KLARIS™

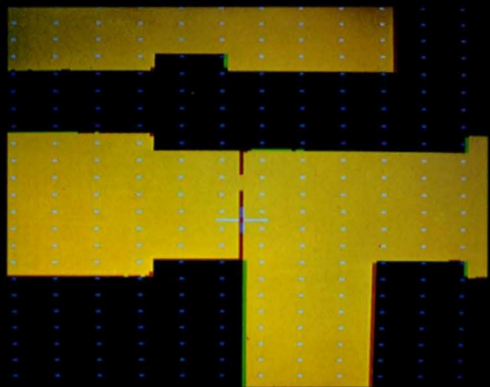## KLA 200 SERIES
AUTOMATIC RETICLE AND PHOTOMASK INSPECTION SYSTEMS

KLA
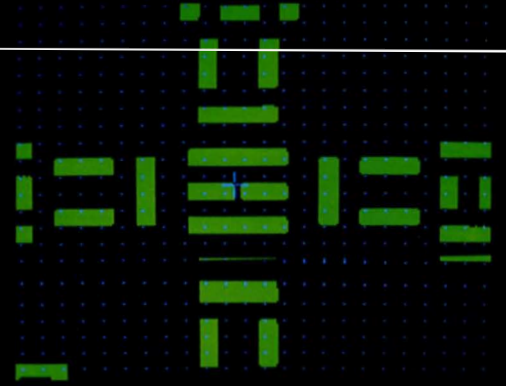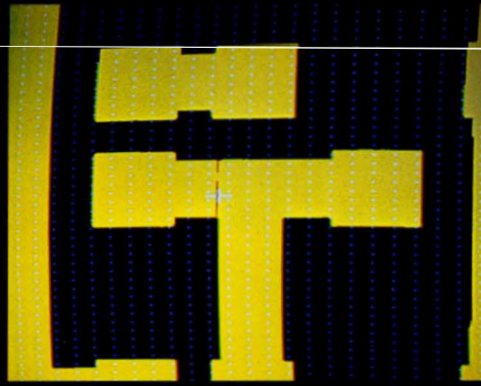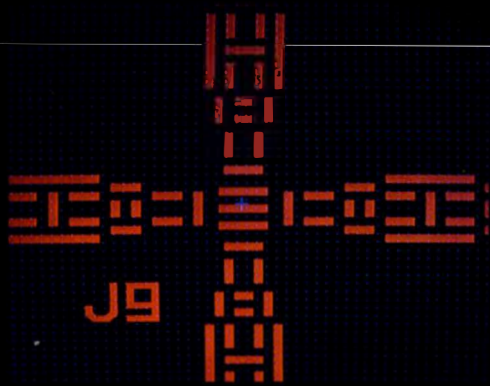
The Problem: How to Detect and Eliminate Killer Defects Before They're Repeated

VLSI circuits require more exacting and precise inspection of reticles and photomasks than ever before. The inability to compare a reticle or photomask die pattern to its database can lead to a fatal defect being repeated in hundreds of thousands of chips. However, installing a method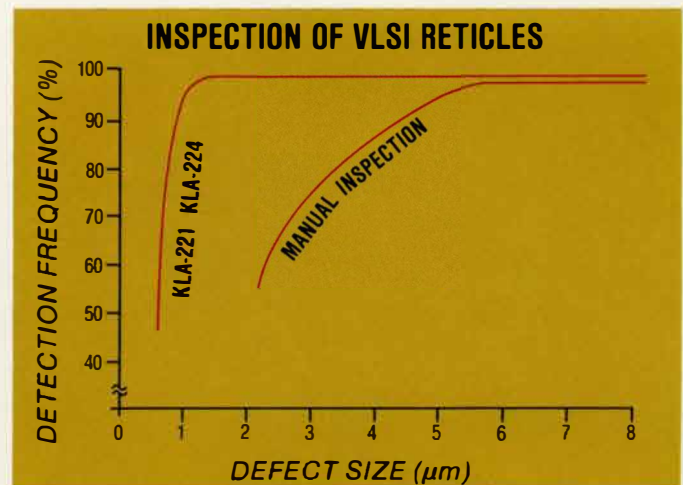 of proper database comparison ensures that the geometry is correct, and that defects due to processing anomalies, contamination and handling will be located in time to prevent staggering losses . . . in both dollars and inventory.

