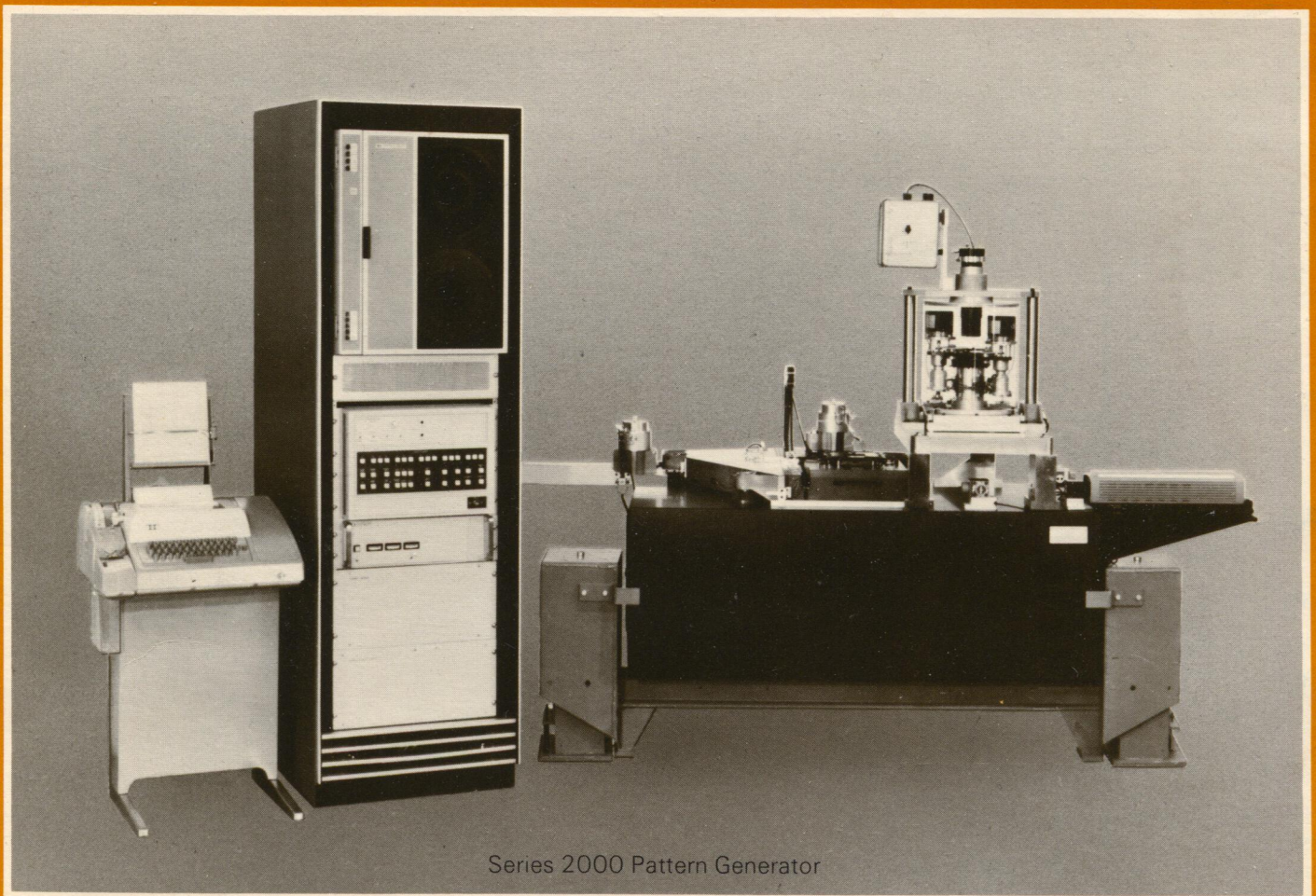


THE ELECTROMASK SERIES 2000 PATTERN GENERATOR

The fastest, most accurate, most flexible system on the market today — the only field-proven pattern generator positioned by laser beam, with stages floating on frictionless vacuum air bearings.

