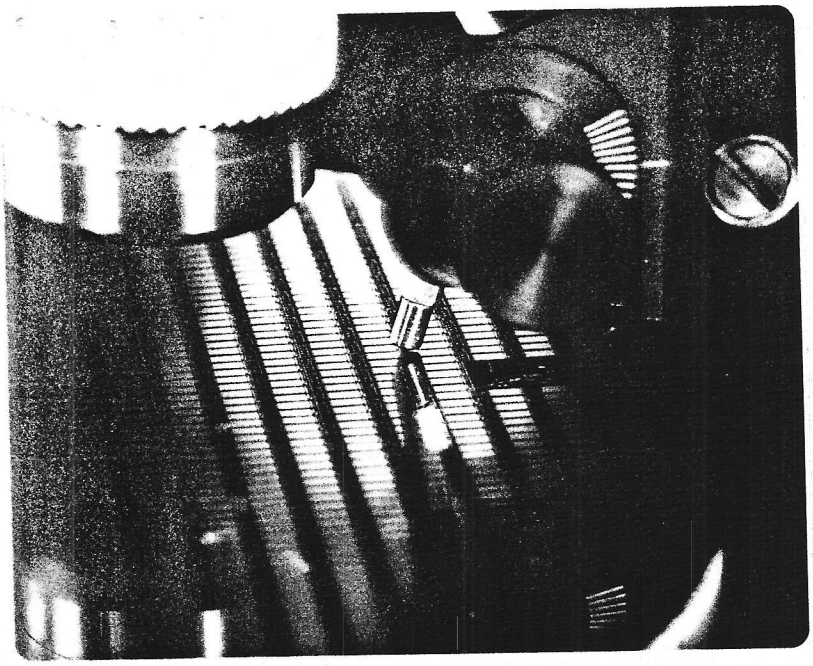


SUSS RA 120 M
SUSS RA 120
Automatic Scribers

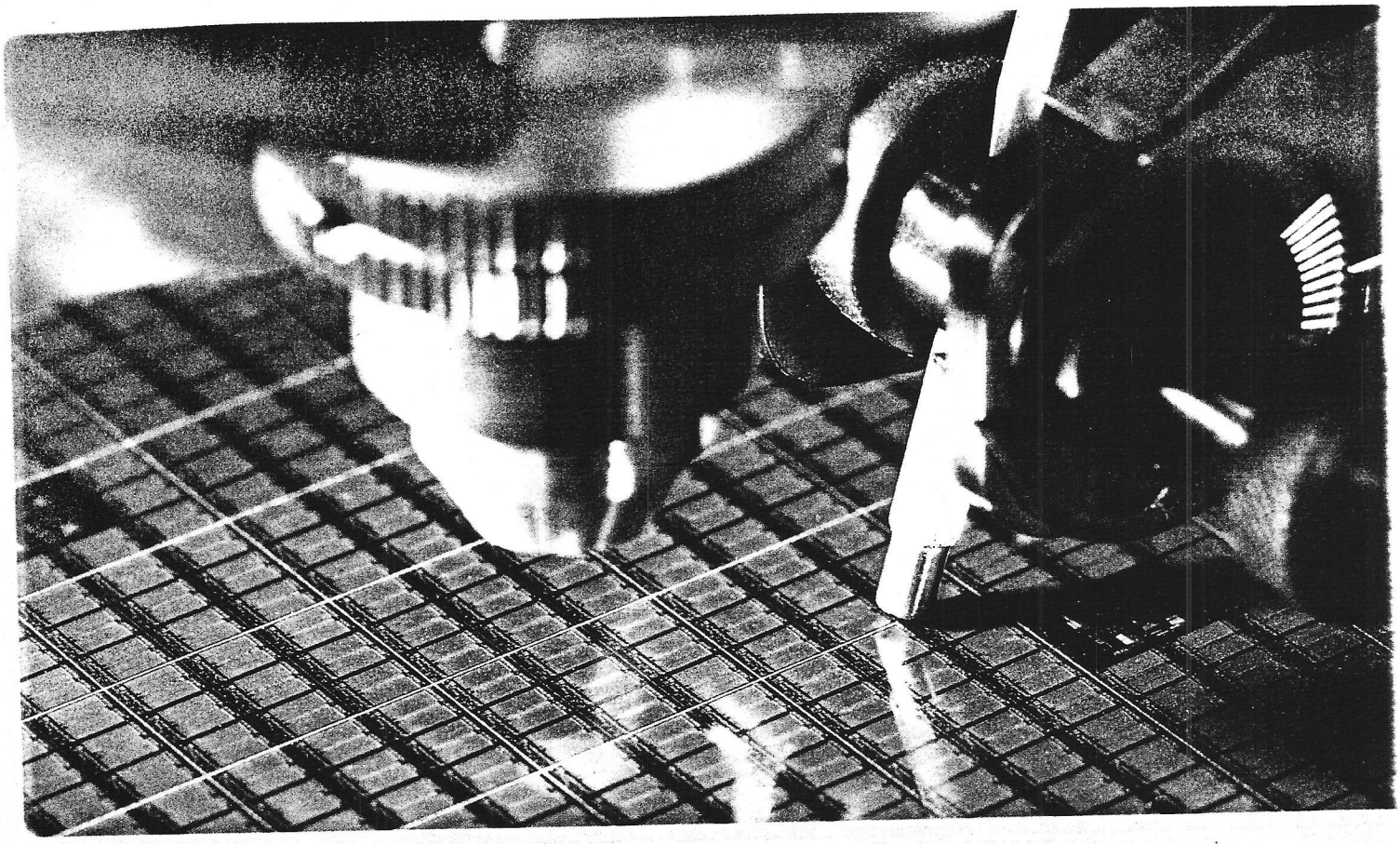
SUSS RA 120 M

Scribing of sensitive materials
such as GaAs.
Performs conventional scribing applications
as well as edge scribing
and interval scribing patterns.
Substrate or wafer size up to 3" x 3".

SUSS RA 120

Scribing of silicon, ceramic,
glass, and other materials
with high throughput and productivity.
Substrate or wafer size
up to 120 x 120 mm.

K SM Karl Suss



Scribing of Wafers and Substrates

For many years, the dominant method employed to separate semiconductor wafers into chips was scribing and breaking. More recently, sawing has replaced scribing as the favored separation technique for the mass production of silicon components.

Diamond scribing, however, remains unsurpassed in many application areas:

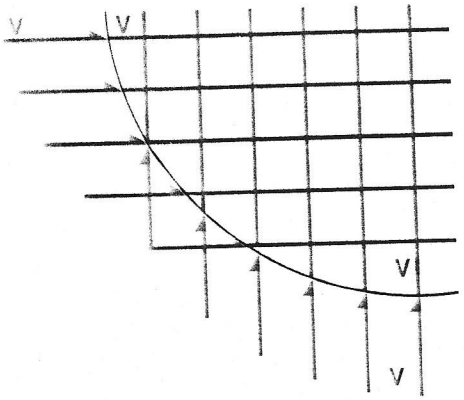
- In laboratories, due to its high flexibility.
- In limited production, through cost-effectiveness, clean operation, short set-up times, and simple entry and storage of process parameters.
- For the production of small devices from thick wafers (devices with unfavorable width/thickness ratios).
- For the separation of compound semiconductors, which require
  - clean, exact edges
  - narrow separation lines with negligible material loss
  - low thermal and mechanical stressing of the substrate
  - separation possibilities along precise crystal planes, not only through continuous scribing, but also through the use of specialized scribing patterns.

The basic prerequisite for employing these advantages is an efficient, high-quality scribing tool, such as either the SUSS RA 120 M or SUSS RA 120 Automatic Scriber. Both of these fine systems offer:

- Precise setting and control of all scribing parameters: Scribing depth, pressure, speed, angle, and scribe position.
- Vibration-free movement of wafer and tool.
- Gentle contact of the diamond, even at high scribing speeds.

