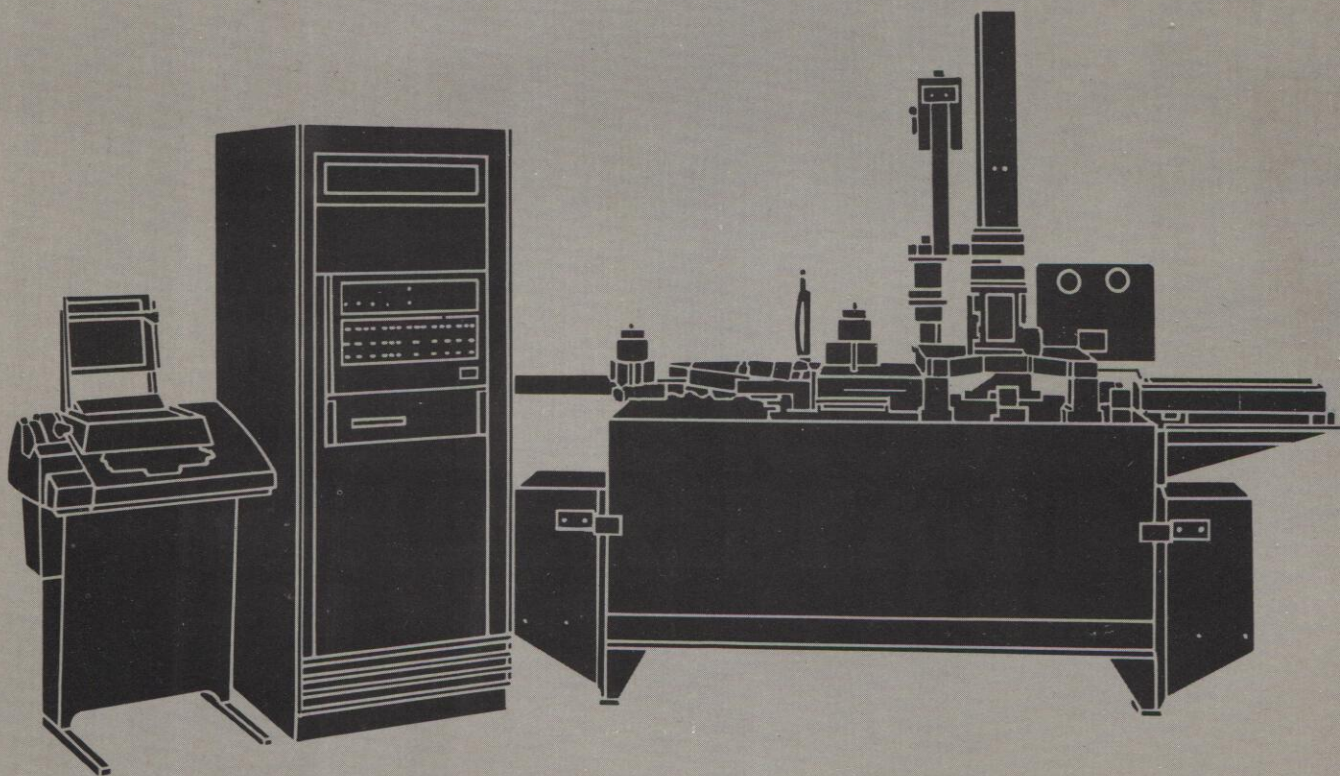


THE ELECTROMASK SERIES 1000 IMAGE REPEATER

The fastest, most precise step-and-repeat system available for producing photomask arrays on either photoresist or emulsion—the *only* field proven system positioned by laser beam, with stages floating on frictionless air bearings.



MAJOR FEATURES

Unique Hardware Design

- Exceptional Speed — Many times faster with an absolute accuracy greater than any mechanical system. Stage speeds up to 1 inch per second. 5 flashes per second on emulsion, 1 second per exposure on photoresist.
- No Deadheading—exposures made in both directions.
- Lasometric™ Precision—the ultimate in speed, precision and reliability. Laser beam gives a positional precision of ± 10 micro-inches with an absolute accuracy of less than ± 15 micro-inches. Minimum programmable resolution of 0.1 microns.
- Non Degradable Accuracy—Non-contact, laser interferometer system and frictionless, wear-free, air-bearing stages provide maximum control of stage speed and positioning and ensure a constant reliability. Non-degradable accuracy to 0.381 of a micron over full stage travel.
- Camera Options — One to four barrels, e-line, h-line or g-line with variations of ultra resolution 10X or 5X lenses able to resolve lines below one micron, with automatic lens focus to eliminate problems as a result of non-flat plates.