AND THE SERIES 2500 COMBINATION PATTERN GENERATOR/ IMAGE REPEATER

This compact combination system quickly converts from pattern generator to image repeater and back in a matter of minutes — maintains the speed and accuracy of the independent Series 1000 and 2000 systems.



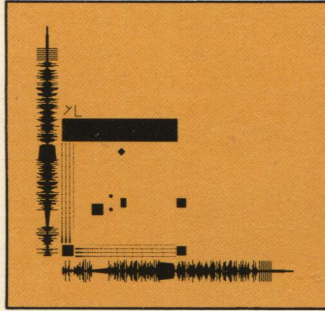
Series 2000 Pattern Generator

SERIES 2000 PATTERN GENERATOR

PROOF POSITIVE WITH TESTER 7

Electromask not only offers equipment built to specifications many times more exacting than any other competitive system, but we also offer the customer a quick and accurate means of verifying that our system is performing to specifications.

We provide a digital tape input for our pattern generator which contains data that will produce a combination of rigorous test patterns. Each pattern is designed to exercise a specific portion of the machine in order to verify that that particular section is performing within specifications. All the patterns combined — Tester 7 —



verify the overall system performance.

In addition to proving system performance during the acceptance test phase, this test tape is furnished as part of the extensive documentation supplied with each machine. This provides the customer with an absolute method of verifying system performance at any time he wishes to implement a confidence test during the life of the system.

This kind of concern for absolute accuracy, for proof positive of specification validity, and for continuing system performance sets ELECTROMASK apart as the unchallenged leader in this high technology field.

MAJOR FEATURES

UNIQUE HARDWARE DESIGN

- **Lasometric™ Precision** — The ultimate in speed, precision and reliability. Laser beam gives a stage position resolution of approximately 3 microinches.
- **Matchless Stage Speeds** — Patented, frictionless vacuum air bearings permit stage speeds of 2.5 inches per second in either axis. Rapid acceleration and deceleration is made possible by a powerful closed-loop dc servo system. Net result is a substantial increase in total system throughput which is typically 33% greater than other systems — and as much as 1000% greater than some systems.
- **Precise Stage Positioning** — Minimum incremental positioning 0.1 microns contributes to all-around system performance. Position precision is ± 10 microinches over 5" x 5" area.
- **Non-Degradable Accuracy** — Non-contact laser system and wear-free air bearing stages ensure non-degradable accuracy over full-stage travel.
- **Variable Aperture Control** — Aperture sizes at photographic plate range from 60 mils maximum to 0.2 mil minimum in increments of 10 microinches.
- **High Aperture Speed** — Less than one-half second from minimum to maximum opening permits, along with high stage speeds, an unmatched throughput rate.
- **Aperture Rotation** — Rotation in 0.1° increments through 90° combines with variable aperture control to permit exposure of any selected rectangle at any desired angle.
- **No Deadheading** — Exposures made in both directions with no accuracy degradation.

VERSATILE SOFTWARE CAPABILITY

- **Command Data** loaded into controller core memory automatically after simple installation of tape on tape unit.
- **Completely Automatic** photomask production, once tape data is loaded into memory.
- **Aperture** size, angle and positioning is controlled by sequential instructions from controller memory.
- **Verify Mode** checks for proper data format . . . checks all flash coordinates for compatibility with specified plate size . . . and preprints coordinates for array centering.
- **Commands** can be organized to maintain all parameters constant except X and Y, thereby increasing machine speed dramatically.
- **Minimum Programmable Increment** of 0.1 μ makes optional "shrink/expand" function a practical reality. Circuits can be shrunk or expanded by any amount within the resolution capability of the hardware and reconstituted to the scale specified without reformatting the original data.
- **Aperture Scaling** — An optional software program permits shrinking or expanding rectangles within a circuit (example: contact mask) without changing rectangle X-Y position.
- **Other Formats** — This software option allows the system to accept magnetic tape data formatted for other pattern generators.
- **Extended X-Y Stage Travel** — The air bearing, laser controlled X-Y stage may be optionally specified for travel up to 6 inches by 9 inches.
- **Floating Focus** — Optional floating focus ensures maximum resolution over the entire stage travel.