K SM Karl Suss

Continuous Scribing



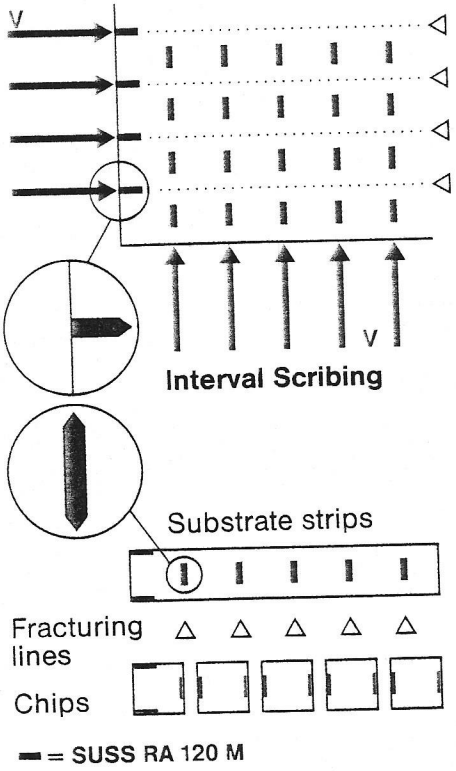
Continuous Scribing

= Approach/Scribing speed RA 120

V = Scribing speed RA 120 M

▬ = SUSS RA 120 M

Edge Scribing



▬ = SUSS RA 120 M

	Si Production	Si Laboratory	GaAs Production	GaAs Laboratory	Glass	Ceramic
● recommended ◐ good ○ not suitable						
RA 120	●	●	○	○	●	●
RA 120 M	○	●	●	●	○	○
M 50	○	○	○	○	●	●
M 80	○	●	●	●	○	○
M 200	●	○	●	○	○	○
Diamond holder 1,5 – 20 g	●	●	●	●	○	○
5 – 60 g	●	●	○	○	○	○
20 – 130 g	○	○	○	○	○	○
20 – 800 g	○	○	○	○	●	●
Diamond 2 sided	○	○	○	○	●	●
Diamond 6 sided	●	●	●	●	○	○
Continuous scribing	●	●	●	●	●	●
Edge scribing	○	○	●	●	○	○
Interval scribing	○	○	●	●	○	○

Scribing Processes

Continuous Scribing
(SUSS RA 120 M and SUSS RA 120)

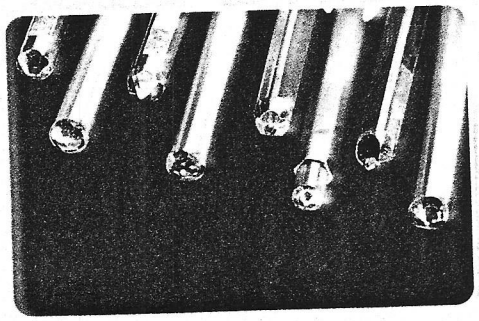
Continuous scribing in X and Y with subsequent breaking is the technique of choice for all silicon applications and many III-V compound devices. Examples are: integrated circuits, sensors, and discrete components. The SUSS RA 120 M produces a first-class scribing result through the exact control of scribing depth, scribing speed, and scribe position.

The SUSS RA 120 employs a special control circuit which accelerates the stage at the exact moment of tool contact from a relatively slow approach to the preset scribing speed. Both the substrate edge and diamond are thus protected from impact damage. Perfect scribes are produced over the entire length of the substrate even at high scribing speeds, thereby providing the basis for problem-free breaking and high yield in production.

Edge Scribing
(SUSS RA 120 M)

For many opto-electronic devices the surface quality of the chip sides is paramount for the performance of the component. This is especially true when the side surfaces serve as mirrors or emission planes (e. g. lasing devices).

Due to the characteristic of III-V compounds to fracture along crystal planes, some III-V applications require only a short scribe at the edge of the substrate in order to produce a continuous, flawless edge surface. The SUSS RA 120 M allows edge scribing on any compound with precise depth and distance control that is easily entered via CRT and keypad. The gentle contact of the tool and the exact control of scribing depth, scribe length, and scribe position allow fracturing of the substrate into discrete strips. In this way very parallel cleaved sides are produced with a minimal distortion of the crystal structure.

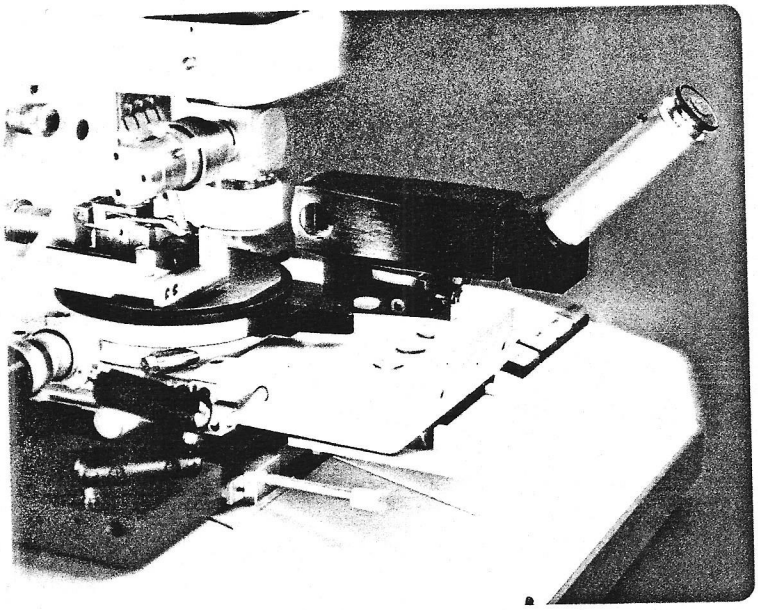


Interval or Skip Scribing (SUSS RA 120 M)

