

## Visit to an OEM Supplier

# A Look at Shugart's New Fixed Disk Drive

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*Photo 1: One of the high speed conveyors at Shugart Associates' Sunnyvale CA plant. Metal arms swing out to capture plastic bins of parts. 600 to 800 floppy disk drives and 300 to 400 minifloppy drives are turned out every day at the plant.*

OEM can be a confusing term for people new to the personal computing field. It means "Original Equipment Manufacturer"—that is, a company which uses parts and equipment of *other* manufacturers in order to produce end user equipment for sale to the public.

Recently I had the opportunity to visit an OEM supplier whose name is well-known to the personal computing field: Shugart Associates. Shugart manufactures the floppy and minifloppy disk drives that go into equipment sold by North Star, Apple, PolyMorphics, Smoke Signal Broadcasting, Radio Shack, and many more. They also supply companies that manufacture large computer systems. All told, they claim to manufacture over three quarters of the floppy disk drives on the market, and two thirds of the minifloppies.

Upon entering their brand new 150,000 square foot facilities in Sunnyvale CA, I immediately noticed that the flow of production parts was controlled by an impressive array of high speed conveyor belts (see photo 1). Their workforce of over 700 people turns out 600 to 800 standard floppy drives and 300 to 400 minifloppy drives every day.

The most interesting feature of the tour, however, was getting a glimpse of the new Shugart SA4000 fixed disk drive—a unit that may have a major impact on the personal computer market a year or so from now. The SA4000 (see photos 2 and 3) is available in 14.5 and 29 megabyte (unformatted) capacities with an optional 144 K bytes of additional head-per-track storage. Winchester heads (named after IBM's "Winchester" disk technology) are used in the 35 pound (16 kg) unit, which is designed to fit in a 19 inch (48 cm) rack. But price is the most significant feature: the 14.5 megabyte

Photo 2: Prototype of the SA4000 fixed disk.



unit is \$2550, and the 29 megabyte unit is \$3500, both quantity one; prices for quantity 100 are \$1450 and \$2000, respectively.

The same voltage requirements are used for both the SA4000 drives and the Shugart standard size IBM compatible floppy drives, so the same power supply can be used for both types of drives in a system. In addition, the SA4600 intelligent controller (or equivalent) can be used to control up to four floppy disk drives and four SA4000 fixed disk drives with the same controller board. The new fixed disk drive has an interface similar to that of the standard Shugart SA800 and SA850 floppy drives, but it employs a higher transfer rate. The drive includes a data separator and encoder providing normalized NRZ read and write data.

Data on each disk surface is read by two read and write heads, each of which accesses 202 tracks. The drive is available in two basic configurations: one disk with four read