Versatile Software Capability

- Automatic exposure run for rapid selection of optimum exposure.
- Nine insert patterns from a single tape. Automatically goes to origin at each pass.
- Optional circular array pattern which reduces stepping time 15 to 20 percent. (See Figure 2.) Simple input requiring keyboard entry of die size and array size. Computer print-out of the number of rows and columns.

time 15 to 20 percent. (See Figure 2.) Simple input requiring keyboard entry of die size and array size. Computer print-out of the number of rows and columns.

- Facilitates complex photo compositions or placing more than one device type on the plate, even with different stepping centers or origin locations.

Exposure values for h-line cameras are set on the stepping tape thus reducing operator error.

Ability to repeat any given pass by switch control on front panel, allowing simple double exposure for any given pass or producing ROM patterns by running primary pattern first followed by the bit pattern.

- Repeats same stepping tape by simply entering "GO" on the input terminal.
- Ability to reverse sequence pattern insertion, particularly useful if making multiple copies of a device with a test pattern. Reversing the sequence of the insertion obviates the need of removing each reticle twice.
- Simple operation requiring the operator to follow printed instructions from the terminal that requests correction to bad operator input.
- Optional magnetic tape cassette can store 50 jobs, and will print-out job directly on command.
- English/Metric operation at operator command. Other software in development will give user alternative programs for high-volume production or research oriented shops.

GENERAL DESCRIPTION

The Electromask 1000 Image Repeater is the fastest, most precise step-and-repeat system available for producing photomask arrays on either emulsion or photoresist, because it is the *only* such system positioned by a laser beam with stages floating on frictionless vacuum air bearings. These features allow the Image Repeater to reproduce many times faster with an absolute accuracy greater than any mechanical system.

Speedy, More Efficient Design — No deadheading mode and stage speeds up to 1 inch per second provides maximum throughput. (See Figure 1.) Typical speeds of 5 flashes per second on emulsion and 1 second maximum on photoresist, thus producing a 3 inch photomaster on emulsion with an array of 200-mil in less than 1 minute and on photoresist in less than 8 minutes.