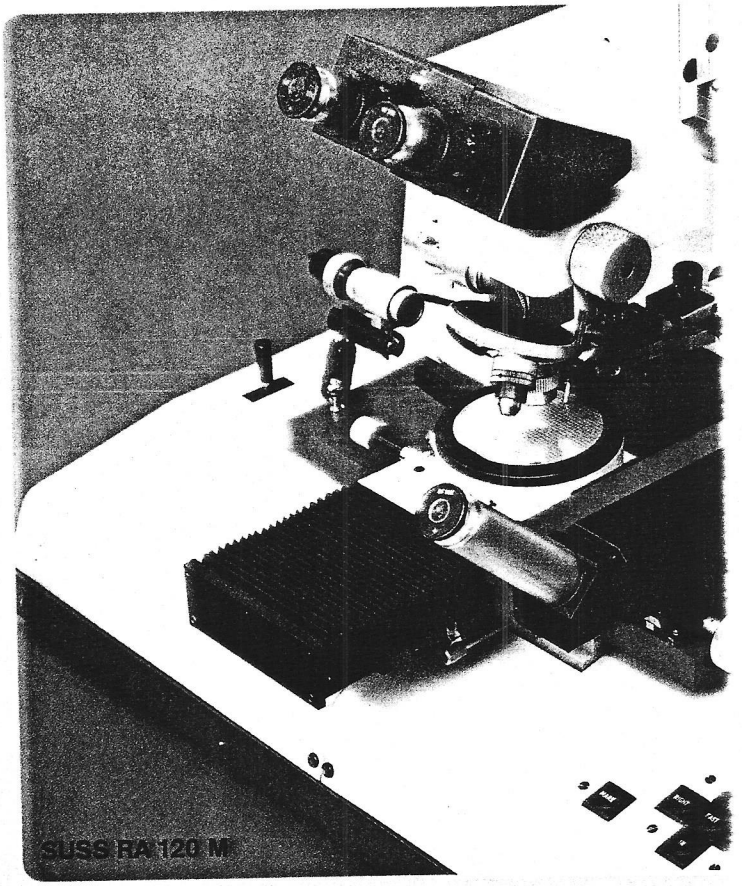
This same characteristic of III-V compounds to fracture along crystal planes is also used to advantage with "skip scribing", wherein the diamond is programmed to make a series of short scribes across the substrate perpendicular to the lines defined by the edge scribe. This technique allows edge-scribed strips to be separated into individual devices with no breakout at the corners. The operator enters the scribe length and scribe position in X and Y as well as the other scribe parameters either through direct data entry or in "learn mode". Both substrate alignment and starting point initialization are performed using a crosshair in the microscope. Upon the "Start Scribe" command, the SUSS RA 120 M will automatically skip scribe the entire wafer or chosen field.

Scribing Diamonds

A variety of quality diamonds is available for practically every material, application, and scribing method.



SUSS Adjustment microscope
with back-light illumination
for precise positioning of the diamond,
here in combination with the SUSS RA 120



SUSS RA 120 M Automatic Scriber

The SUSS RA 120 M is utilized in:

- **Production lines for III-V and other compound semiconductor devices.**
- **Research institutes and laboratories for all semiconductor applications.**

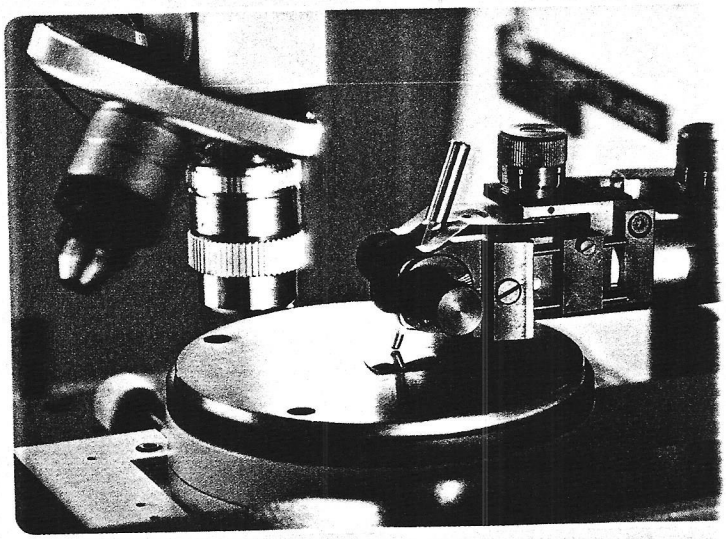
Its strengths in production are:

- **High productivity in difficult and problematic scribing situations: edge scribing and skip scribing for opto-electronic devices such as lasers, light-emitting diodes and sensors fabricated from GaAs and other compound semiconductors.**
- **Gentle substrate handling.**

For applications in the laboratory these benefits are supplemented by:

- **High flexibility, through the ability to combine the above tasks with completely different applications such as the scribing of glass substrates.**

The SUSS RA 120 M responds to the requirements of various materials and devices with the ability to optimize all critical scribe parameters. It also offers several distinct scribing modes. Its flexible control and refined precision mechanics, coupled with a wide range of application-optimized chucks, scribing tools, and first-class microscopes, qualify this precision tool as the industry's preeminent automatic scriber.



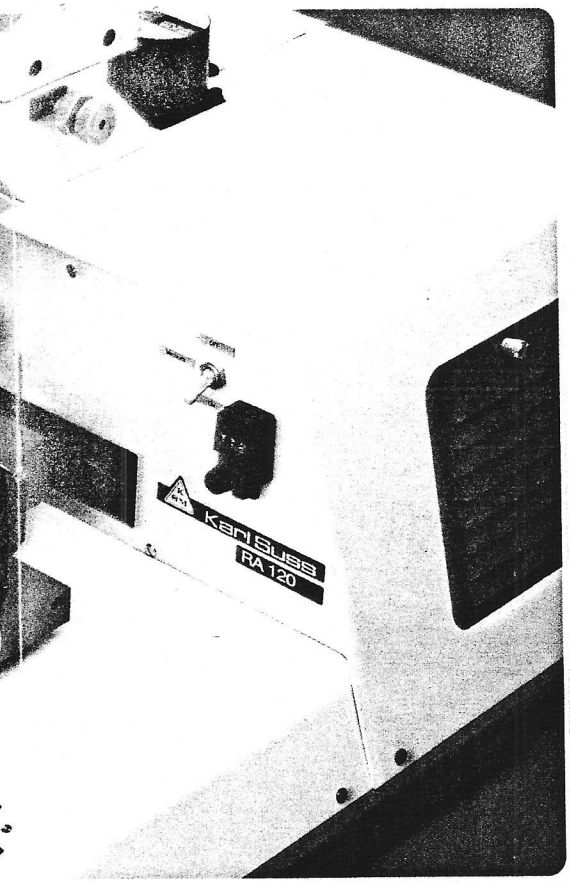
Scribing Processes (see Page 3):

