Diamond Scriber Instructions

- 1. DO NOT ADJUST ANY PARAMETERS NOT EXPLAINED IN THESE INSTRUCTIONS. DO NOT MOVE THE LENS OBJECTIVE, CROSSHAIR, LAMP ASSEMBLY OR ANY OTHER PIECE THAT IS NOT DESCRIBED HERE. If this instructions are not helping you in your project, contact a cleanroom staff.
- 2. Make sure that the vacuum line valve on the wall (right behind the scriber) is open and that the vacuum gauge reads a vacuum pressure.
- 3. Place a test sample in the center of the wafer stage and flip the "Wafer" switch to secure it using vacuum. Also flip the "Down/Up" switch to lift the stylus. See Figure 1.



Figure 1. Front view of the diamond scriber.

- 4. Place the stylus over the test sample by pushing or pulling the table forward or backwards using the table bar (use the handle) and moving the table left to right using knob "C"(see figure 1).
- 5. Flip the "Down/Up" switch to drop the stylus on the sample. Turn the micrometer screw "MB" (see figure 2) clockwise to lift the stylus above the surface and then back until it barely touches the sample surface. (It is better to have your eyesight at the sample level to better determine the touchdown point.) After this, turn MB counterclockwise 5 divisions (=0.1 mm) to allow the proper force to scribe a line.
- 6. Scribe a line by moving the table towards you. Once the stylus is outside your test sample move the stylus up using the "Down/Up" switch. Check the scribed line with the optical

microscope. THE ONLY MICROSCOPE ELEMENT YOU CAN SET IS THE FOCUS KNOB (see figure 2). Turn the focus knob until you have a good image. At this point do not worry if the crosshair in the microscope image does not match the scribed line. DO NOT ADJUST ANY OTHER PIECE OR SCREW IN THE MICROSCOPE UNIT. If anything seems wrong to you, contact a staff member.



Figure 2. Side view of the diamond scriber highlighting the basic controls of the unit.

- See how good the line looks. You want to have an even line without any outbreaks (too much force). You can increase/decrease the force by moving the stylus arm weight "VG" (see figure 2). Moving VG towards you adds more force (3 grams/division). Adjust VG if needed and make another line (see next step)
- 8. This step describes the standard way to scribe a line. With the stylus raised, push the table forward so that the stylus is outside the sample and closer to you than the sample. Drop the stylus with the "Down/Up" switch. Pull the stage slowly but at constant speed until the stylus crosses the length of the sample and is again outside the sample. Raise the stylus with the "Down/Up" switch and inspect the line with the optical microscope.

9. Once you are satisfied with the quality of the line, it is time to adjust the microscope crosshair so that it matches the scribed line. You do this by using two micrometer screws. Micrometer "ML" (see figure 2) moves the crosshair laterally with respect to the scribed line. Turn it until it matches the line. It might be possible that the line is slightly rotated with respect to the crosshair. To fix this use the micrometer "MC" (see figure 3), which rotates the sample very precisely (0.05°/div) with respect to the crosshair. Adjust ML and MC until the crosshair matches the scribed line.



Figure 3. Top view of the lower section of the diamond scriber.

- 10. Remove the test sample. Place your "real" sample and repeat step 8. You can scribe parallel lines spaced precisely using the digital caliper readout. **Remember to turn the digital caliper off once you are done with the tool.** To scribe perpendicular lines, rotate the stage 90° using handle "H" (see figure 3) until a v-shape notch in the stage sits on the notch lock (see figure 3).
- 11. Breaking: there are several techniques for breaking samples. If you need assistance with this step, contact a staff member to discuss the best method for your kind of samples. One method suited for small samples (~1x1 cm²) is to place a glass slide on a solid surface and then place the sample on the glass slide with a scribed line aligned to an edge of the glass slide. Using a filter paper hold the sample tight by pushing it down against the slide, then apply an uniform pressure on the hanging section of the sample until it breaks.





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Operation Manual

Diamond Scriber RV-129





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Setup

- 1. Connect the Vacuum port to a vacuum pump capable to achieve less than 200 mbar.
- 2. Pull the table to the front stop, place a test wafer or substrate on the chuck and turn the chuck switch "VW" to ON Position. The adjustment switch "VT" must be in "A" position. Move the chuck using the knurled screw "C" to a position, where the cut can be made.
- 3. Push the table to the rear stop and turn the adjustment switch to "S" position.
- 4. Slowly pull the table until the diamond toll drops in his lower position. The dropdown point can be determined by moving the control block with the knurled screw "AS2" forwards or backwards.
- Turn the micrometer screw "MB" clockwise until the diamond is lifted and then back until it touches the wafer surface. Turn counter--clockwise 5 divisions = 0.1 mm.
- 6. Move the weight "VG" toward the operator to adjust the scribing force (3 grams per division). To find out the optima scribing force increase the force step by step in small portions until a shallow, even and continuous groove without any outbreaks is achieved.
- 7. Turn on the microscope light. Turn the Allen screw "X" on the microscope stand until the cross hair is aligned with the scribed groove on the wafer.

