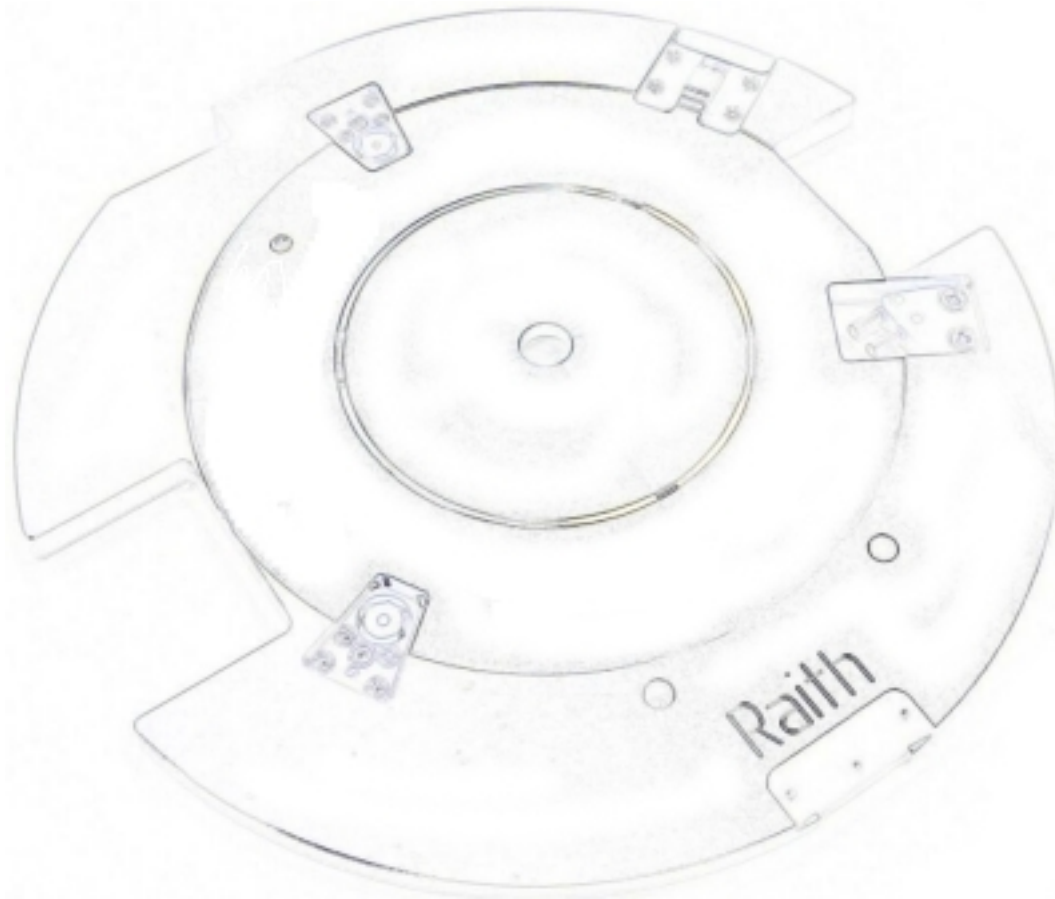


# Raith

Innovation from a world leader in  
e-beam lithography and  
semiconductor navigation solutions



## Operation Manual RAITH150 Sample Holders

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**Statement**

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# 1 RAITH150 sample holders

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The following Allen keys are needed to carry out the operation steps described in this sample holder guide.

**Table 1** Required Allen keys.

Allen key size	usage
0.9 mm	grub screw of kinematic mount
1.5 mm	countersunk head screw of kinematic mount
2.0 mm	sample holder transportation lock
3.0 mm	wafer holder case
5.0 mm	case for electrostatic chuck and mask holder case



Deactivate the transportation lock before uncasing the sample holder. For that unscrew the corresponding grub screw at the front side of the sample holder case.

Activate the transportation lock again in case of any transportation of the sample holder.

## 1.1 Pre-leveling

The Raith sample holder provides the possibility to pre-adjust the holder in aspect to the stage condition. This procedure allows the piezo height control system to perform a fine leveling of the sample holder. The described course of action has only to be done once after getting a new sample holder or in case of misalignment.

### STEP 1 ►

Load in the sample holder without any sample.

### STEP 2 ►

Center the piezos by pressing the [Center piezos](#) button on the [Leveling](#) tap at the [Height Control](#) module.

### STEP 3 ►

Switch on the beam by using 30µm aperture and 10 kV high tension.

