technology

The latest news from Silicon Valley, now confirmed from its source, is the Shugart Associates Minifloppy ("mini floppy" is a Shugart trademark) disk drive for small systems. Its significance is that the price and physical size of random access magnetic recording with removable media has taken another step in the right direction. This drive was specifically designed for use which:

- include word processing and text editing systems, mini and micro program storage, power typing systems, "intelligent" desk top calculators and the emerging microcomputer hobby market.

The parameters of this new design are basically similar to those of a conventional floppy, but reduced in size. The data error ratings include 1 error in 10**8 bits for "soft" (recoverable) errors, and 1 error in 10**11 bits for "hard" (nonrecoverable) errors. The data rate for the drive is 125 kilobits per second, which is about half a typical conventional floppy's data rate, but far superior to the best of tape cassette drives. Formatted into records of 256 bytes, the drive has a capacity 89,600 bytes. At this capacity, each track contains 10 such records. An alternate recording mode is formatting each track with 128 bytes, in which case the track capacity is 2304 bytes and total capacity is 80,640 bytes per drive. If the sophisticated user elects to supply his or her own controller design employing unformatted tracks, the raw capacity of each track is 3125 bytes or of 109,565 bytes per drive on line.

Shugart is an old line floppy disk manufacturer, one of the first in the field. The company has delivered more than 40,000 of the model SA800 conventional drive, prior to introducing this new "baby brother" for smaller applications.

The Shugart Mini floppy has a compact package measuring 3.25 inches high by 5.75 inches wide by 8.0 inches long (8.3 cm high by 14.6 cm wide by 20.3 cm long) and weighs three pounds (1.4 kg), yet provides 89,600 bytes. At 109.4 bytes, the drive is 10% smaller than the SA800 in dimensions and weight.

The information in this feature is based upon materials supplied by Shugart Associates.

Photo 1: New SA-400 mini floppy disk drive sitting vertically. Shown is belt mechanism which is driven by a DC motor mounted on the top of unit. The door, shown in the open position, cannot be accidentally closed on the media. The minidiskette must be fully seated and centered on the spindle before the door will close and lock, allowing the drive to operate.

Shugart Associates have trademarked the following terms: Mini floppy, Minidiskette, Ministreaker.

The new Shugart minidiskette is specifically designed for use with emerging microcomputer hobby market. The drive is a "baby brother" of the sophisticated user who supplies his or her own controller design employing unformatted tracks, the raw capacity of each track is 3125 bytes or of 109,565 bytes per drive on line.

The new Shugart minidiskette is the smallest floppy disk drive in the world, measuring 3.25 inches high by 5.75 inches wide by 8.0 inches long (8.3 cm high by 14.6 cm wide by 20.3 cm long) and weighs three pounds (1.4 kg), yet provides 89,600 bytes. At 109.4 bytes, it is exactly the same as its larger counterpart, the standard flexible disk, except the size is only 5.25 inches (13.3 cm) square. Mini diskette media comes soft or hard sectored and stores 109.4 K bytes of data (unformatted), or 3125 bytes per track. The media is available from Shugart and several independent media suppliers.

Photo 2: The new Shugart minidiskette is the smallest floppy disk drive in the world, measuring 3.25 inches high by 5.75 inches wide by 8.0 inches long (8.3 cm high by 14.6 cm wide by 20.3 cm long) and weighs three pounds (1.4 kg), yet provides 89,600 bytes. At 109.4 bytes, it is exactly the same as its larger counterpart, the standard flexible disk, except the size is only 5.25 inches (13.3 cm) square. Mini diskette media comes soft or hard sectored and stores 109.4 K bytes of data (unformatted), or 3125 bytes per track. The media is available from Shugart and several independent media suppliers.

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cost effective interface to allow upward expansion of the units within the system and future system enhancement with the large floppy drive. The drives also provide, as a standard feature, write protect circuitry to protect written diskette information.

Also being introduced along with the minifloppy drive and minidiskette media is the SA4400 ministreaker controller on a 7.0 by 11.0 inch (17.8 cm by 27.9 cm) printed circuit board which utilizes latest generation LSI circuitry to provide up to 241.8 kilobytes of online data storage. The controller board handles one, two or three minifloppy drives.

Using the IBM 3740 format with modified gap structure and a 128 byte buffer, the controller operates with an 8 bit byte bidirectional parallel I/O to a microcomputer bus. It also features direct track and sector addressing, asynchronous TTL host interface, seek overlap and a simplified command structure.

