

Photo 1: New SA-400 minifloppy 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.

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

State of the Art Disk Technology

The latest news from Silicon Valley, now confirmed from its source, is the Shugart Associates Minifloppy ["minifloppy" 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 uses 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 18 records of

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 109,365 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 Minifloppy 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 the high precision and mechanical integrity of die cast chassis construction. It features a direct drive stepping motor actuator utilizing a spiral cam with a v-groove positive detent. AC power requirements have been totally eliminated through the use of a DC servo-controlled spindle drive subsystem. An all new 5.25 inch (13.3 cm) minidiskette (Model SA104 soft sectored and Model SA105 hard sectored) has also been developed for the minifloppy drive. The new media is based on today's proven flexible disk technology and will be available from

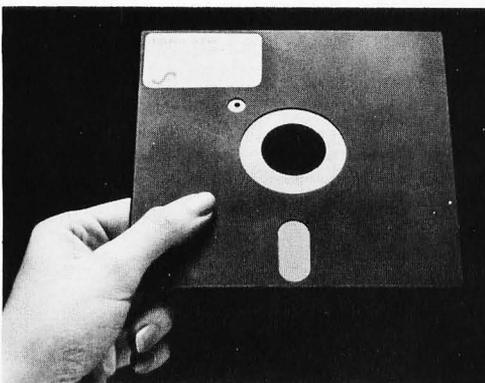


Photo 2: The new Shugart minidiskette is exactly the same as its larger counterpart, the standard flexible disk, except the size is only 5.25 inches (13.3 cm) square. Minidiskette media comes soft or hard sectored and stores 109.4 K bytes of data (unformatted), or 3125 bytes per track. The media is available from Shugart and several independent media suppliers.

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

SPECIFICATIONS SUMMARY

SA400 Minifloppy Disk Drive

Disk capacities	109.4 Kbytes (unformatted) 89.6 Kbytes (256 bytes/sector) 80.6 Kbytes (128 bytes/sector)
Track capacities	3125 bytes (unformatted) 2560 bytes (256 bytes/sector) 2304 bytes (128 bytes/sector)
Sector size	128/256 bytes
Tracks	35
Heads	1
Transfer rate	125 Kbits/sec
Seek time	40 ms track to track 463 ms average
Settling time	10 ms
Head load time	75 ms
Average latency time	100 ms
Media	Shugart SA104/105 Minidiskette
Maximum recording density	2581 BPI (103 Bpmm) 5152 FCI (206 fcpmm)
Recording method	FM
Track density	48 TPI (1.89 tpmm)
Rotational speed	300 RPM
Magnetic recording head	Glass bonded ferrite/ceramic

SA104/105 Minidiskette Media

Media	Industry standard flexible diskette Media oxide on 0.003 inch (0.0008 mm) Mylar
Index holes	1
Sector holes	0 (SA104) 16 (SA105)
Jacket	5.25 inch (133.4 mm) square
Disk	5.125 inch (130.2 mm) diameter
Center hole	1.125 inch (25.4 mm) diameter
Media life	3×10^6 passes/track

SA4400 Ministreaker Controller

Drive capability	1 to 3 SA400 Minifloppy units
Total capacity	One drive 80.6 Kilobytes Two drives 161.2 Kilobytes Three drives 241.8 Kilobytes
Format	IBM 3740 format with modified gap structure
Buffer	128 bytes
Data structure	8 bit byte, bidirectional parallel IO
Features	Direct track and sector addressing Asynchronous TTL host interface Seek overlap Simplified command structure
Controller power	5 V at 3 A nominal
Size	7 x 11 inches (177.8 x 279.4 mm)
IO connector	34 pin ribbon or twisted pair connector interface

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 IO 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

Photo 3: Top view of the new Shugart SA-400 minifloppy disk drive. Shown in upper right is the DC motor which features precision servo speed control and integral tachometer. The large black spiral cam in the center has a ball bearing V groove for positive detent and is connected to the stepping motor. Directly above the cam is the head load pad and proprietary glass bonded ferrite/ceramic read/write head. The read/write head is the same one used in the standard Shugart floppy drive.

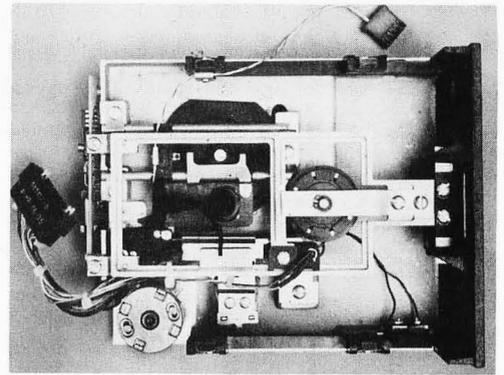


Table 1: Low cost storage products comparison.

