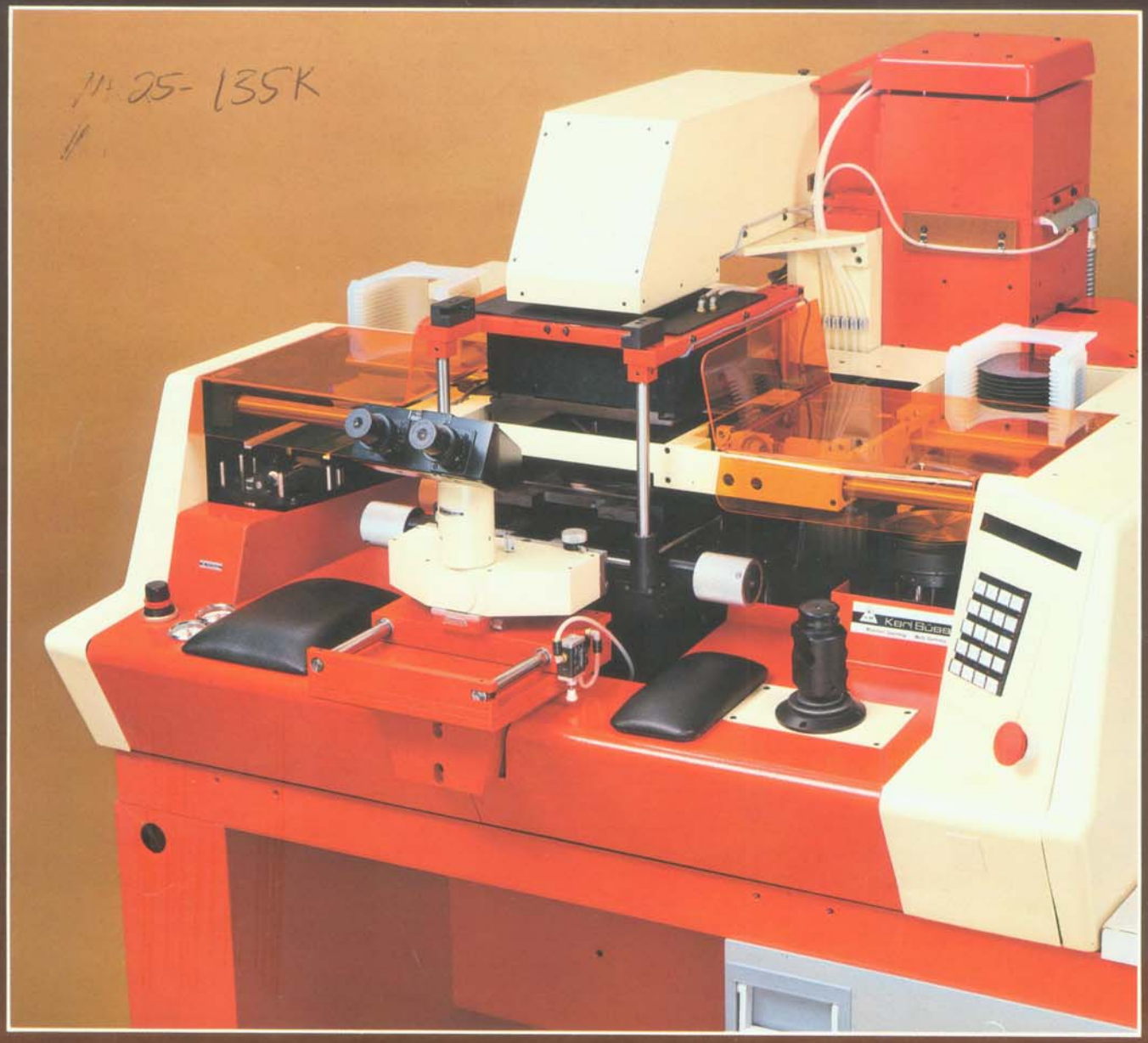
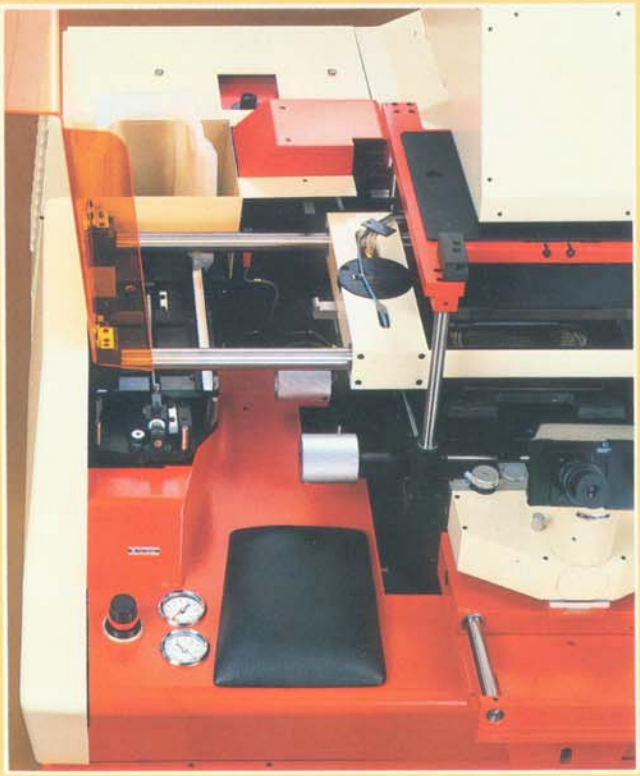