This minifloppy drive represents a most significant improvement in the peripherals available to the small systems user. Advanced amateurs can use this machine directly, purchasing the controller and one or more drives in quantities of one from Shugart. Based on the specifications, it should be possible to wire the controller directly to a PIA port on the typical microcomputer and proceed to build a disk operating system in software. In 4 to 6 months, we should see this drive advertised by retailers and manufacturers of kit or finished product computers. For purposes of information and comparison, we print table 1, supplied by Shugart, which gives a rundown of the cost and capacity figures of several media. (Note: the Philips cassette column is oriented towards traditional digital drive manufacturers in both price and capacity estimates; it does not include the lower cost, lower performance drives presently sold to amateurs.)

A small information processing system in a desk top package could easily use two of these drives, an ASCII keyboard, video display output, and 16 K to 32 K of memory as a standard product. Using the disk drive as a key component, such a system could easily run compilers for traditional or new computer languages providing a level of function previously unheard of. We won't venture to guess what the price of the package will be, but it should certainly be less than $3000 in the retail store and still retain profit margins for all concerned with its production and distribution. Time will tell at which price such a system will actually hit the market.

List price in quantity one for the minifloppy drive is $390. OEM quantity pricing brings the price down to about $250. Minidiskettes are priced at $45 for a single box of ten. This drops to about $35 in large OEM quantities. Ministreaker controllers sell for $490 in quantity one and for about $330 in larger quantities. Delivery is 60 days ARO. Shugart Associates, 435 Indio Way, Sunnyvale CA 94086. Phone: (408) 733-0100.

Table 1: Low cost storage products comparison.

<table>
<thead>
<tr>
<th></th>
<th>SA400 Minifloppy</th>
<th>SA800 Floppy</th>
<th>3M Mini Cartridge</th>
<th>Philips Cassette</th>
<th>3M Cartridge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unformatted capacity</td>
<td>110 KB</td>
<td>400/800 KB</td>
<td>100 KB</td>
<td>720 KB</td>
<td>2870 KB</td>
</tr>
<tr>
<td>Tracks</td>
<td>35</td>
<td>77</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Heads</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Transfer rate</td>
<td>125 Kbits/sec</td>
<td>250/500 Kbits/sec</td>
<td>2.5 Kbits/sec</td>
<td>24 Kbits/sec</td>
<td>48 Kbits/sec</td>
</tr>
<tr>
<td>Relative head/media velocity</td>
<td>80 in/sec max</td>
<td>120 in/sec max</td>
<td>30 in/sec</td>
<td>30 in/sec</td>
<td>30 in/sec</td>
</tr>
<tr>
<td>Recording density</td>
<td>2600 BPI max</td>
<td>3200/6000 BPI max</td>
<td>800 BPI</td>
<td>800 BPI</td>
<td>1600 BPI</td>
</tr>
<tr>
<td>Average access time</td>
<td>50 ms</td>
<td>40 ms</td>
<td>20 s</td>
<td>20 s</td>
<td>20 s</td>
</tr>
<tr>
<td>Typical drive size</td>
<td>3.25 x 5.75 x 8.0 in</td>
<td>5 x 5 x 6.5 in +5 x 12 in PCB</td>
<td>4 x 6 x 8 in</td>
<td>7 x 9 x 12 in</td>
<td></td>
</tr>
<tr>
<td>Typical weight</td>
<td>3 lbs</td>
<td>14 lbs</td>
<td>3.25 lbs</td>
<td>5 lbs</td>
<td>5 lbs</td>
</tr>
<tr>
<td>Typical power requirements</td>
<td>12 V, 5 V DC</td>
<td>24 V, 5 V, -15 V DC</td>
<td>+12V, +5 V, -12 V DC</td>
<td>+12V, -12 V DC</td>
<td>+12V, -12 V DC</td>
</tr>
<tr>
<td>Drive price (qty 1) including head electronics but not controller</td>
<td>$390</td>
<td>$600</td>
<td>$550</td>
<td>$750</td>
<td>$1000</td>
</tr>
<tr>
<td>Media size</td>
<td>5.25 in sq envelope</td>
<td>8 in sq envelope</td>
<td>2.4 x 3.2 x 0.4 in</td>
<td>4 x 2.5 x 0.4 in</td>
<td>4 x 6 x 0.67 in</td>
</tr>
<tr>
<td>Media price (qty 1)</td>
<td>$4.50</td>
<td>$6.50</td>
<td>$16</td>
<td>$8</td>
<td>$20</td>
</tr>
</tbody>
</table>

Notes: 1) Average access time = average seek time + average latency time.
2) Typical cassette drive characteristics assumed, including high speed search.