### STEP 4 ►

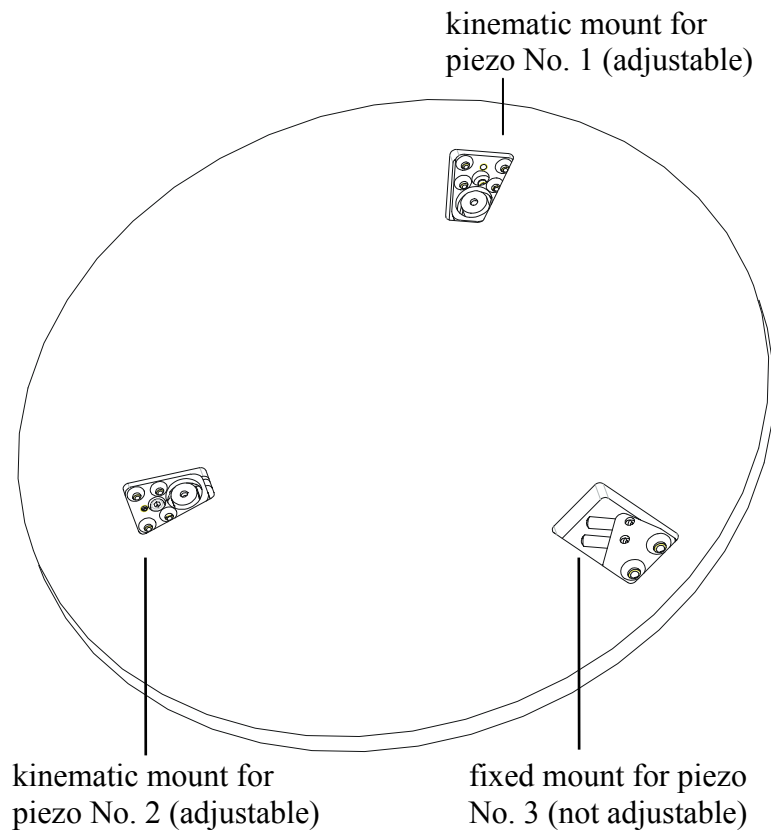
Measure the working distance  $WD_{Px}$  at the following positions:

$WDP_1:$        $\underline{X} = 20 \text{ mm}$      $\underline{Y} = -65 \text{ mm}$      $\underline{Z} = 19 \text{ mm}$

$WDP_2:$        $\underline{X} = 58 \text{ mm}$      $\underline{Y} = 25 \text{ mm}$      $\underline{Z} = 19 \text{ mm}$

$WDP_3:$        $\underline{X} = -58 \text{ mm}$      $\underline{Y} = 20 \text{ mm}$      $\underline{Z} = 19 \text{ mm}$

**Figure 1** General overview and definition of kinematic support points.



**STEP 5 ►**

Unload the sample holder.

**STEP 6 ►**

Calculate the necessary height modification  $\Delta WD_{P_x}$  by using the following formula:

$$\Delta WD_{P_1} = WD_{P_3} - WD_{P_1}$$

$$\Delta WD_{P_2} = WD_{P_3} - WD_{P_2}$$

If the absolute value of  $\Delta WD_{P_1}$  and  $\Delta WD_{P_2}$  is lower than 50  $\mu\text{m}$  no further leveling procedure is necessary. The following steps can be skipped.

**STEP 7 ►**

Calculate the necessary screw rotation  $R_{P_x}$  by using the following formula:

$$\Delta WD_{P_x} > 0 \quad R_{P_x} = \Delta WD_{P_x} / 0.169 \text{ mm}$$

$$\Delta WD_{P_x} < 0 \quad R_{P_x} = -\Delta WD_{P_x} / 0.133 \text{ mm}$$

**STEP 8 ►**

Modify the height of the kinematic mounts:

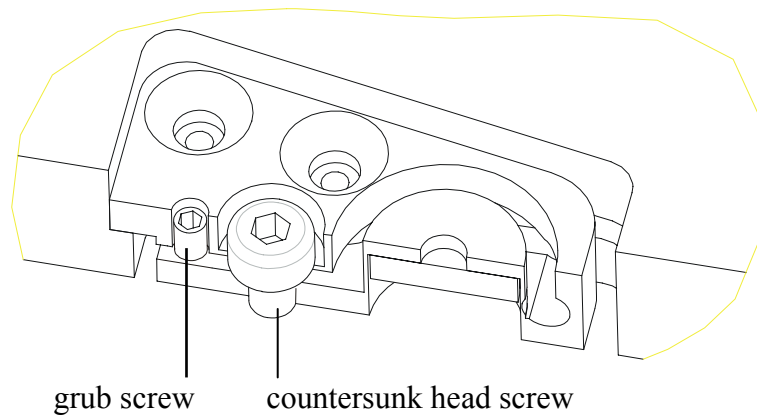
$\Delta WD_{P_x} > 0$  Loose the grub screw.

Rotate the countersunk head screw clockwise by  $R_{P_x}$  revolutions. Fix the grub screw again.