GENERAL DESCRIPTION

The Electromask 2000 Pattern Generator is the fastest, most precise, most versatile system available today for generating 10X reticles used in the manufacture of large scale integrated circuits. The 2000 not only eliminates the need for preparing manual artwork, but offers a concept so far advanced over competitive designs that it is years ahead of the ever-more demanding requirements of the semiconductor industry. As LSI circuits become more and more complex, the advantages of the Electromask 2000 become more and more pronounced.

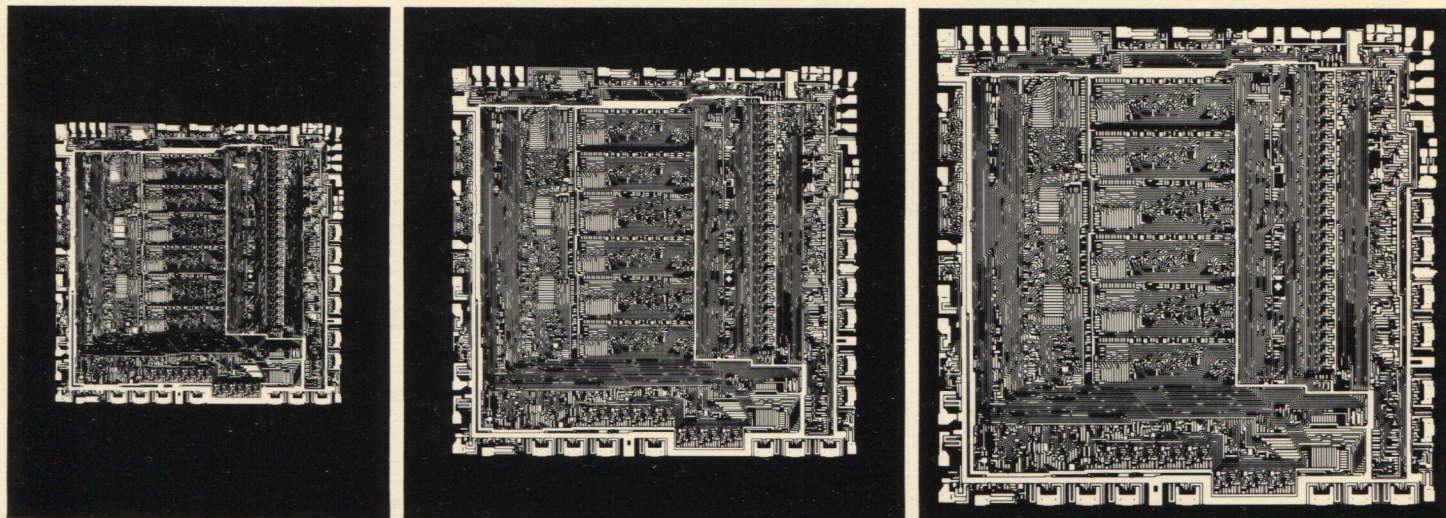
The Series 2000 creates the reticle by a photo-composition process utilizing a variable aperture assembly and sequentially exposing discrete rectangles on a sensitized plate. The system is designed to place these rectangles to a precision of less than four millionths of an inch. Due to the huge volume of data required to create today's LSI circuits by this method, digital information must be fed into the system by magnetic tape. A nine-track tape transport is, therefore, furnished as standard equipment with the system.

SYSTEM CAPABILITIES

Because the Electromask Series 2000 Pattern Generator is the fastest, most accurate, most flexible field-proven system on the market today — it can outperform any other system commercially available in all significant operations.

For example: stage positioning under precise laser control at all times . . . a powerful closed loop dc servo system for rapid acceleration and deceleration . . . wear-free vacuum air bearings ensuring long trouble-free life . . . and many software capabilities unique and unavailable in other systems.

A prime example of the Series 2000's unique hardware/software capability is its "Shrink/Expand" function. As illustrated below, to expand or shrink a circuit the operator need only specify the desired ratio to the system by use of the keyboard. Circuits are then reconstituted automatically to the new scale specified. And an optional software program that permits shrinking or expanding the rectangles within a circuit without changing the rectangle position is another powerful extra available.