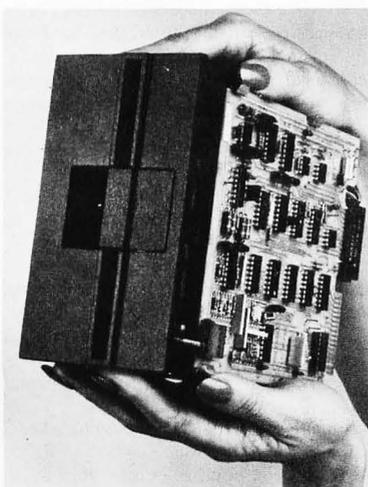
	SA400 Minifloppy	SA800 Floppy	3M Mini Cartridge	Philips Cassette	3M Cartridge
Unformatted capacity	110 KB	400/800 KB	100 KB	720 KB	2870 KB
Tracks	35	77	1	2	4
Heads	1	1	1	1	4
Transfer rate	125 Kbits/sec	250/500 Kbits/sec	2.5 Kbits/sec	24 Kbits/sec	48 Kbits/sec
Relative head/media velocity	80 in/sec max	120 in/sec max	30 in/sec	30 in/sec	30 in/sec
Recording density	2600 BPI max	3200/6400 BPI max	800 BPI	800 BPI	1600 BPI
Average access time	566 ms	286 ms	20 s	20 s	20 s
Typical drive size	3.25 x 5.75 x 8.0 in	4.62 x 8.55 x 14.25 in	5 x 5 x 5 in +5 x 12 in PCB	4 x 6 x 8 in	7 x 9 x 12 in
Typical weight	3 lbs	14 lbs	3.25 lbs	5 lbs	5 lbs
Typical power requirements	12 V, 5 V DC	24 V, 5 V, -15 V DC	+12, +5 V DC	+12V, +5 V, -12 V DC	+18, -18 V, +5 V DC
Drive price (qty 1) including head electronics but not controller	\$390	\$600	\$550	\$750	\$1000
Media size	5.25 in sq envelope	8 in sq envelope	2.4 x 3.2 x 0.4 in	4 x 2.5 x 0.4 in	4 x 6 x 0.67 in
Media price (qty 1)	\$4.50	\$6.50	\$16	\$8	\$20

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

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.■



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?

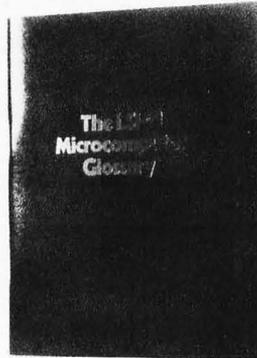
The North Star controller is a single S100 bus (Altair/IMSAI . . .) printed circuit compatible card which can control up to three drives. A PROM contains much of the DOS software including power on startup. The controller operates with or without interrupts as a software option.

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.

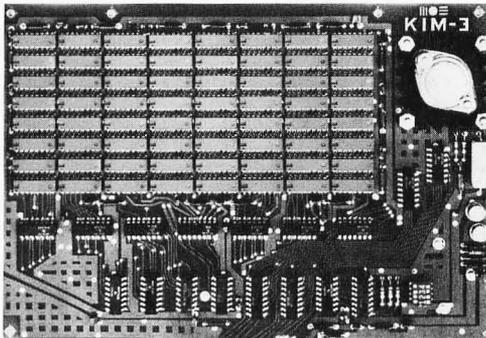
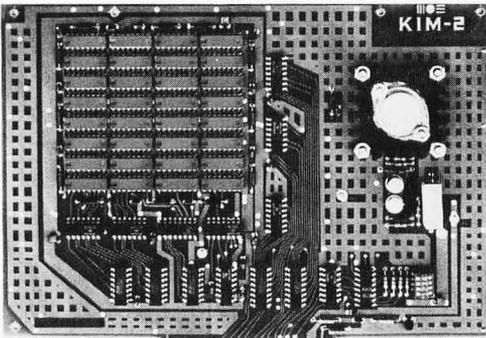
Delivery begins late December or January. Orders are now being accepted, either cash in advance or 25% deposit with balance payable COD (including COD charges). BankAmericard accepted with signed order.

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



DEC's LSI-11 Lexicon, Defined

Digital Equipment Corp, Components Group, One Iron Way, Marlborough MA 01752, has published a new pocket sized glossary of computer related terms. The booklet is entitled *The LSI-11 Microcomputer Glossary* and it contains listings with definitions for more than 200 microcomputer related terms covering the hardware and software aspects of systems. Typical terms in this booklet include "trap," "daisy chain," "interrupt vector," etc. The booklet is 44 pages in length and was written primarily to acquaint executives, engineers and sales people with microcomputer related terminology. ■



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:

	KIM-2	KIM-3
Current required at +5 V (5% regulated) or 8-10 V unregulated	1.5 A	3.0 A
Memory size (8 bit bytes)	4096 bytes	8192 bytes
Price (1-9)	\$179	\$298
Shipping and handling charges (United States and Canada)	\$ 3	\$ 3
International	\$ 15	\$ 15

KIM-2 and KIM-3

Physical Dimensions: 10 by 6½ inches (25.4 by 16.5 cm) exclusive of connector tabs and removal tabs.