Low Priced Disk System for Altair/IMSAIs

The North Star Micro-Disk System is a complete, high performance floppy disk storage system for use with any Altair/IMSAI compatible computer. The introductory price of $599 includes everything needed to turn on the computer and start loading or saving programs and accessing online data files.

The disk unit is a compact version of the standard Shugart floppy. Drive capacity is approximately 100 K bytes per diskette. Rotation time is 200 ms. Track to track access is 40 ms. The size of the unit permits mounting of the drive inside your computer cabinet with a specified cutout. The power supply requirements (0.5 A at +5 V and 0.9 A at +12 V) permit utilization of your existing computer power supply.

What's New?

The North Star controller is a single $100 bus (Altair/IMSAI ...) printed circuit compatible card which can control up to three drives. A PROM contains much of the DOS software including power on startup. The controller operates with or without interrupts as a software option. The $599 introductory price covers the North Star controller (highest quality...
printed circuit card and components, with sockets for all integrated circuits, the Shugart minifloppy drive (model SA-400), disk to controller cabling and connectors, two diskettes (one preloaded with the DOS software), complete documentation, limited warranty, and shipping. Additional drives are $425 each. Diskettes are available for $4.50 each. A cabinet for mounting up to three drives, with optional power supply, is also available.

Delivery begins late December or January. Orders are now being accepted, either cash in advance or 25% deposit with balance payable COD (including COD charges). BankAmereicard accepted with signed order.

For further information write North Star Computers Inc, 2465 Fourth St, Berkeley CA 94710. Phone (415) 549-0858.

KIM Had Twins?

The latest additions to the KIM line have just been introduced by MOS Technology. These are the KIM-2, a 4 K programmable memory expansion board, and the KIM-3, an 8 K programmable memory expansion board. As with the original KIM module, both of these boards come from the factory completely assembled and tested. They feature high speed low power static memory integrated circuits, so the MOS Technology 6502 processor on KIM-1 can be used flat out at a 1 MHz clock rate. Each board has memory address decoding selection using on board DIP switches (lower right corner of each board in the photos). Thus KIM-2 can be located at any even 4 K boundary in memory address space, and KIM-3 can be located at any even 8 K boundary in memory address space. As with the rest of the KIM line, complete documentation is provided for the board, its installation checkout and operation. Schematics and theory of operation are also provided. Also available is a KIM-4 motherboard to allow expansion of KIM to up to 64 K (65,536) bytes of memory. The following chart summarizes the specifications of KIM-2 and KIM-3:

<table>
<thead>
<tr>
<th></th>
<th>KIM-2</th>
<th>KIM-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current required at +5 V (5% regulated) or 8-10 V unregulated</td>
<td>1.5 A</td>
<td>3.0 A</td>
</tr>
<tr>
<td>Memory size (8 bit bytes)</td>
<td>4096</td>
<td>8192</td>
</tr>
<tr>
<td>Price (1-99)</td>
<td>$179</td>
<td>$298</td>
</tr>
<tr>
<td>Shipping and handling charges (United States and Canada)</td>
<td>$3</td>
<td>$3</td>
</tr>
<tr>
<td>International</td>
<td>$15</td>
<td>$16</td>
</tr>
</tbody>
</table>

KIM-2 and KIM-3

Physical Dimensions: 10 by 6 inches (25.4 by 16.5 cm) exclusive of connector tabs and removal tabs. Connector: single 44 connection male edge connector. Mating female connector is Vector R644. Connector tabs are centered on 10 inch side of board.

Warranty: 50 days parts and labor.

Memory circuits: 21L02 type memories. 450 ns access time. Suitable for systems using 1 MHz, 2 phase clocks.

Availability: 30 days ARO or better.

MOS Technology is located at 950 Rittenhouse Rd, Norristown PA 19401.

Attention Educators:
Take a Look at the Texas Instruments Microprocessor Learning System

Three preassembled, add on modules to the Texas Instruments Microprogrammer Learning Module have just been introduced and are available now.

The self-contained units, controller, memory and input/output, complete the user-paced system for understanding microprocessors and provide a training ground for basic software and hardware development. The basic Microprogrammer Module, which is designed to illustrate the most fundamental level of microprocessor operation, was announced last January. The new modules allow users to progress in a logical sequence from micro to macro level programming to the operation of a fully automated digital system. Each module has its own instruction manual, battery, charger and interconnecting cables and connectors.

The system helps users learn microprocessor concepts and design techniques by providing an insight into the hardware requirements and limitations in designing microprocessor-based systems. Enough system hardware is provided for actual applications limited only by the 4 bit capabilities and the necessary interface circuitry to output devices.