Unfortunately, manual inspection simply doesn't work. It's not practical, and is virtually impossible to perform error-free on VLSI circuits with line widths approaching one micron. Furthermore, manual inspection on complex 10X reticles for 3.0 micron defects is likely to be less than 75% effective.

KLARIS (KLA Reticle Inspection System) is the first automatic inspection system to ensure that killer defects as small as 0.7 microns on both reticles *and* photomasks will be detected. KLARIS systems achieve this by combining both die-to-database and die-to-die inspection techniques.

INSPECTION OF VLSI RETICLES

A graph with DETECTION FREQUENCY (%) on the vertical axis (40 to 100) and DEFECT SIZE (µm) on the horizontal axis (0 to 8). Curves labeled KLA-221, KLA-224, and MANUAL INSPECTION.

Avoids Inventory Losses

KLARIS systems protect your manufacturing process against the catastrophic loss of inventory and production time. Finding a defect only after hundreds of thousands of circuits have *already* been produced means you'll have to start all over again from the beginning to replace them. The manufacturer that finds these killer defects before fabrication starts saves a potential loss of hundreds of thousands of dollars.

high-speed die-to-die photomask inspection.

Decreases Field Failure Rates

Perhaps an even more costly event is a field failure—a "time bomb" defect in one of your customer's electronic systems months after delivery. The cost of this type of failure is almost unimaginable: the customer's million-dollar system is down; you lose business—and probably your reputation. Such latent defects due to these "time bombs" can cost millions of dollars in warranty claims, lost inventory *and* lost market share.

Improves Design Turnaround

KLARIS systems help you bring VLSI parts to market faster. Without a database inspection capability for design verification, you may lose a competitive edge by losing precious time looking for design problems that are caused by nothing more than a process or database error in a prototype reticle.
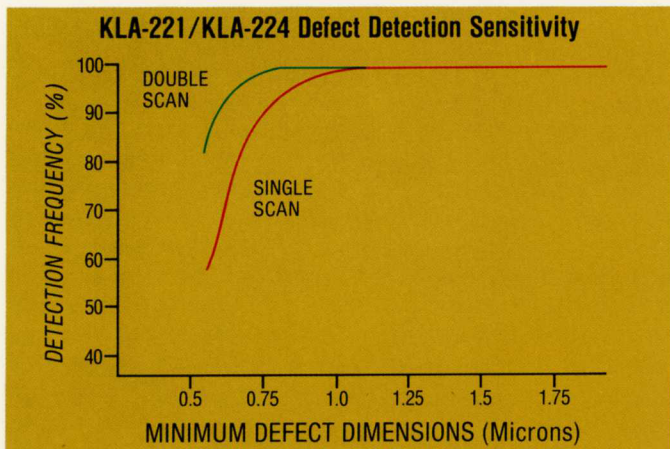
A FULL RANGE OF KLARIS SYSTEMS

The KLA-201 Automatic Photomask Inspection Station allows you to inspect photomasks and multi-die reticles for random defects today and to quickly add repeating defect inspection and single-die reticle inspection capability tomorrow. In addition, glass wafers can be inspected for both random and repeating defects. This product features a number of improvements on KLA's field-proven die-to-die inspection technology.

The KLA-221 Automatic Reticle and Photomask Inspection System allows you to inspect photomasks, multi-die reticles, single-die reticles and glass wafers for both random and repeating defects. This versatile, high-performance production system employs both die-to-die and die-to-database inspection technology.

The KLA-224 Automatic Reticle Inspection System is designed for dedicated, high-volume reticle inspection applications. This system gives you extremely high throughput on 5X and 10X reticles, and provides repeating defect inspection for photomasks and multi-die reticles.

KLARIS PERFORMANCE: The State-of-the-Art Defect Detection and Throughput You Expect

KLA-221/KLA-224 Defect Detection Sensitivity

Chart — X-axis: MINIMUM DEFECT DIMENSIONS (Microns) from 0.5 to 1.75; Y-axis: DETECTION FREQUENCY (%) from 40 to 100. Curves labeled DOUBLE SCAN and SINGLE SCAN.