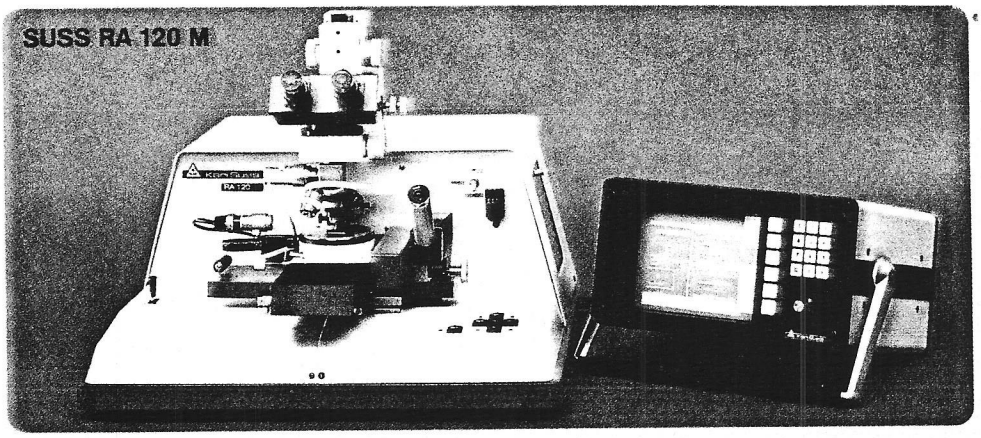
Continuous Scribing

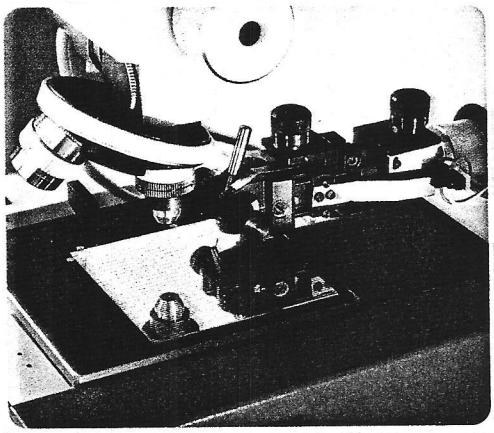
Edge Scribing

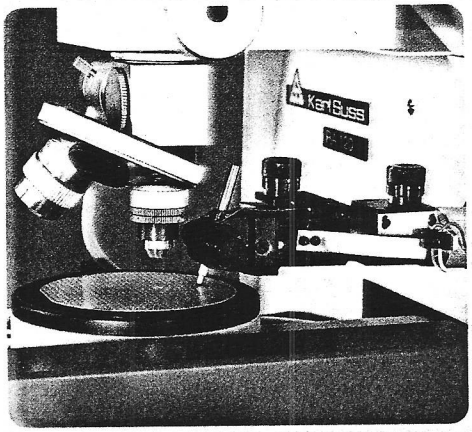
Interval or Skip Scribing

Karl Suss









Technical Details

XYΘ Stage
The heart of the SUSS RA 120 M is the XYΘ stage, which serves two distinct functions. First, it provides an alignment table for the substrate. Second, it guides the substrate under the scribing diamond, thereby performing the scribing process.

The stage has a built-in fixed 90° rotational movement. The fine Θ alignment of the substrate is performed manually using a spindle, while the X alignment mechanics utilize a lead screw with fine positioning capability. A step motor performs the X-indexing in metric or inch units (jumper selectable, requiring no replacement of mechanical parts). The scribe movement is achieved by a DC motor. A closed-loop feedback system is used to define the chuck position and, for skip-scribing, the scribe length and position parameters as well. The scribes are carried out first in X and then in Y (according to chuck orientation).

Control and Operation
The machine is operated via CRT dialog and variable-definition function keys. The CRT indicates the current machine status and process parameters. The scribing operation can be interrupted in process at any time to check the result and resumed on operator command. The electronics and microprocessor control are incorporated in a separate housing.

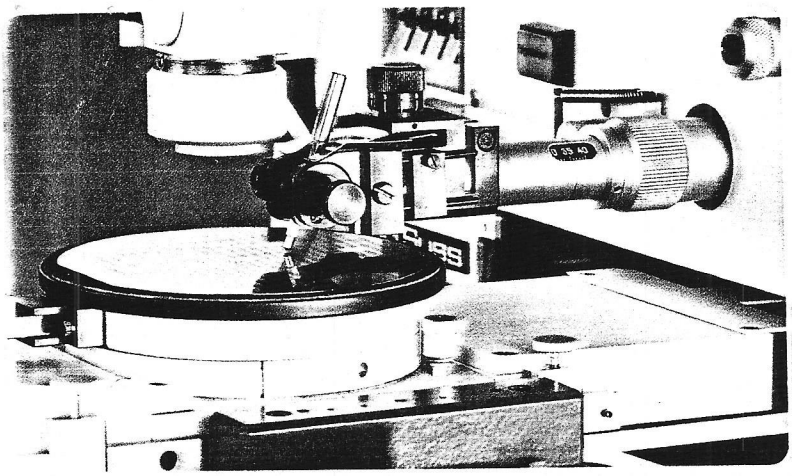
Microscopes
Scriber microscopes serve not only to align the substrate, but also to check the scribing result, and in many cases to align the scribing diamond. Therefore the SUSS RA 120 M allows application optimization through a choice of accessory optical equipment:

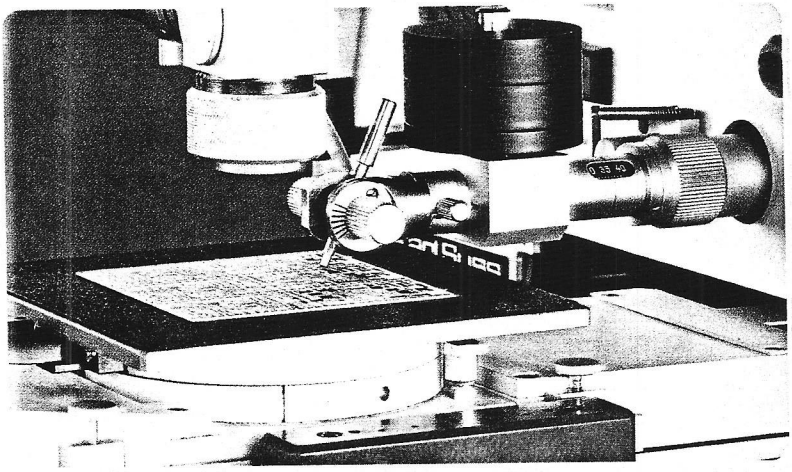
SUSS M 80 / RA 120
Normalfield Microscope
For demanding scribing tasks. Two magnification ranges. Crosshair with fine adjustment in X and Θ. 40 X magnification for quick and accurate substrate alignment and scribe placement. 80 X magnification for inspection of scribe quality and verification of scribe position.