SUSS MA 25

Double Side Mask Aligner

Microprocessor controlled
For simultaneous double-sided, or single side,
first mask and multiple exposure
of wafers up to 125 mm dia.
With cassette loader.
For mass production of double side exposed wafers.

K SM Karl Suss



The concept of the SUSS MA 25:

- Future-oriented development based on the most advanced technological know-how.
- Microprocessor controlled.
- Wafers up to 125 mm dia processed.
- Compact design, clearly arranged construction, easy and reliable operation. Quick program entry.
- Automatic operation with interruption capability for manual alignment.
- Fully automatic operation for first mask exposure, using the high accuracy pre-alignment station.
- Easy wafer alignment by centrally located, one-hand, power manipulator (the joy-stick).
- High-precision, robust mechanics.
- Short retrofit times.

The result of the SUSS MA 25 concept:

Unsurpassed, highly economical production capabilities in the mass production of double side exposed wafers. The superior economy of operation, and high productivity, combined with the high positioning accuracy of multiple exposures, and between the two sides, are the result of the fast speed of operation and the unique reliability of the microprocessor controlled mechanical construction.

Serviceability:

The SUSS MA 25 is particularly easy to service:

- Modular build.
- Easy accessibility of all functional groups.
- Easy replacement of complete assemblies.

Technical Details

Programmable microprocessor control
In a novel, dialogue-type communication the microprocessor takes the operator through the work program of the machine, i.e., it calls the various parameters sequentially up for data entry and places the data in the store after they have been displayed on the 16-digit, alpha-numeric LED display and confirmed by the operator by pressing the YES button.

The control unit is contained in a tiltable 19" tray mounted on telescopic rails. A terminal board accommodating the connectors for each assembly interfaces the control unit with the mechanical assemblies of the machine.

Four operating sequences available:

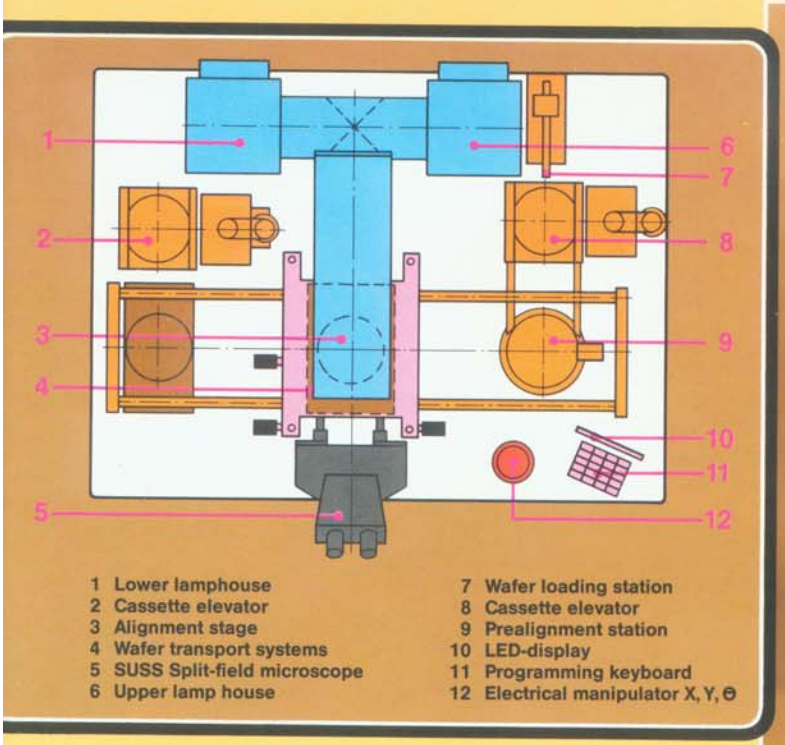
- simultaneous, double side, multiple exposure;
- Single side multiple exposure, in both cases with interruption capability for manual alignment using the manipulator;
- Simultaneous, double side, first mask exposure;
- Single side first mask exposure.

Operational features
All machine functions are fully powered and/or automated, thus meeting all the requirements for fast, economical operation.

Mask alignment stage
The heart of the machine is the mask alignment stage. It features two mask holders, arranged one above the other with the lower mask aligned to the upper mask manually by means of three micrometer screws. The upper mask holder can be moved in the Z direction by means of step motors on a four-column guide mechanism. Wedge error compensation is also incorporated in this mechanism.

MA 25- 5" - ~170K
MA 24- 4" - ~135K

K SM Karl Suss



1 Lower lamphouse
2 Cassette elevator
3 Alignment stage
4 Wafer transport systems
5 SUSS Split-field microscope
6 Upper lamp house
7 Wafer loading station
8 Cassette elevator
9 Prealignment station
10 LED-display
11 Programming keyboard
12 Electrical manipulator X, Y, Θ

After wedge error compensation the upper mask holder frame is clamped by powerful pneumatic brakes. Vacuum is used for holding the upper and lower masks to their mask holders, while the latter are secured to their mask holder frames by compressed air. Alignment of the lower mask to the wafer and thus of the upper mask in X, Y and Θ is effected by three DC motors which move the lower slide together with the two masks aligned to each other. Control is effected manually using the one-hand manipulator. All slides and drives are equipped with ball slides between steel plates ground flat and hardened.

Cassette loader with pre-alignment station

The cassette loader accommodates all commercially available cassette types. Wafers are supported only along their edges by inclined PTFE supports, which is an important feature for wafers coated on both sides. This ensures absolute protection of the finish (no belt transport, no air cushion). Wafers are handled by pushrods actuated by DC motors.

Each pocket spacing, controlled by contactless switches, equals a multiple of the pitch of the DC-controlled screw for vertical cassette movement.

The wafer coming from the full cassette is preliminarily aligned on a pre-alignment station. Individual wafers can also be pre-aligned on this station when the cassette is not used.

Wafer transport

The wafer transport uses two pick-up systems which pick up the wafer by motion in the z axis and hold it by vacuum. The slides of the two pick-up systems run in revolving ball sleeves on two horizontally parallel rods. The vertical slide of the right-hand unit runs in ball bearings and is controlled by a stepping motor. The slide is suspended in an oscillating frame which also acts as a wedge error compensation system. The transport plate for the wafer is mounted on the outer frame. After wedge error compensation this frame is pneumatically fixed in place.

Contacting and separation of wafer and lower mask are controlled by a stepping motor.

The second pick-up system picks the exposed wafer up from the lower mask. The transport plate is again suspended in an oscillating frame. The wafer on the pre-alignment station and the exposed wafer are picked up simultaneously. The aligned wafer is then placed on the lower mask while the exposed wafer is deposited on the wafer-unloading station.

Lamphouses

The two lamphouses which are located adjacent to each other are individually accessible. They are equipped with diffraction-reducing optical systems and with 350-Watt HBO lamps.