$\Delta WD_{P_x} < 0$  Loose the countersunk head screw.

Rotate the grub screw clockwise by  $R_{Px}$  revolutions. Fix the countersunk screw again.

**Figure 2** Cross section view of kinematic support point.



### STEP 9 ►

Load in the sample holder once again to check the result. Measure the working distance at the positions mentioned above. If the absolute value of  $\Delta WD_{P1}$  or  $\Delta WD_{P2}$  is still higher than 50  $\mu\text{m}$  repeat the pre-leveling procedure.

## 1.2 Sample insertion

The following chapter gives instruction how to place a sample on the sample holders. Read the instructions carefully before any operation.

Do never load in a sample the sample holder is not explicit designed for. Improper handling may result in damage of the sample or the sample holder itself. Further the Raith150 system may get damaged during the load procedure.

Use gloves when ever handling the sample holder to avoid contamination.

### 1.2.1 Universal sample holder



The maximum allowed sample height is 12 mm. Do never load in a higher sample. Otherwise the sample, the stage or the gun may get damaged during the load procedure.

The universal sample holder offers different ways to fix different sample sizes on the holder.

- To fix wafer pieces or whole wafers up to 4 inch use the clamps on the holder. Alternatively the sample can also be fixed directly on the sample holder surface by using a conductive tape or a

double-sided cleaving carbon pad. After removing the sample make sure remaining adhesive is fully eliminated.

- Up to three stubs can be mounted on the universal sample holder. For that use the specified pin hole and the corresponding edgewise grub screw to fix the stub holder.
- The additional frame on the holder can carry 10x10mm squared pieces of wafer. Use this frame to fix permanent used sample like a calibration sample. The frame has to be unscrewed when exchanging the sample.
- A further mechanism can be used to mount a sample under the following conditions. Loosen the screw to move the slider. Fix the slider with the screw after sample arrangement.

<b>maximum dimension</b>	<b>tilt</b>
20 x 10 mm	45 degree
20 x 7 mm	90 degree

### 1.2.2 Electrostatic chuck (option)

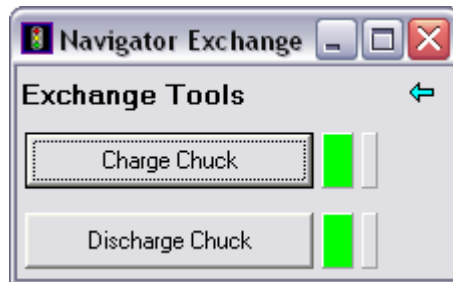
Some general hints for the electrostatic chuck handling:

- There is no fixed connection between the silicon disk and the metal frame. Be careful the disk is not falling out when handling the electrostatic chuck.
- Before placing a wafer on the electrostatic chuck make sure the silicon disk and the backside of the wafer are free from any particles.
- Do never touch the silicon disk barehanded.

The electrostatic chuck can handle 4, 5 and 6 inch wafer. Follow the instructions below to use the electrostatic chuck.

- STEP 1 ►** Open the sample holder case.
- STEP 2 ►** Adjust the grounding device with the clamp in aspect to the desired wafer size. For that unscrew the grounding device and place it by orientating by the signs on the frame.
- STEP 3 ►** Make sure the silicon disk is free from any particle or dust.
- STEP 4 ►** Make sure the backside of the wafer is free from any particle or dust.
- STEP 5 ►** Place the wafer on the electrostatic chuck. The flat has to be at the clamp position. Make sure the flat abuts fully on the specified lay-on edge. Do never use metal tweezers to place a wafer on the electrostatic chuck. Otherwise the passivation layer of the silicon disk may get damaged.

- STEP 6 ►** Put the electrostatic chuck into the load.
- STEP 7 ►** Close the load lock cover.
- STEP 8 ►** Open the navigator [Exchange Tools](#) (software version 3).
- STEP 9 ►** Press the button [Chuck charging](#) (software version 3).
- STEP 10 ►** Press the button [Charge chuck](#) and follow the given instructions (software version 3).



- STEP 11 ►** Now the electrostatic chuck can be loaded in.
- STEP 12 ►** When unloading the electrostatic chuck the wafer will be discharged automatically.



When ever attaching the silicon disk to the metal frame consider the following steps.

- Loose the two screws of the white plastic slider with the contact pin for the silicon disk.
- Put the slider back as far as possible.
- Attach the silicon disk carefully. Take care the structured size of the disk is upside. Further the disk has to be orientated in that way that the polished position at the border of the disk is located at the contact pin of the slider.
- Move the slider ahead till there is a certain contact between the pin and the disk.
- Fix the two screws of the slider.

When ever removing the silicon disk from the metal frame put back the slider back as far as possible first.