Educators will find the learning modules to be unique tools that allow students to learn how stored program digital systems work through hands-on experience. Students can develop their own macro instructions, write the microcode and observe the sequence of events associated with instruction execution using the microprogrammer.

For those not familiar with the most fundamental hardware/software relationships, Texas Instruments Learning Center has published a 390 page book, Software Design for Microprocessors. The book is an ideal companion
to the learning system, especially for non-technical professionals, and is designed to give the reader an understanding of the basics of microprocessor machine code and assembly language.

Requests for information should be sent to Texas Instruments Inc, Inquiry Answering Service, POB 5012, M/S 308 (Attn: MP Modules), Dallas TX 75222.

Use a High Resolution Text Display

by
David Jon Fylstra
POB 10051
Stanford CA 94305

Most homebrewed video displays these days have 32 to 40 characters per line, with perhaps 16 lines. An occasional lucky person has a high-bandwidth monitor, with up to 64 characters per line. But for many applications, such as text editing and word processing, this just isn't enough -- the industry standard of 80 characters per line would be far more suitable.

If you're considering a video display, take a serious look at a new line of components introduced by Matrox Electronic Systems of Canada. The video RAM (VRAM) is a small module which stores all of the screen characters in its internal random access memory, and generates an EIA standard 75 ohm output, complete with horizontal and vertical sync signals, which can be connected directly to your video monitor. While the Matrox VRAM modules are available in a variety of formats (8 line X 16 characters, 16 X 32, 16 X 64, and 32 X 64), of particular interest is the MTX-2480, which generates the standard 24 line by 80 character format in full upper and lower case ASCII. This 6.5 X 6 inch (16.51 X 15.24 cm) module can be tied directly to the address and data bus of any microprocessor, and requires a mere single +5 V, 1 A power supply. Especially appealing is the organization of the address and data bus: in the 12 bit address, 5 bits indicate the line to be accessed, and 7 bits select the character, making it simple to generate a carriage return and line feed sequence when filling the screen -- just zero the 7 bit character counter in your program, and bump the 5 bit line counter up 1 bit. The 9 bit data bus is divided into a 7 bit field to select the ASCII character, and a 2 bit control field which allows any individual character on the screen to be black on white, white on black, blinking, or half intensity. While any character can be accessed directly at any time (access time < 650 ns), two pins of this 28 pin module are provided to indicate horizontal and vertical blanking retrace intervals. Writing characters into the VRAM during these retrace intervals will result in a truly flicker free display.

The MYX-2480 is available from Matrox for $395 in unit quantity FOB Montreal (with generous quantity discounts), delivery time 4 to 8 weeks. The module is available in several character fonts, including the standard upper and lower case alphanumericics with Greek letters, general European, French, and Japanese kata-Kana. Matrox Electronic Systems may be reached at POB 56, Ahuntsic Sin, Montreal, Quebec H3L3N5 CANADA. (514) 481-6838.

If You Z-1, You Z Them All?

Cromemco has announced a new processor, available with stock to 60 days delivery, which is intended as a "plug in and turn on" method of obtaining a Z-80 computer system. The product looks very suspiciously like another well known computer which has been assembled with a custom screened front panel and Z-80 card. For $2495, your cold hard cash will purchase the following standard configuration from Cromemco:

- Z-80/4 microprocessor and mainframe with 22 card sockets, 28 A power supply.
- 8 K bytes of programmable memory.
- "ByteSaver" PROM card with room for 8 K 2704 or 2708 PROM and PROM burner.
- PROM monitor program.
- RS-232 serial IO interface.

Add your own RS-232 terminal to the system, plug in the power, and enjoy the fruits of the block move, block IO and block search instructions in your programming, to say nothing of the relative and direct addressing modes of Z-80 chip. Cromemco is located at 2432 Charleston Rd, Mountain View CA 94043.

A System Product with a Software Orientation

Picture this as your general purpose computer system, American Microsystems Inc has introduced the AMI 6800 microcomputer development center, a stand alone 6800 system with dual floppy disk, printer and video terminal options. While it can easily serve as a system for the development of industrial microcomputers, it can also be used as a general purpose data processing system in business, and as an intelligent communications terminal. By paying attention to such end user applications, AMI has done more than just reinvent the wheel of design aids for engineers in commercial and industrial shops. Local dealers would be well advised to consider this system as a product for possible sale to business and high end amateur customers. Contact AMI at 3800 Homestead Rd, Santa Clara CA 95051.