KLARIS Throughput in Die-to-Database Mode

Chart — X-axis: INSPECTION TIME (Minutes) from 0 to 60; Y-axis: INSPECTION AREA (in²) from 0 to 16. Lines labeled: KLA-224 1.7μ SENSITIVITY; KLA-221 1.8μ SENSITIVITY; KLA-221 & KLA-224 0.9μ SENSITIVITY.

High Resolution

High numerical aperture optics allows the KLA-201/221/224 systems to detect 95% of all defects of 0.9 microns and above. And you can run each system in Double Scan mode to achieve even better defect detection sensitivity. In Double Scan mode, all areas of a reticle or photomask are scanned twice, increasing the probability of detecting minute defects. In this mode, KLARIS systems can typically detect 95% of all defects of 0.7 microns and above.
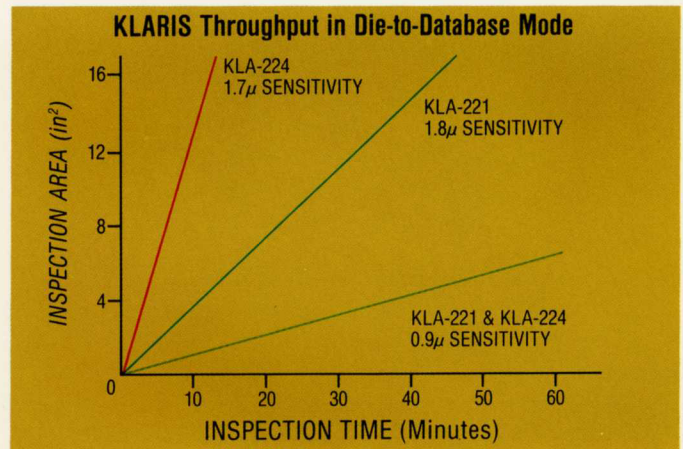
High-Speed Digital Image Processing Through Advanced Design

To increase your production throughput, two important design concepts have been incorporated into KLARIS systems:

First, those portions of KLARIS' image processing capability with significant impact on system throughput have been implemented in high-speed, dedicated pipelined hardware, rather than software, firmware, or general-purpose hardware. As a result of this architectural decision, KLARIS can process more than 14 million pixels of optical information per second.

Continuous Scanning

Second, its ability to continuously scan patterns means throughput is not mechanically limited, as is the case with "stepping stage" systems.

These two design features allow a KLA-221 to inspect a 100mm x 100mm 10X reticle in only 45 minutes, and a 10mm x 10mm 1X reticle in less than *two* minutes. Further, the KLA-224 can inspect the 10X reticle even faster—in 23 minutes.

This high throughput not only improves your productivity, but also reduces your turnaround time for design verification.

High Speed Data Conversion

KLA's Database Conversion Software (DBCS) utilizes proprietary high-efficiency algorithms to achieve conversion speeds as high as 1.5 million flashes per hour. This lets your data conversion keep up with KLARIS' high-throughput reticle inspection. Further, the DBCS can process patterns containing up to 20 million flashes.