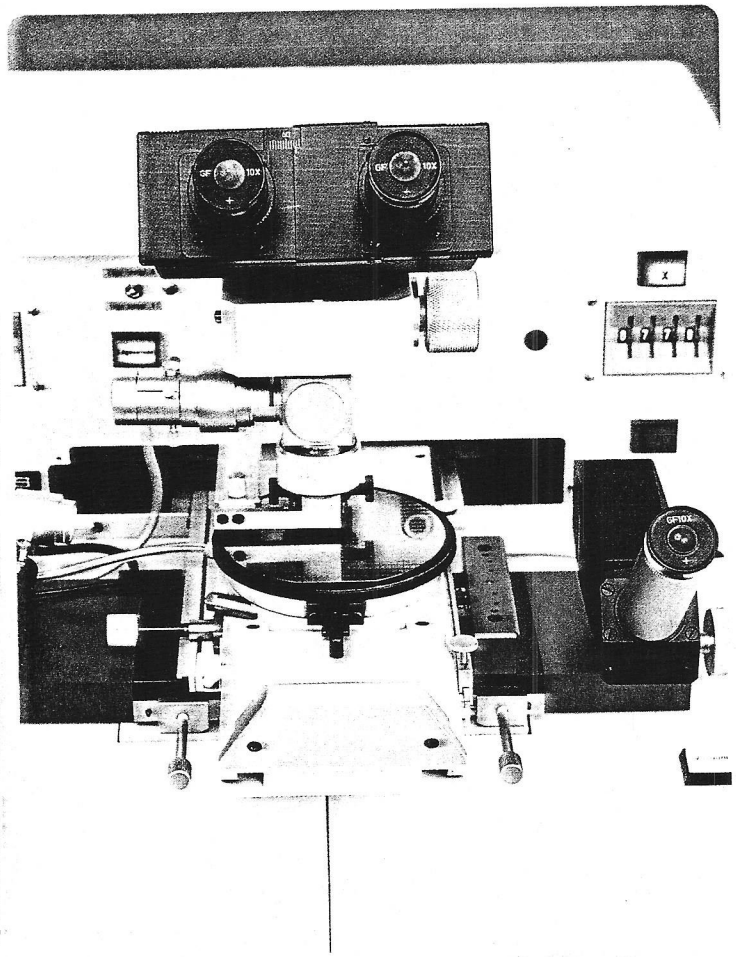
SUSS M 200 / RA 120 Splitfield Microscope
Allows extremely fast substrate alignment. The first choice for the throughput oriented line. Crosshair adjustable in X and Θ. Simultaneous observation and alignment of two points on the substrate.

Adjustment Microscope
All SUSS diamond holders allow fast exchange of the scribing diamond and exact adjustment of the scribing angle. The optional SUSS M 20 / RA 120 adjustment microscope makes this procedure especially precise, and repeatable.

Diamond Holder
Suitable for GaAs and other compound semiconductors. Allows quick exchange of the scribing diamond. Standard diamond holder provides 1.5 to 20 g fine adjustment range for scribing pressure. Optional diamond holders available with special springs for scribing pressure ranges of 5 – 60 g or 20 – 130 g. Adaptable for silicon or glass applications.







Technical Details

The complete electrical and pneumatic control as well as the machine power supply are built into the SUSS RA 120 housing.

XYΘ Stage and Control

The most important component of the SUSS RA 120 is the XYΘ stage, upon which the substrate is aligned. In addition to its alignment function, the stage travels back and forth under the scribing diamond, thereby accomplishing the scribing process itself.

The stage has a built-in fixed 90° rotational movement. The fine Θ alignment of the substrate is performed manually using a spindle, while the X alignment utilizes a lead screw with fine positioning capability. A step motor performs the X-indexing in metric or inch units according to machine configuration. The separation between scribes may be individually selected for each direction using digital switches. The pneumatically driven scribe movement is controlled according to application by a user-selectable optical edge sensor or limit switch. The optical edge sensor is located close to the scribing diamond and performs two control functions. First, it switches the stage from slow approach speed to the user-set scribing speed. Second, it initiates the direction change from the scribe stroke to return (and vice-versa) at the edge of the substrate. The scribes are carried out first in X, and then in Y.