In case of serious contamination of the silicon disk remove the disk from the metal frame. Flush the disk intensely with isopropyl alcohol and dry it by using a compressed nitrogen pistol.

### 1.2.3 Mask holder (option)

Make sure the mask is within the range of the mask holder specification to avoid any damage of the mask or the mask holder.

**Table 2** Minimum and maximum Dimension for several mask plates.

mask holder size	minimum dimension	maximum dimension	maximum thickness
4 inch	100.84 mm	101.60 mm	2.30 mm
5 inch	126.34 mm	127.00 mm	2.30 mm
6 inch	151.64 mm	152.40 mm	6.35 mm

Each clamp corresponds to a certain mask thickness. Do not use a mask with a thickness the clamp is not designed for. If you want to use a different mask thickness, contact Raith directly or your local representative.

Follow the instructions below to use the mask holder.

- STEP 1 ►** Open the sample holder case.
- STEP 2 ►** Make sure the clamp fits to the mask thickness and loose the screw of the clamp.
- STEP 3 ►** Make sure the backside of the mask is free from any particle or dust.
- STEP 4 ►** Place the mask on the mask holder.
- STEP 5 ►** Push the mask carefully against the three metal cylinders to get the right position.
- STEP 6 ►** Tighten carefully the screw of the clamp to contact the mask surface with the sample holder.
- STEP 7 ►** Put the mask holder into the load lock.
- STEP 8 ►** Close the load lock cover.
- STEP 9 ►** Now the mask holder can be loaded in.

### 1.2.4 Wafer holder (option)

Make sure the wafer is within the range of the wafer holder specification to avoid any damage of the wafer or the wafer holder.

Follow the instructions below to use the wafer holder.

- STEP 1 ►** Open the sample holder case.
- STEP 2 ►** Rotate the turning knob clockwise as far as it will go.
- STEP 3 ►** Place the wafer on the holder. The flat should be placed at the two corresponding lay-on sockets.



- STEP 4 ▶** Rotate the turning knob carefully anti-clockwise till the clamp touches the wafer.
- STEP 5 ▶** Put the wafer holder into the load lock.
- STEP 6 ▶** Close the load lock cover.
- STEP 7 ▶** Now the wafer holder can be loaded in.

### 1.2.5 Rotation tilt module (option)

The maximum sample size is about 20 x 30 mm. Use the clamps to fix the sample on the rotation disk.

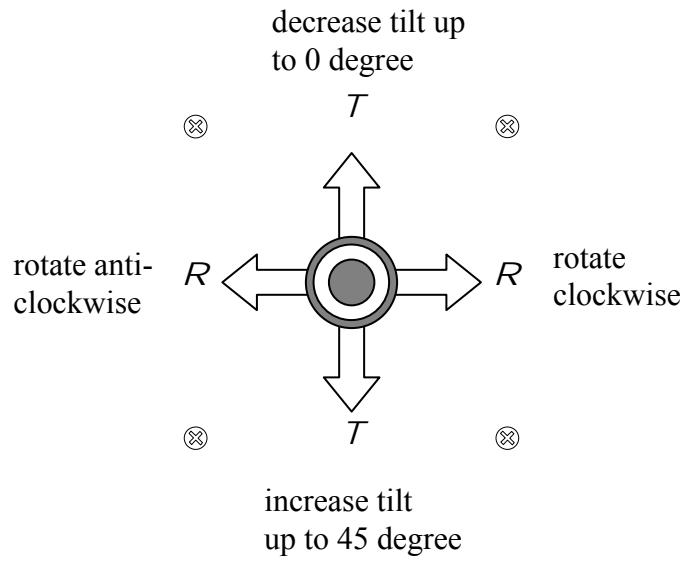


Whenever driving the tilt or Z axis of the stage be sure this movement is possible without crashing into the gun. Observe the movement via CCD camera.

Follow the instructions below to use the rotation tilt module.

- STEP 1 ▶** Open the rotation tilt module case.
- STEP 2 ▶** Fix the sample by using the slider.
- STEP 3 ▶** Put the rotation tilt module into the loadlock.
- STEP 4 ▶** Make sure the R/T module joystick is connected correctly with the motor controller and the power supply. Leave it turned off.
- STEP 5 ▶** Load in the rotation tilt module.
- STEP 6 ▶** Turn on the joystick. Now the rotation tilt module is ready for operation.
- STEP 7 ▶** Use the turning knob to adjust the desired rotation and tilt speed. Clockwise knob rotation increases the speed. The flashing frequency of the green LED indicates the speed.
- STEP 8 ▶** The rotation and the tilt can be controlled simultaneously.

**Figure 3** Description of the R/T module joystick.



Do never unload the rotation tilt module without driving the tilt back to zero. Otherwise a fatal system crash is for sure.