Versions of this KLA-supported application software package are available for Digital Equipment Corporation's VAX and Data General Corporation's Eclipse computer systems. These systems can be located remotely from the KLARIS system.
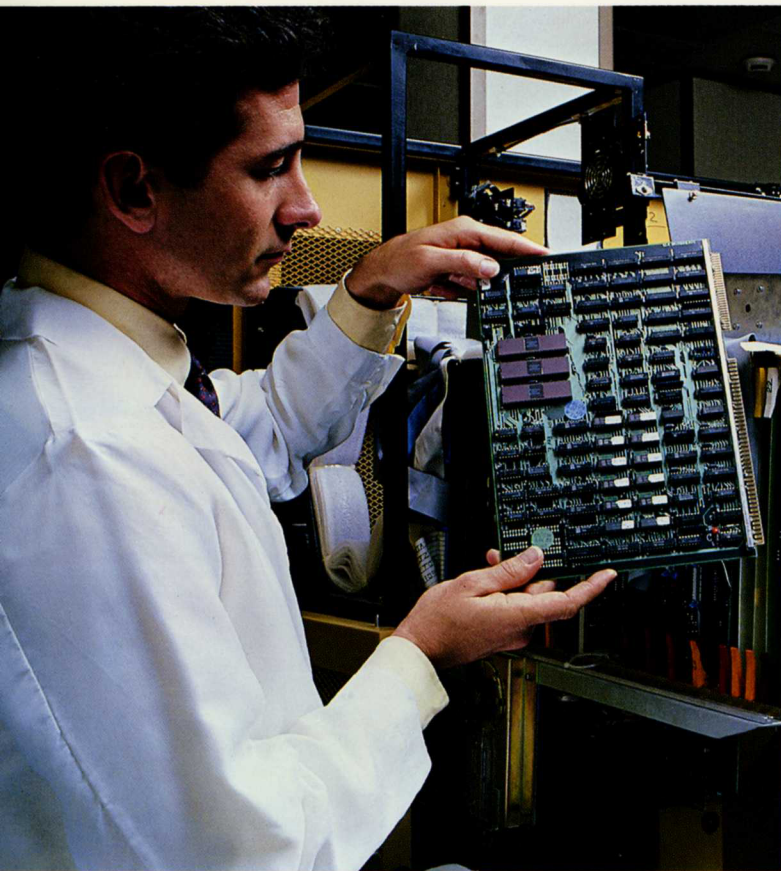
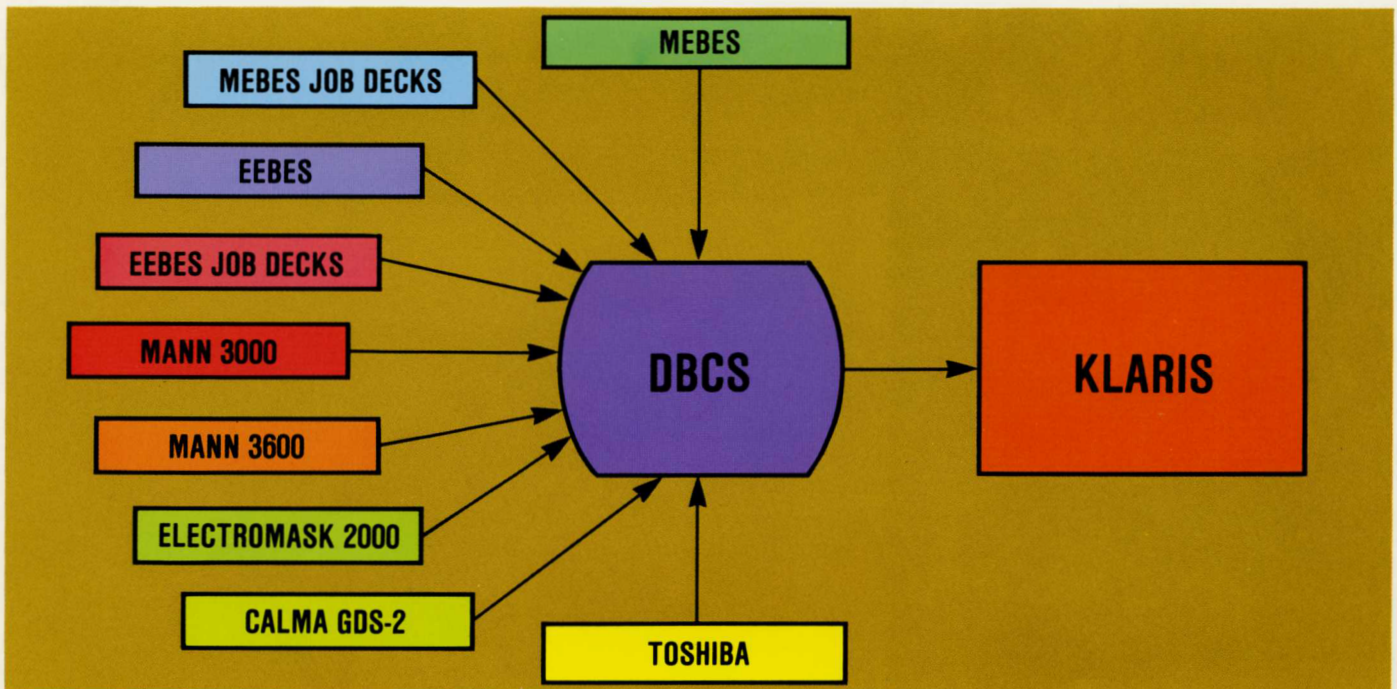# KLARIS VERSATILITY: Meeting All Your Inspection Needs
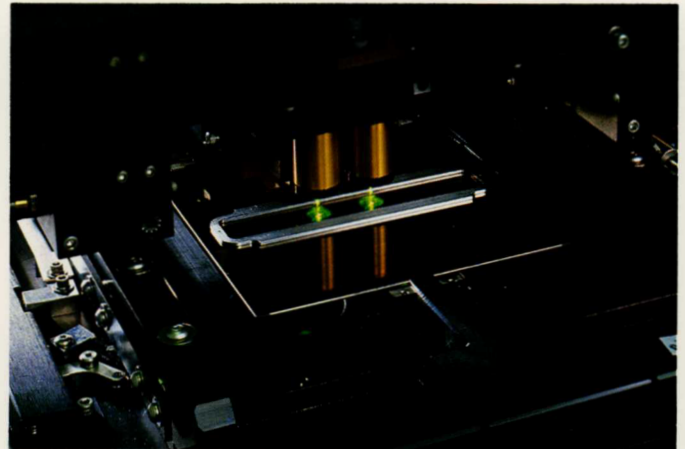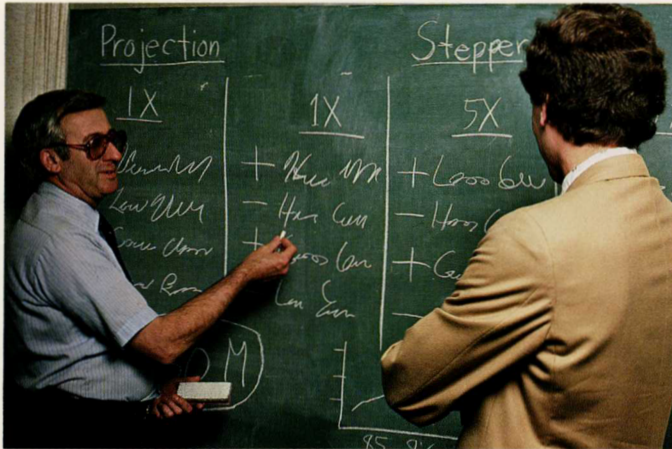
Die-to-Database and Die-to-Die Comparison. The KLA-221 combines both die-to-database and die-to-die inspection in one powerful system. This means you can efficiently and accurately inspect 1X photomasks, 1X reticles, 5X reticles, 10X reticles, and glass wafer patterns, without worrying about future changes in lithography that would make other inspection systems obsolete.