The light beams are conducted to the upper and lower masks via ellipsoidal and deflector mirrors. Lamp replacement is easy and simple.

SUSS Split-field microscope

The SUSS split-field microscope with its excellent optical performance features a focus compensating objective adjustment combined with fine focussing facility, as well as a selection facility for single field or split field illumination in both light paths. It is also possible to choose between bright field and dark field illumination.

The microscope is moved manually into and out of the light path.

Functional checks

Magazine loading and transport are monitored by functional checks, no double loading possible, no "vanishing" of wafers in the system possible. The open construction of all slideways permits manual access if required.

Performance

A complete working cycle with an exposure time of 5 sec. takes approx. 25 sec. for double side exposure and approx. 15 sec. for single side exposure per wafer.

Program entry

Working with or without cassette loader, the program to be entered includes:

"Mode" – double side or single side exposure, with or without alignment; "Separation" (alignment distance); "exposure times upper side and lower side", "exposure distance" (separation between upper mask and surface of the wafer); "wafer thickness", "number of contacts" on mask (so that the operator knows when the mask has to be exchanged). Moving the red filter into the upper illumination beam switches on the mask alignment program, the manipulator drives automatically into the central position.

Example of mask aligning program sequence for "double side exposure with alignment"

1. Align upper and lower masks to each other using mask aligning program.

2.1 Wafer transport from cassette to pre-alignment station.

2.2 Automatic wafer pre-alignment (single or double pre-alignment, at choice).

2.3 Transfer of wafer to transport plate.

2.4 Transport to alignment stage (between the masks)

2.5 Wedge error compensation and separation.

3. Wafer alignment. The three alignment motors are controlled in two reverse directions using the central manipulator.

4.1 Wafer deposit on lower mask. The wafer is fixed by nitrogen onto the mask to avoid a slipping.

4.2 Transport chuck moves to mid position.

4.3 Upper mask moves down to exposure position.

5. Microscope is moved manually out of the light path to its stop position.

6.1 Exposure

6.2 Upper mask moves upward.

Machine thus performs item 2.1 through 2.5 automatically and then stops to allow alignment (push microscope in manually). After alignment (press "exposure") the machine automatically performs items 4.1 and 4.2, then waits for the microscope to be retracted (unless this has already been done), performs exposure, item 6.1 and then after 6.2 immediately restarts with item 2.3.. Items 2.1 and 2.2 are performed parallely to alignment and exposure.

When working without the manual wafer alignment step (program: "double side exposure without alignment") the machine will work through the program non-stop and continue until the cassette has been emptied.

The two other programs, "single side exposure with alignment" and "single side exposure without alignment" are performed similarly.

If any function cannot be carried out by the control because some condition is not met, an error number will be displayed in the 16-digit LED display.

Technical Data — SUSS MA 25

Alignment table	
Range of adjustment in X and Y by DC motors, manipulator controlled	± 5 mm
Traversing speed, continuously variable	20 µm – 2 mm/sec.
Alignment table rotation Θ	± 2°
Adjustment range of mask aligning system by micrometer screws in X, Y and	± 5 mm
Rotation Θ	± 2°
Maximum wafer dia	125 mm
Maximum mask size	6" x 6"
Alignment accuracy between upper side and lower side of the wafer	<±2 µm
Pre-alignment station Pre-alignment accuracy	<±20 µm
Separation adjustment range	0 ... 1 mm
in steps of	1 µm
Exposure unit Two UV mercury vapour superpressure lamps	350 W each
DC Power supply	220 V, 50 Hz/ 110 V, 60 Hz
Exposure light beam	130 mm dia
Timer setting range	0.1 – 100 sec.
Power supply rating	220 V, 50 Hz, 1500 W
or	110 V, 60 Hz
Pneumatic system Connected pressure	5 bars min
Vacuum (small pumps on request)	<150 Torr
Nitrogen	2 bars
SUSS horizontal split field microscope Total magnification	30x or 100x
Objective distance, variable	26 to 98 mm
Vertical illumination	15 W
Dimensions and weight Width x depth x height	1200 x 850 x 1410 mm
Weight	approx. 400 kg

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