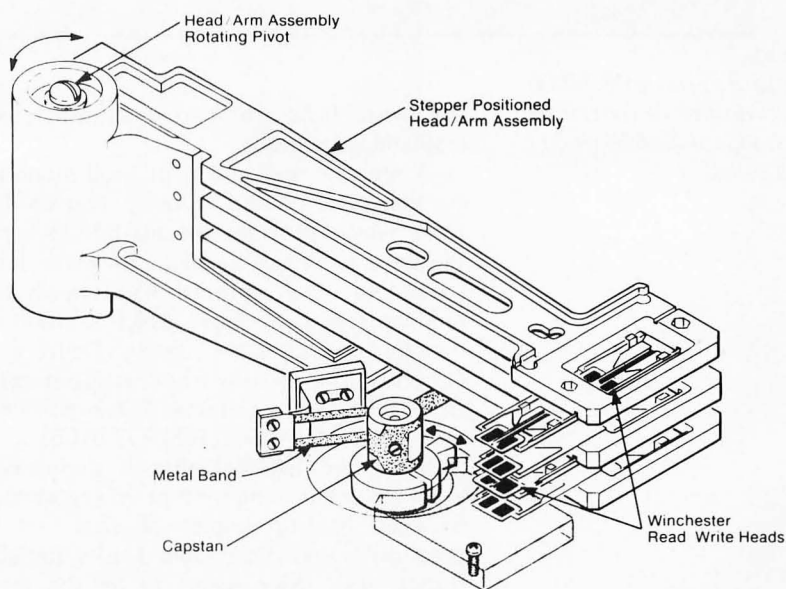
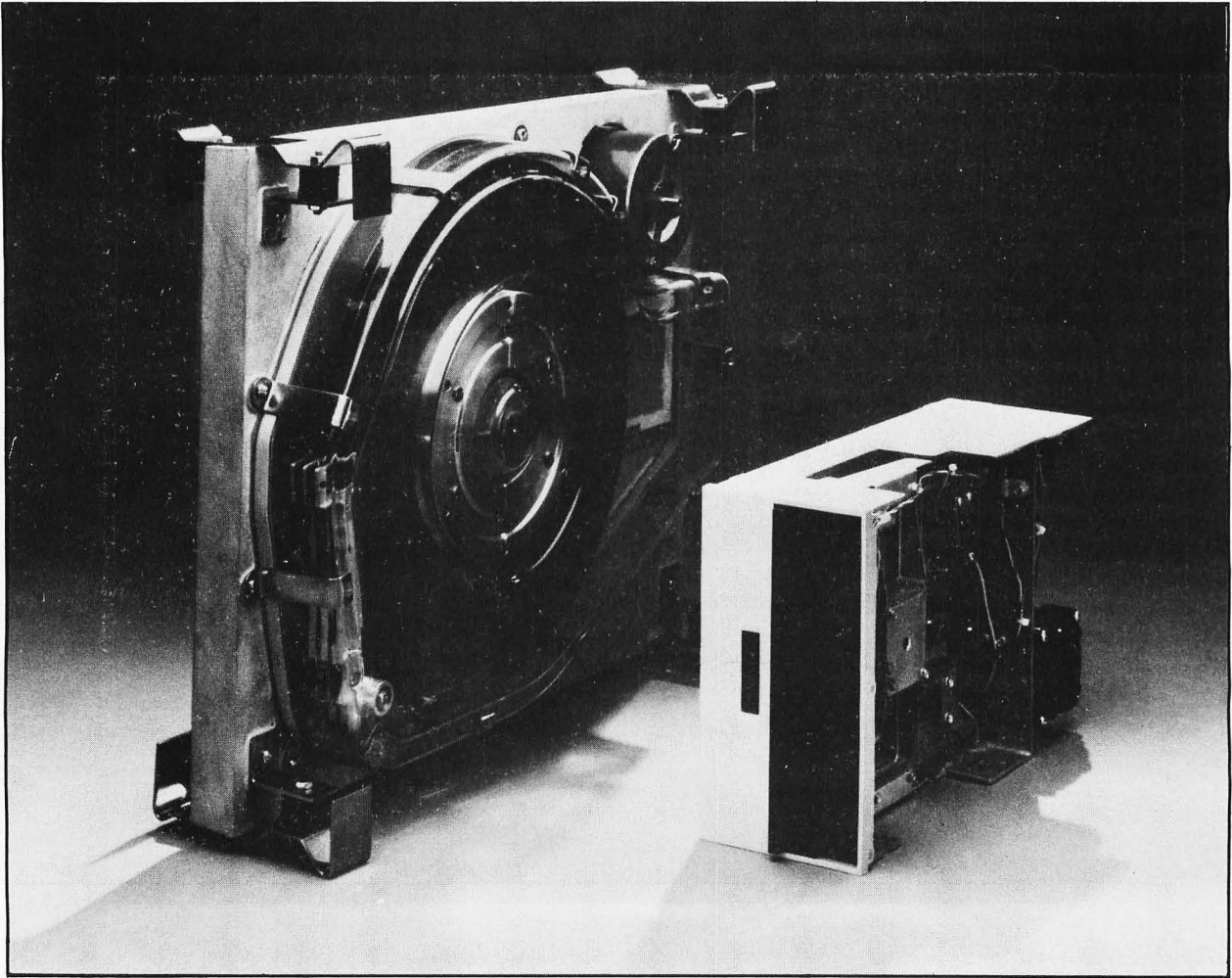


Figure 1: The Shugart SA4000 fixed disk head actuator assembly. A novel coiled-metal band driven by a stepper motor is used to position the head assembly. Graphics courtesy Shugart Associates.



*Photo 3: Shugart SA4000 fixed disk drive (left) next to standard SA800 floppy disk drive.*

and write heads, or two disks with eight read and write heads.

A separate read and write head mounted to the base casting reads a prerecorded track which provides the master clock for the drive as well as the clock for write clock generation. The optional fixed heads are mounted on an assembly which is mounted directly on the base casting. Delivery is currently four months from receipt of order from Shugart Associates, 415 Oakmead Pky, Sunnyvale CA 94086, (408) 733-0100.

Since the SA4000 disk is permanent, users will need some form of off line storage to keep back-up copies of vital files in practical systems: a double density full size floppy disk drive seems to be the most logical choice.

We should soon see the era of the 14.5 megabyte mass storage system *built into* a high end personal computer which sits on

top of a desk. The typical box might include:

- SA4000 disk main filing system
- SA800 removable media filing system (optional)
- 16 K bytes read only memory systems software
- 48 K bytes volatile program store
- Any third generation processor (9900, Z8000, 8086, 6809, etc)
- Video display (graphics plus full ASCII text capability)
- Keyboard
- Machine independent PASCAL systems software

Externally, this would look fairly conventional, but buried inside might be the SA4000 as a permanent on line nonvolatile memory resource. ■