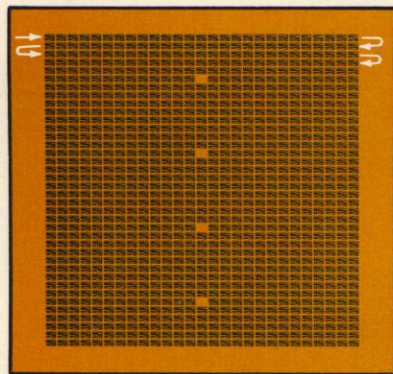


Figure 1

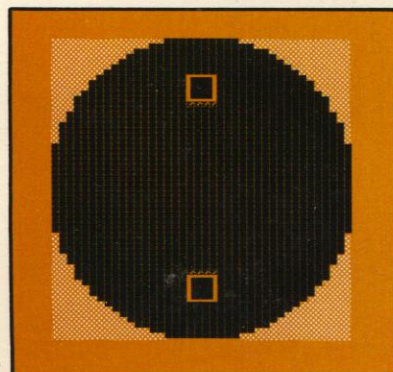


Figure 2

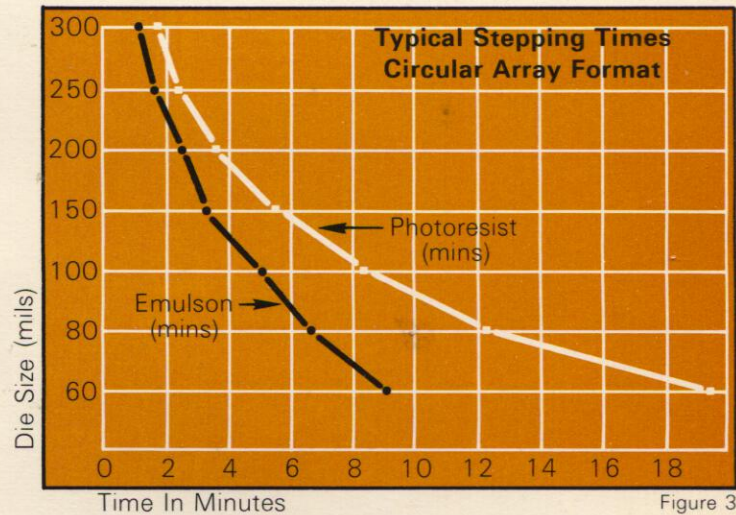


Figure 3

Figure 1 — No Deadheading Mode

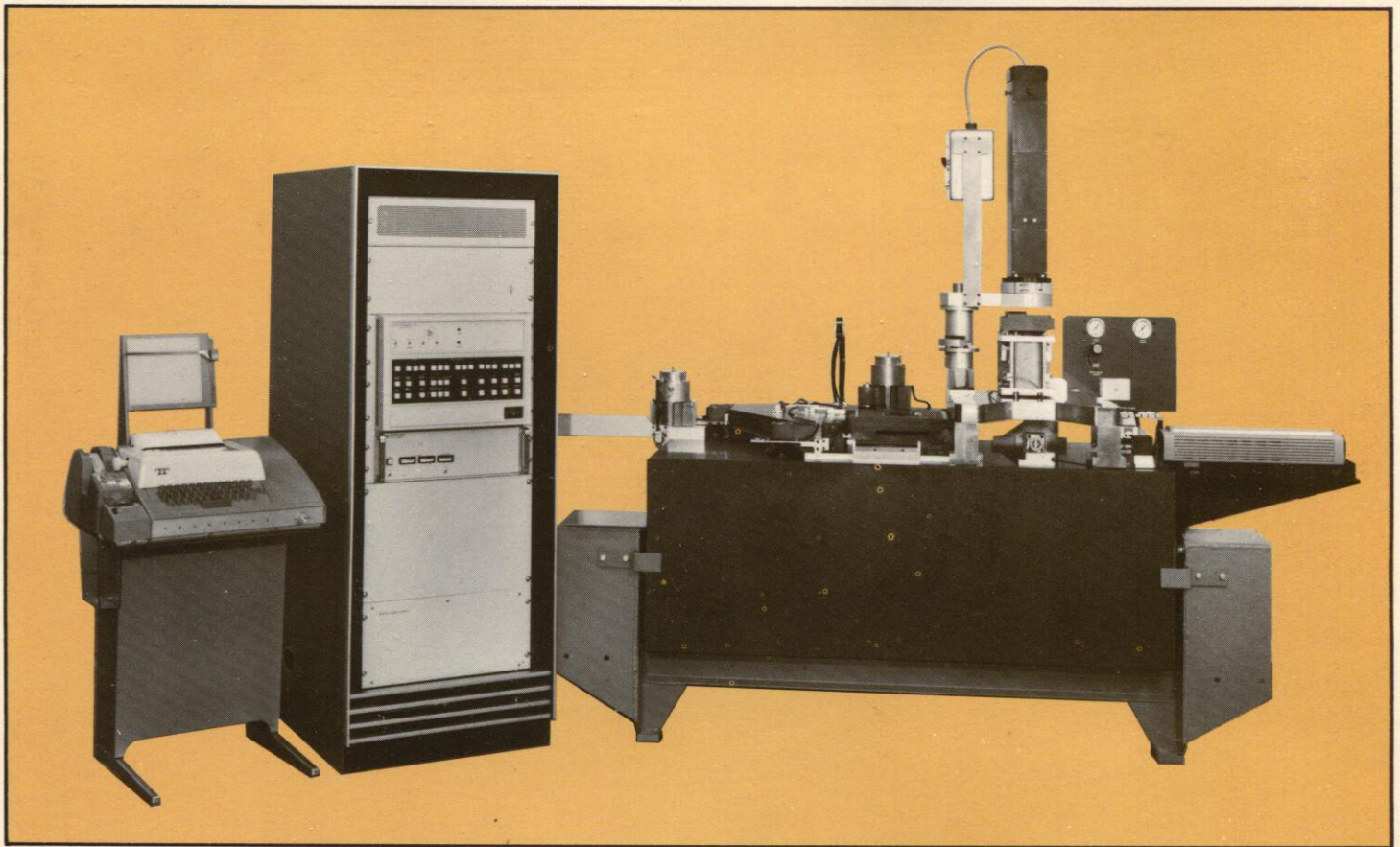
The stage starts in one direction; when it completes a line of pattern, it drops down to the next line and prints the pattern in the opposite direction.