In fact, applying the die-to-database and die-to-die combination to photomasks and multi-die reticles gives you the best of both worlds:

1) you can inspect the first few dice on these plates in die-to-database mode to detect all repeating defects;

2) then you can inspect the remaining dice in high-speed die-to-die mode to catch random defects in minimum inspection time.

Though-the-Pellicle Inspection. Without the ability to inspect a photomask or reticle with a pellicle attached, there is a risk of added contamination during pellicle attachment. KLARIS systems meet this challenge with optional LWD optics with the long working distance needed to inspect either die-to-database or die-to-die *directly through the pellicle*.

Accepts Popular E-Beam, Optical PG, and CAD Formats. KLA's DBCS accepts tapes from a wide variety of popular data formats, including MEBES, EeBES, MEBES and EeBES job decks, Mann 3000, Mann 3600, Electromask 2000, Toshiba, and Calma GDS-2. Thus, in most cases, KLARIS systems can compare your reticles and photomasks directly with the tapes used to manufacture them.

KLARIS EASE OF OPERATION:
A Human-Engineered Self-Teaching System.


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ENTER DESIRED CODE AT KEYBOARD

  1)CLASSIFY DEFECTS
  2)DISPLAY DEFECT SUMMARY
  3)OPEN DOOR TO RELOAD

  6)STORE DATA

  9)RESCAN PLATE
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Movable, Hand-Fitted Keypads. The keypads for manipulating the XY stage and for classifying defects are movable for convenient positioning and reduced operator fatigue. Also, the buttons on the pads are ergonomically positioned for fast learning. Monitor and keyboard face the operator squarely for optimum comfort and ease of use.

User-Friendly, Self-Teaching Operation. Operation is so completely menu-driven that the operator simply answers the questions presented on the monitor and follows the prompts to begin using the KLARIS system quickly, accurately and with precise repeatability. In reticle mode, the presentation of defects is in color, and the keyboard permits direct communication with a KLA-50, KLA-60, or KLA-70 System Controller.

KLARIS NETWORKING:
Part of a Network Providing Useful Information...Not Just "Data"

TO FACTORY MANAGEMENT SYSTEMS

NETWORK OF KLA SYSTEMS
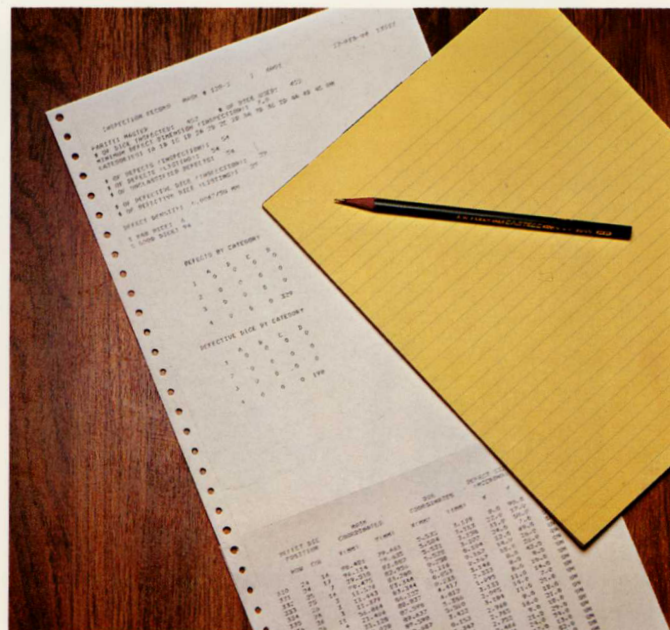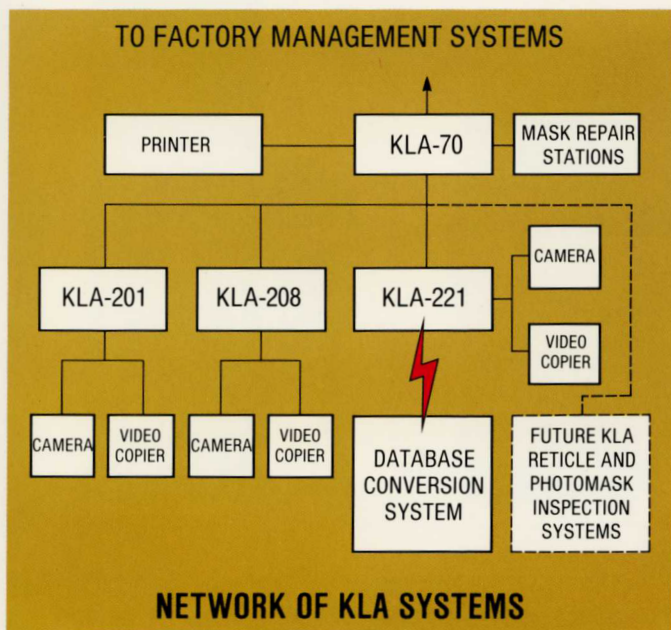
Interface to System Controller. KLARIS systems interface not only with the KLA-50 and KLA-60 System Controllers, but also the new KLA-70 System Controller, a computer system consisting of modular, high-performance, multiprocessor hardware and powerful KLA-developed application software. It's the key element in a network of KLA image processing systems and non-KLA equipment, such as repair stations. The KLARIS/KLA-70 link increases throughput by storing set-up data and provides a wide range of data analysis capabilities, including predicted yields, repeating defect review, and image qualification with glass wafers.