Microscopes

As with the SUSS RA 120 M, the SUSS RA 120 allows application optimization through a choice of accessory optical equipment:

SUSS M 80 / RA 120
Normalfield Microscope

For demanding scribing tasks. Two magnification ranges. Crosshair with fine adjustment in X and Θ. 40 X magnification for quick and accurate substrate alignment and scribe placement. 80 X magnification for inspection of scribe quality and verification of scribe position.

SUSS M 200 / RA 120 Splitfield Microscope

Allows extremely fast substrate alignment. The first choice for the throughput oriented line. Crosshair adjustable in X and Θ. Simultaneous observation and alignment of two points on the substrate.

SUSS M 50 / RA 120
Normalfield Microscope

This economical alternative for the SUSS RA 120 provides fixed 50 X magnification which is adequate for many applications.

Adjustment Microscope

All SUSS diamond holders allow fast exchange of the scribing diamond and exact adjustment of the scribing angle. The optional SUSS M 20 / RA 120 adjustment microscope makes this procedure especially precise, and repeatable.

Diamond Holder

The diamond holder for the SUSS RA 120 provides fine scribe pressure adjustment from 5 to 60 g standard, with additional weights from 60 to 600 g available for glass and ceramic applications. In addition, diamond holder for scribing pressure from 1.5 to 20 g is adaptable (described under the SUSS RA 120 M).

Technical Data

	SUSS RA 120 M	SUSS RA 120
XYΘ Stage		
Alignment Range		
In X (coarse alignment via table drive)	120 mm	120 mm
In X (fine alignment via lead screw)	0.1 mm	0.1 mm
In Y (via scribe-drive)	3"	–
In Θ (via alignment spindle)	10°	10°
Chuck rotation	90°	90°
Scribe Movement		
Scribe range	120 x 120 mm	120 x 120 mm
Scribe range with skip scribing	3 x 3"	–
Smallest step in X	5 µm	10 µm
Largest step in X	Unlimited	99.99 mm
Accuracy in X	7 µm	10 µm
Smallest step in Y	1 µm	–
Accuracy in Y over 3"	5 µm	–
Speed in Y	0.25–15 mm/sec	10–80 mm/sec
Lead screw speed	variable	10 mm/sec
Approach speed	–	10 mm/sec
Overshoot before and after scribing	–	3–8 mm
Switching of the scribe direction	by micro-processor control	1. photo-electric edge sensor 2. photo-electric limit switch
Diamond Holder		
Type RA 120/1.5–20 g		
Scribe pressure adjustable	1.5– 20 g	1.5– 20 g
or	5 – 60 g	5 – 60 g
or	20 –130 g	20 –130 g
Scribe angle adjustable	40°–90°	40°–90°
Type RA 120/5–60 g		
Scribe pressure adjustable	–	5– 60 g
with additional weights	–	60–600 g
Scribe angle adjustable	–	40– 90°
Chucks		
For wafer size	1–4"	1–4"
For partial wafers and substrates	5 x 5 mm –4 ½ x 4 ½"	5 x 5 mm –4 ½ x 4 ½"

	SUSS RA 120 M	SUSS RA 120
Microscopes		
SUSS M 50/RA 120		
Binocular Normalfield Microscope		
Fine-adjustable crosshair		
Magnification	–	50 x
Incident light illumination	–	8 V 5 W
SUSS M 80/RA 120		
Binocular Normalfield Microscope		
Fine-adjustable crosshair		
Magnification	40 x and 80 x	40 x and 80 x
Incident light illumination	6 V 4 W	8 V 5 W
SUSS M 200/RA 120		
Binocular Splitfield Microscope		
Fine-adjustable crosshair		
Magnification	75 x	75 x
Halogen incident light illumination with fiber-optic light guides	6 V 20 W	6 V 20 W
Objective separation	24–100 mm	24–100 mm
SUSS M 20/RA 120		
Monocular Microscope for Adjustment of the scribing diamond		
Magnification	20 x	20 x
Back illumination	6 V 4 W	8 V 5 W
Dimensions and Weight		
Machine:		
width x height x depth	600 x 590 x 440 mm	600 x 590 x 440 mm
weight	55 kg	60 kg
Control:		
width x height x depth	500 x 445 x 280 mm	–
weight	25 kg	–
CRT:		
width x height x depth	410 x 470 x 200 mm	–
weight	5 kg	
Utilities		
Vacuum	200 mbar (–0.8 bar)	200 mbar (–0.8 bar)
Power requirement	110 V/60 Hz 220 V/50 Hz 240 V/50 Hz 0.4 kW	110 V/60 Hz 220 V/50 Hz 240 V/50 Hz 0.25 kW
Environment		
No special requirements		

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