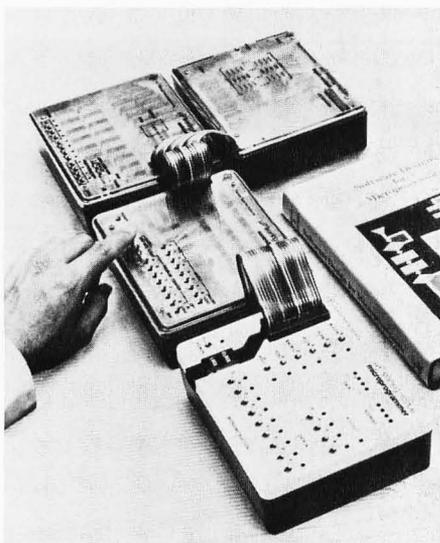
Connector: single 44 connection male edge connector. Mating female connector is Vector R644. Connector tabs are centered on 10 inch side of board.

Warranty: 90 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.

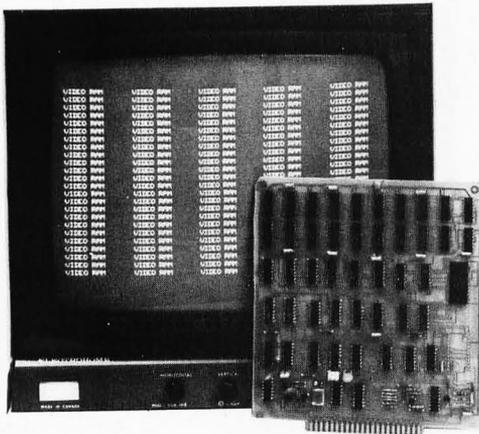
Educators will find the learning modules to be unique tools that allow students to learn how stored program digital systems work through hands-on experience. Students can develop their own macro instructions, write the microcode and observe the sequence of events associated with instruction execution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

For those not familiar with 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. ■

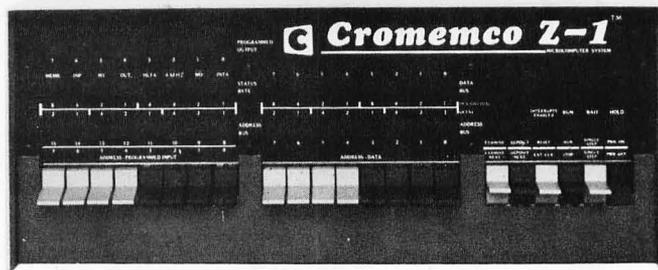
Use a High Resolution Text Display



by
David Jon Fylstra
POB 10051
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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 verti-



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.

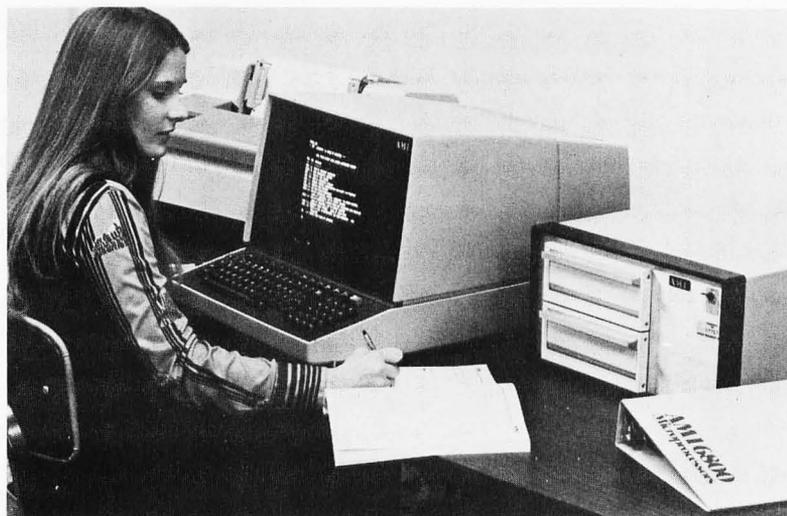
Add your own RS-232 terminal to the system, plug in the power, and enjoy the fruits of the block move, block IO and block search instructions in your programming, to say nothing of the relative and direct addressing modes of the Z-80 chip. Cromemco is located at 2432 Charleston Rd, Mountain View CA 94043.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

cal 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 alphanumerics with Greek letters, general European, French, and Japanese Kata-Kana. Matrox Electronic Systems may be reached at POB 56, Ahuntsic Stn, Montreal, Quebec H3L3N5 CANADA. (514) 481-6838. ■



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. ■