Ethernet Link Between DBCS and Reticle Inspection Adapter. A high-speed Ethernet link between the DBCS

and the KLA-20 Reticle Inspection Adapter is optionally available. With this link, you can transmit your KLARIS formatted database representations of reticles and photomasks from your off-line DBCS to your KLARIS system by direct communication. This link eliminates the handling of magnetic tapes and significantly improves turnaround time and reliability.

Hard Copy Report. A quick summary of inspection results is provided in an easy-to-read hard copy printout of inspection parameters. This also includes number, size, location, and type of defects found and is handy for repair and quality control purposes.

KLARIS PRODUCTION ORIENTATION:
KLA Technology Means Field-Proven Dependability.

Automatic Focusing. KLARIS systems' laser focus automatically corrects for bow and taper, ensuring high resolution over the entire surface of the reticle or photomask. This feature also allows the KLARIS system to focus through optical elements such as pellicles.

Dynamic Alignment. Dynamic alignment circuitry corrects mechanical inaccuracies electronically, thereby compensating for runout, table wander, operator misalignment errors, and thermal expansion. Turnaround time is minimized because you don't have to thermally stabilize your plates before inspection. Dynamic alignment also means that no environmental chamber is

required. This keeps KLARIS' footprint to less than 23 square feet, saving expensive clean-room space.

Air Bearing Stage. A friction-free, non-contaminating air bearing stage assures non-degradable performance over the life of the system.

Dual Viewing Optics. Reticles and photomasks can be seen on either the high-resolution binocular eyepiece or the large format monitor, a choice that reduces operator fatigue and training, as well as allowing experienced operators to review defects clearly in less than 4 seconds.

KLA-224 AUTOMATIC RETICLE INSPECTION SYSTEM

The KLA-224 Automatic Reticle Inspection System offers die-to-database inspection with detection of 95% of all defects 0.7 microns (typically) and above in Double Scan mode and detection of 95% of all defects 0.9 microns and above in Single Scan mode. A high throughput 1.7 micron inspection mode is also provided. The KLA-224 allows inspection of photomasks and 1X, 5X and 10X multi-die reticles for repeating defects as well as inspection of 5X and 10X single-die reticles.

KLA-224 SPECIFICATION SUMMARY

DEFECT DETECTION SENSITIVITY		MINIMUM LINE WIDTH/FEATURE SIZE/FEATURE DISCONTINUITY	
Double Scan	(typ.) 0.7μm	Double Scan & Single Scan	1.5μm
Single Scan	0.9μm	High Throughput	2.7μm
High Throughput	1.7μm		
NOMINAL PIXEL SIZE		INSPECTION RATE	
Double Scan & Single Scan	0.5μm	Double Scan	(typ.) 0.05 in^2/min
High Throughput	0.9μm	Single Scan	0.1 in^2/min
		High Throughput	0.6 in^2/min

DATABASE CONVERSION SOFTWARE (DBCS) SPECIFICATION SUMMARY

INPUT FORMATS:
- MANN 3000
- MANN 3600
- ELECTROMASK 2000
- MEBES
- MEBES with job decks
- EeBES
- EeBES with job decks
- TOSHIBA E-Beam
- CALMA GDS-2

CONVERSION RATE:
1.5 million figures per hour (approximate) based on die pattern with one million five micron untilted rectangles evenly distributed.

HARDWARE REQUIREMENTS:
Data General Eclipse S/140 or S/280 Computer System or Digital Equipment VAX 11/750 or 11/780 Computer System.