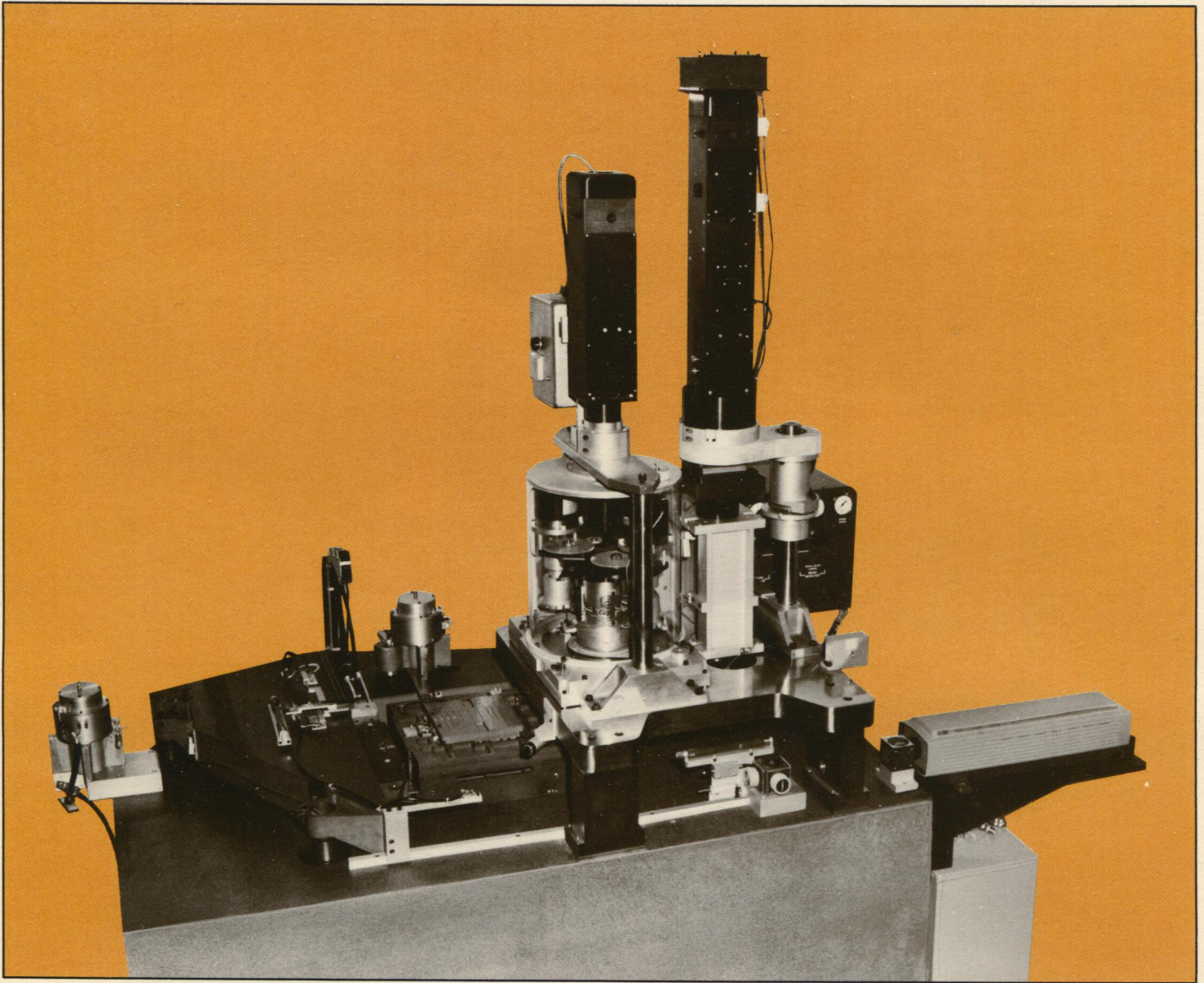
Shrink/Expand Function — Fig. 1. 10X circuit pattern shrunk to 72%. Fig. 2. Circuit pattern 10X final size. Fig. 3. 10X circuit pattern expanded to 123%.