Figure 2 — Circular Array Pattern

Circular Array approximates actual wafer. The useless fringe areas on the array are eliminated, reducing stepping time.

Figure 3 — Approximate Stepping Times, Circular Array

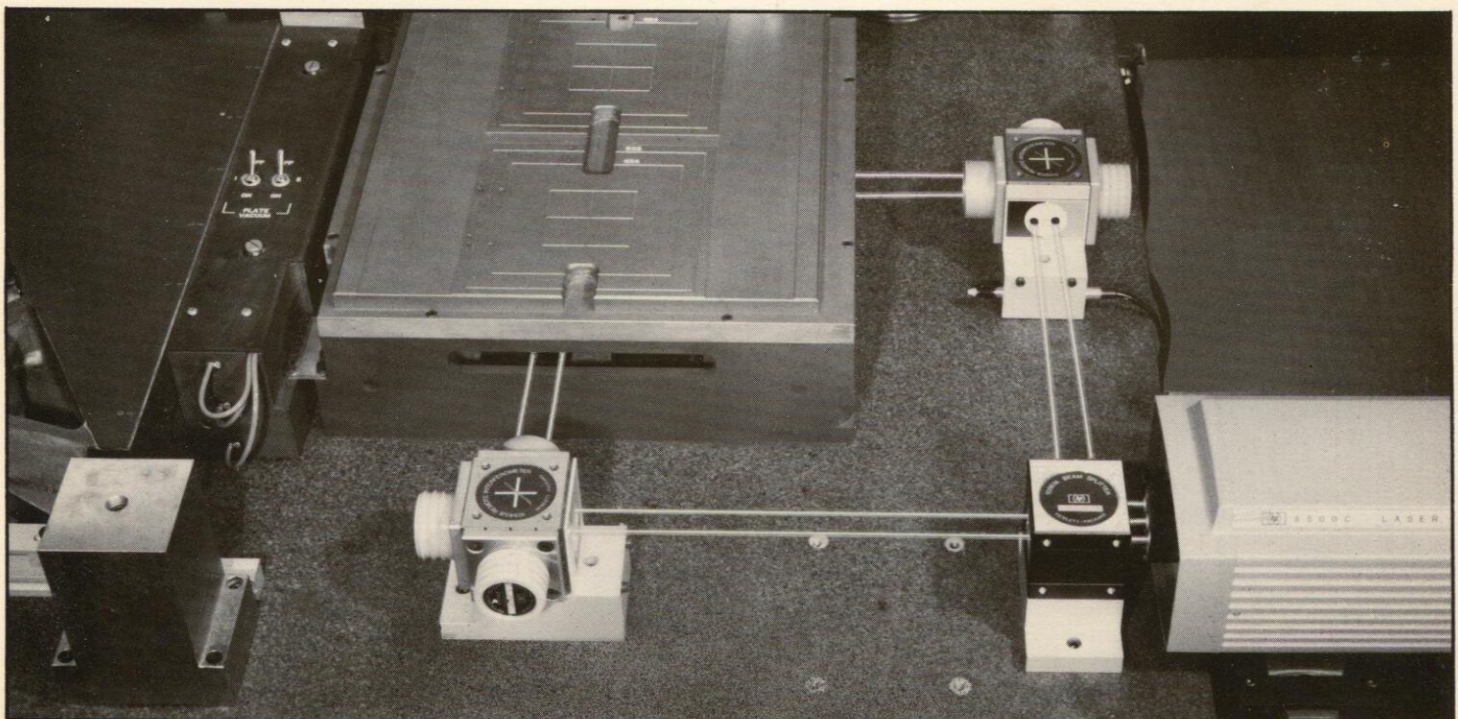
Curves for stepping times for both emulsion and photoresist for a 3-inch wafer in the circular array pattern are shown here. Test pattern inserted in 5 locations in 20 seconds or less.



PRECISE LASER CONTROL

Unlike conventional, mechanical systems, the Image Repeater is laser controlled, which provides optimum precision and accuracy and eliminates mechanical contact wear, since there is no mechanical contact used in the measuring system. The Image Repeater utilizes an HP2100 Series Controller, and an HP Laser System, which consists of a helium-neon laser, a beam splitter, and two interferometers.