Complete specifications available from your KLA Sales Engineer.
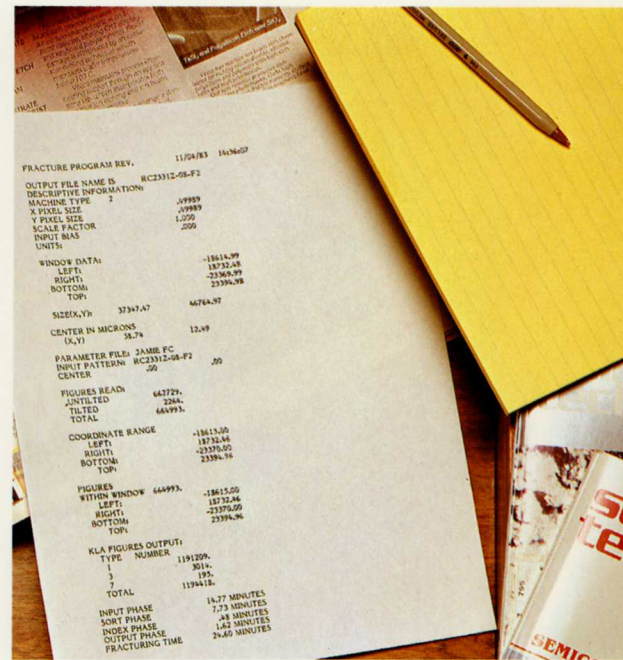
HD-160 AND HD-675
WINCHESTER DISC DRIVES

The HD-160 Winchester Disc Drive is an option to the KLA-20 offering 160 megabytes of unformatted storage contained in the KLA-20 Reticle Inspection Adapter. It allows you to store data for several reticles or photomasks and significantly reduces defect review times.

Another option to the KLA-20 is the HD-675 Winchester Disc Drive which is a 675-megabyte unit in a free-standing cabinet. This drive offers data storage for several high flash-count reticles or photomasks and also significantly reduces defect review times.

ETHERNET NETWORK CONNECTION
FROM DBCS TO KLA-20

The Ethernet Network Connection will allow KLARIS reticle or photomask pattern information to be transmitted directly from the Database Conversion System to the KLA-20 Reticle Inspection Adapter, eliminating the hand carrying of tapes between the two. The high-speed link will include all the hardware and software required.

DATABASE CONVERSION SOFTWARE (DBCS)

KLA's Database Conversion Software (DBCS) converts reticle or photomask pattern information stored on magnetic tape to the KLARIS format. The KLARIS formatted information is then fed into the KLA-221 or KLA-224 Inspection System for die-to-database inspection of reticles and photomasks.

HD-160 AND HD-675 DISC DRIVES
SPECIFICATION SUMMARY

HD-160
> STORAGE CAPACITY:
> > 160 Megabytes (unformatted)
> FIGURE OR FLASH STORAGE CAPACITY:
> > 5 million

HD-675
> STORAGE CAPACITY:
> > 675 Megabytes (unformatted)
> FIGURE OR FLASH STORAGE CAPACITY:
> > 20 million

ETHERNET NETWORK CONNECTION
BETWEEN DBCS AND KLA-20
SPECIFICATION SUMMARY

MAXIMUM CABLE LENGTH:
> 1000 meters

DBCS HARDWARE REQUIREMENTS:
> Digital Equipment VAX 11/750
> or 11/780 Computer System

KLA-20 HARDWARE REQUIREMENTS:
> Standard KLA-20 with either HD-160
> or HD-675 Disc Drive Options.

Complete specifications available from your KLA Sales Engineer.

KLA Reticle and Photomask Inspection Installations.

KLARIS . . . from KLA

Field-Proven Technology—KLARIS systems are based on KLA technology that has been operating in semiconductor and photomask manufacturing facilities throughout the world for the past five years. Many KLARIS systems are now in the field.

Reliability and Service—The design, manufacture and quality control in all KLARIS systems insures highly reliable and dependable operation. KLARIS systems are supported by KLA's worldwide service organization, which offers installation assistance, ongoing product support, and comprehensive training and documentation services.

Commitment— As a corporation, all of KLA's resources and attention are devoted to image processing systems for the semiconductor industry. KLA's origin was in reticle and photomask inspection systems, and KLA systems now comprise the largest share of this market.

This means that literally *millions* of dollars worth of our customers' products have been entrusted to KLA's Automatic Reticle and Photomask Inspection Systems and their unprecedented performance.

KLA remains similarly committed to your needs . . . now and in the future.

Can you afford LESS than KLARIS performance and versatility in your production process?

All specifications are subject to change.

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