Variable Aperture Assembly* — Circuit design flexibility is guaranteed by a precision aperture assembly that can vary the size of the rectangles generated in 0.1 micron increments.

*Patent Pending

SERIES 2500 COMBINATION PATTERN GENERATOR/IMAGE REPEATER



GENERAL DESCRIPTION

The Model 2500 Combination Pattern Generator/Image Repeater is a two work-station system. One work station is a pattern generator whose throughput and performance are identical to the standard Model 2000. The second work station is an image repeater. Here again throughput and performance are not compromised, as this station has identical characteristics with the stand-alone Model 1000. The image repeater station may be configured as a 10X, a 5X, and either e-line or h-line.

Combining the Pattern Generator/Image Repeater functions on a single system results in the incorporation of features normally available only as special options on the stand-alone units. For example, the Pattern Generator station on this system has floating focus incorporated as a standard feature. Floating focus assures the ultimate in resolution over the entire usable stage travel area.

A nine track magnetic tape is incorporated in this system as a storage medium for the Pattern Generator data. This tape unit can also be used to store X-Y coordinate data for the Image Repeater work station to allow it to function as a fixed aperture P.G. to produce surface wave transducer masks. This feature also lends itself to "computer-on-a-wafer" applications where it is desirable to put many different circuits on a single wafer.

The Series 2500 creates its reticle image directly from the digital data and then reduces that image to final size and reproduces it in a step-and-repeat process on a photo-master or production photomask. The new system is ideally suited for laboratories or system houses as well as any company with the need for its own semiconductor "model shop." With the Series 2500, users possess complete in-house control and the subsequent confidentiality of design.

MAJOR BENEFITS

The Combination System incorporates all the hardware and software features which are instrumental to System 2000 performance. Everything is there — Lasometric precision, matchless stage speeds, precise stage positioning, variable aperture control, high aperture speed, no deadheading, and non-degradable accuracy. Additional benefits give the Series 2500 its unique combination capability.

Simple repositioning of the interferometers converts the system in a matter of seconds from pattern generator to image repeater and back, and dual function capability places total control in-house and ensures complete confidentiality of design.

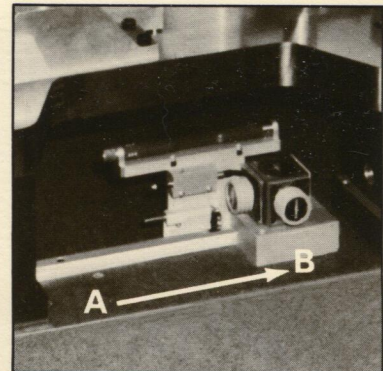
- **Automatic exposure run** for rapid selection of optimum exposure.
- **Optional circular array pattern** which reduces stepping time 15 to 20 percent. (See Figure 2.) Simple input requiring keyboard entry of die size and array diameter. Automatic computer print-out of the number of rows and columns.
- **Facilitates complex photo compositions** of 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.



A To employ the pattern generator, the operator simply loads the magnetic tape containing digital data into the 2500 control console . . .



B Then he presses the "start" button, and the Combo 2500 automatically creates the desired circuit pattern on a glass reticle . . .



C To convert quickly from pattern generator to image repeater operation, the interferometer is moved from position A to position B and the 2500 is ready to load the appropriate operating program and accept the reticle produced by the P.G.

IMAGE REPEATER FEATURES

- **Camera Options** One barrel, e-line, h-line or g-line with lens options of 10X, 5X, and 2X. Automatic focus corrects problems resulting from non-flat plates and assures the maximum resolution designed into the lens.
- **Efficient Design** No deadheading mode and stage speeds exceeding 1 inch per second provides maximum throughput. Typical speeds of 5 flashes per second on emulsion and 1 second maximum on photoresist, thus producing a 3 inch photomaster on emulsion or photoresist, with an array of 200-mil in less than 4 minutes. (See Figure 1.)

- **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.