Breaking

Draw on Latex – gloves. Take the scribed substrate or the wafer on the edge, where the groove ends with both hands between thumb and forefinger, thumbs underneath the substrates with thumb nails close on the substrate below the groove. Push with the thumbs and pull both hands apart simultaneously. Well-scribed substrate or wafer will break easily in a straight line.

Maintenance

1. Tool Replacement

The original ATV Diamond Tool has four cutting edges, numbered 1 to 4. Every edge can be used for more than 1000 meters of cut, if not broken e.g. because of a hit against a hard substrate edge. To use another edge open screw "A", turn the tool to the next No. and fix it again so, that the tip is 10 mm underneath the holder.



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2. Tool angular adjustment.

The original ATV Diamond Tool is adjusted for scribing 60° angle towards the substrates where the tool holder touches the upper stop. If a fine adjustment is necessary, open the screw "A" ¼ turn using an Allen wrench and adjust

with the micrometer screw "MA" –range \pm 7°, 1 division = 0.02°. Tighten the screw "A" again.

3. Adjustment of the scribing force:

Moving the weight "VG" the scribing force can be adjusted among 0 and 360 grams, 3 grams per division. For higher force the counterweight "GG" can be screwed together with the main weight "VG". In this case the scale corresponds to 0-900 grams -6 grams per division.

4. Adjustment of the tool lowering:

The up and down movement of the tool is provided by a vacuum operated cylinder. The knurled screw "B" determined the raised position. The tool does not touch the substrate.

The micrometer screw "MB" determined how far the tool is lowered below the touch-point. The tool should not drop more than 0.1 mm below the touch-point, else the diamond edge may break when hit against the substrate edge. The low-down speed can be adjusted using the throttle valve "D".

5. Optical adjustment of the scriber

Scribe a groove on any wafer. Adjust the microscope so that the vertical line of the ocular cross-hair covers the groove.

6. Adjustment of the front and the rear tool lift points:

The scribing tool can be automatically lowered when the table is moved forward or backward. In position "V" the tool drops when the table is pulled toward the operator. In position "R" it drops when the table is pushed away. This feature allows "toe" or "heel" scribing.

7. Substrate fixture:

The vacuum chuck is designed to hold round wafers or rectangular substrates. It can be lifted and installed up side down. The bottom side has rectangular channels to hold down substrates or strips. The screws on the chuck are provided for rough centering of wafers and substrates different sizes. Just turn the appropriate screws 1-2 turns counter clockwise to achieve stops.

8. Wafer adjustment

The attached wafer can be turned and slided for adjustment. The adjustment switch "VT" must be in "A" position during adjustment. Adjust first the angular alignment moving the table forward and backward. Turn the micrometer screw "MC" (0.05°/div.) until the substrate is aligned. Use the lever "H" to turn the chuck 90°. Set the digital readout to zero. Turn the adjustment switch "VT" to "S" while scribing.





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Ritzvorrichtung RV 129

Ritzdiamant-Auflagekraft F in [Centi Newton bzw. Gramm]

Gewichtpositionierung A: Für Ritztechnik



Skala auf Ritzdiamt in [cm]	Auflagekraft in [cN]
0	0
0.3	5 (Minimalkraft)
1	27
2	53
3	80
4	107
5	134
6	160
7	187
8	214
9	241
10 -	268
11	294
12	321



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Ritzvorrichtung RV 129

Ritzdiamant-Auflagekraft F in [Centi Newton bzw. Gramm]

Gewichtpositionierung B: Für Schabtechnik



Skala auf Ritzdiamt in [cm]	Auflagekraft in [cN]
0	112
1	166
2	224
3	280
4	336
5	392
6	448
7	473
8	498
9	523
10	548
11	572
12	581 (Maximalkraft)



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Legend:

- AS Set screw
- C Adjustable screw
- GG Counterweight
- H Lever
- MA Micrometer screw cutting angle
- MB Micrometer screw
- MC Micrometer screw rotation angle
- S Adjustment switch
- U Lever to be moved
- V Vakuum regulator
- VG Scrolling weight
- VT Valve
- VW Vacuum exhaust