As the beam enters the beam splitter, the outgoing beam is split into two paths at right angles to each other. These paths go to the interferometers and then to the X-Y staging table. The return beams, containing the measurement information, are directed back to two separate photodetectors. The information is then scaled to English or Metric units of measurement.



NON-DEGRADABLE ACCURACY

The Image Repeater staging operates on frictionless, wear-free, air-bearings. This permits maximum control of stage speed and positional precision to less than 0.254 of a micron over the full stage travel, and since there is no surface contact, system accuracy does not degrade with time.

All stage motion and guidance is supported by vacuum air bearings,* which provide a cushion of air between moving surfaces. The system employs a vacuum/pressure method. The cushion of air is precisely established by a controllable application of air or nitrogen at opposing plus-and-minus atmosphere pressures. The vacuum (negative force) pushes the device *toward* the surface, while the pressure (positive force) pushes the device *away*. Therefore, a constant, reliable equidistant spacing is always maintained.

*An Electromask patented feature.

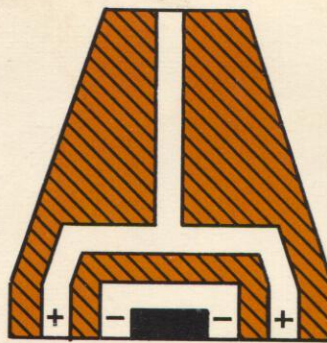


Figure 4
Vacuum Air-Bearing Principle,
profile view.

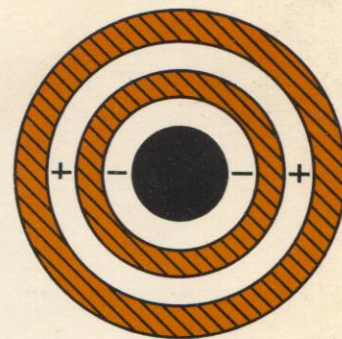


Figure 5
Vacuum Air-Bearing Principle,
bottom view.

QUICK, EASY, PRECISE RETICLE INSERTION

The optical system and camera assembly of the Image Repeater have been designed to produce the most positive and exact image in the quickest, easiest manner. Since the reticles have already been pre-aligned off-camera in the frames, it takes only seconds to place the reticle precisely into the holder on the working system. (See Figure 6.)

Figure 7 shows the pre-aligned framed reticle being inserted into the reticle top block assembly. The L-shaped receiving bracket has Tungsten Carbide pins to correspond with the pins on the reticle frame, which must make electrical contact before the reticle clamps are automatically clamped. When the reticle is properly vacuum clamped, a light signals the operator.

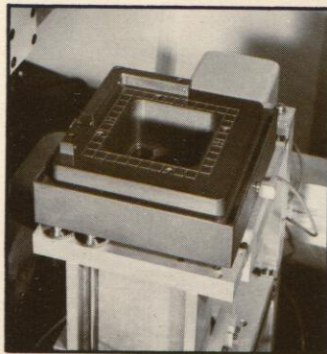


Figure 6



Figure 7

SPECIFICATIONS

Stage Speed: 1 inch per second for stop and expose mode — 2.5 inches per second for load/unload.

Stage Travel: Up to 5 x 5 inches as standard. Extended stage travel optional.

Plate Sizes: Reticle — 2" x 2", 2-1/2" x 2-1/2", or 3" x 3"

Photomaster — 3" x 3", 4" x 4", or 5" x 5"

Other sizes optionally available.

Array Programming: Minimum programmable stage increments

Metric: 0.1 micron

English: 10.0 micro-inches

Positional Precision: ± 10 micro-inches (± 0.254 microns)

Accuracy: ± 15 micro-inches (.381 microns) over 5" x 5" (12.7 cm x 12.7 cm).

Orthogonality: \pm one second.

Automatic focus control assures that the camera is always at the proper height above the photographic plate eliminating the need to select for plate flatness.

ENVIRONMENTAL REQUIREMENTS

To obtain the maximum in operating results from any step-and-repeat camera, proper environmental control is a requisite.

- Class 100 clean room conditions.
- Temperature stability between 68°F and 70°F controlled to $\pm .5$ °F, 20°C and 21°C, within ± 0.28 °C.



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