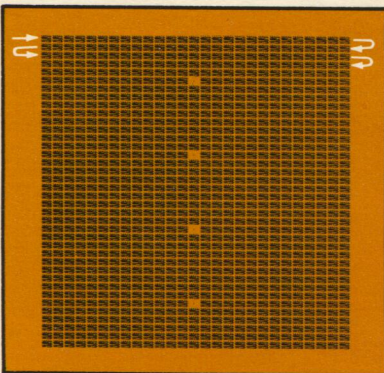


Figure 1—No Deadheading Mode. The stage starts in one direction; when it completes a line of pattern, it drops down to the next line and steps the pattern in the opposite direction.

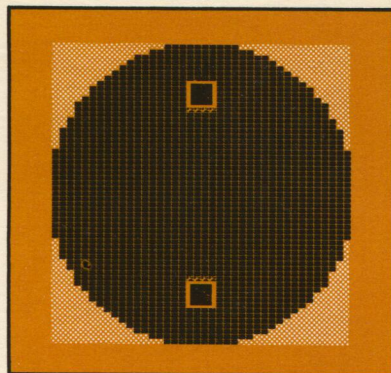


Figure 2—Circular Array Pattern. Circular Array approximates actual wafer. The useless fringe areas on the array are eliminated, increasing system throughput.

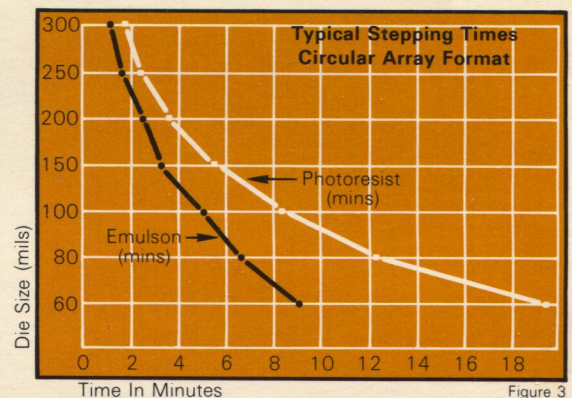


Figure 3—Approximate Stepping Times, Circular Array. Curves for stepping times for both emulsion and photoresist for a 3-inch wafer in the circular array pattern are shown here. Test pattern inserted in 5 locations in 20 seconds or less

SPECIFICATIONS

SERIES 2000 PATTERN GENERATOR

Lasometric Position Control:

Gives stage position resolution of 10 microinches (0.25 microns).

Stage Speed: Patented frictionless air bearing stage permitting matchless stage speeds of 2.5 inches per second in either axis.

Minimum Programmable Increments:

For stage positioning and aperture size –
Metric: 0.1 micron
English: 10.0 microinches

Aperture Sizes At Photographic Plate:

Maximum – 60 mils (1.524mm).
Minimum – 0.2 mil (5 microns).

Aperture Rotation:

0.1° increments through 90°.

Stage Precision:

±10 microinches over 5"x5" area.

High Image Resolution:

650 line pairs per millimeter.

SERIES 1000 IMAGE REPEATER

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"x2", 2-1/2"x2-1/2", or 3"x3".
Photomaster — 3"x3", 4"x4", or 5"x5".

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"x5" (12.7 cm x 12.7 cm).

Orthogonality: ±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.

SERIES 2500 COMBINATION PATTERN GENERATOR/ IMAGE REPEATER

The Series 2500 Combination Pattern Generator/ Image Repeater performs to the same specifications as the two independent Series units described above.

ENVIRONMENTAL REQUIREMENTS (For Series 1000, 2000, and 2500)

To obtain the maximum in operating results from any LSI process, proper environmental control is a requisite.

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

SYSTEM SELECTION

Remember, Electromask is the only company that delivers everything from photomasking services to photomasking equipment, including complete turnkey installations.

Only after a careful evaluation of your particular application can a proper choice be made from the

selection of systems that Electromask has to offer. Once chosen, the Electromask system will perform its task better, faster and more economically than any other system. Demonstrations and additional information available upon request.



ELECTROMASK, INC.

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Image Repeaters • Pattern Generators • Mask Savers • Environmental Chambers • Mask ID Printers • Precision Glass Cutters • Photomasking Services