Cleaving-tool automatic

Type WACU.S2A.03

Operation manual/Device documentation

Version: WACU.S2A.03-BH V0

This manual serves for information purposes only. We reserve the right to make changes at any time. Q-tec is not liable for direct or indirect damages resulting from using this manual or in connection with this use.

The present manual is based on the current state of the device development. The manufacturer reserves the right to make technical changes and software extensions. The manual will be amended accordingly.

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1. Function

The cleaving tool WACU.S2A.03 is designed for cleaving wafers in crystal direction. The device can be configured for 6, 8 and 12 inch wafers. The crystal direction must be marked on the wafer. The cleaving process is fully automatic after the crystal has been aligned in the tool. The two halves can be removed after the cleaving process.

1.1 Measurement site WACU.S2A.03

The cleaving tool consists of the following main components:

- Cleaving tool with interchangeable components for various wafer diameter.
- Electronic housing with servo-control for drives
- PC, screen, keyboard and mouse for control and operation.
- Connection cables for various components.

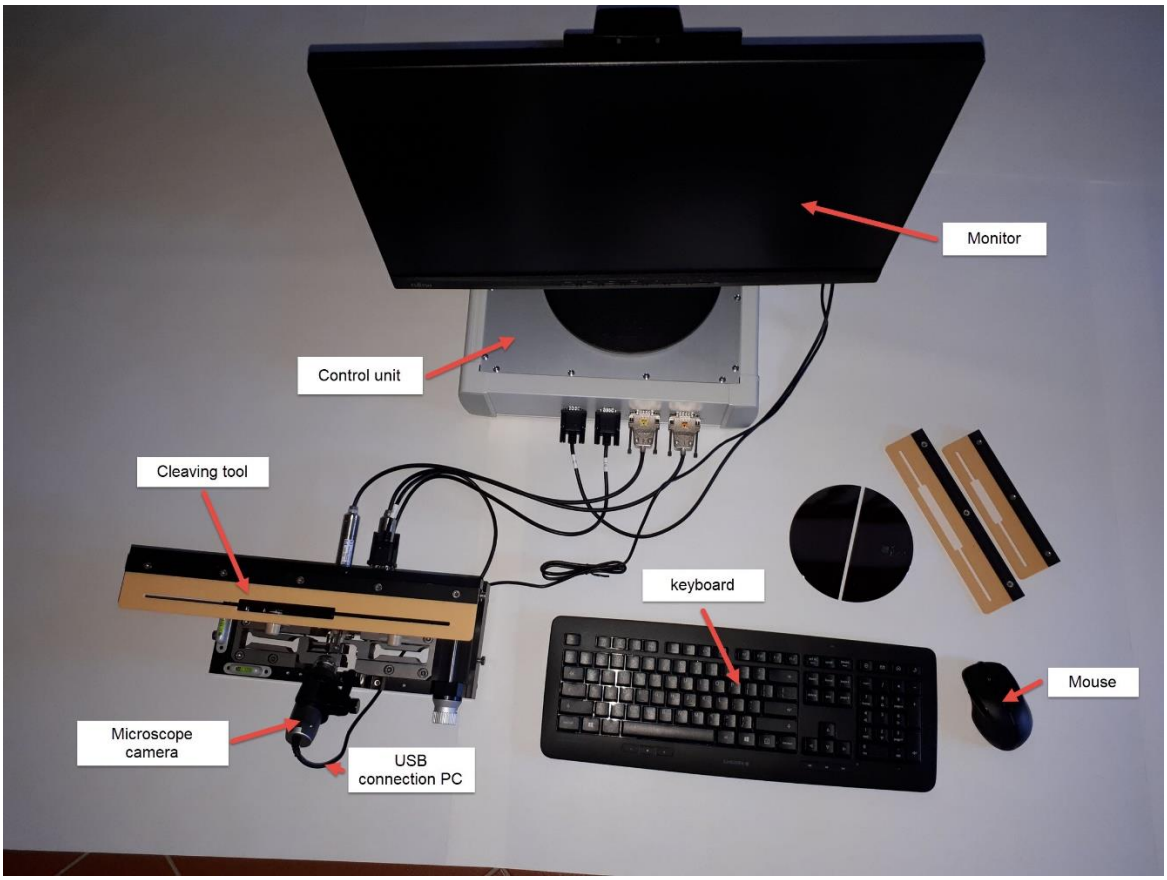


Image 1

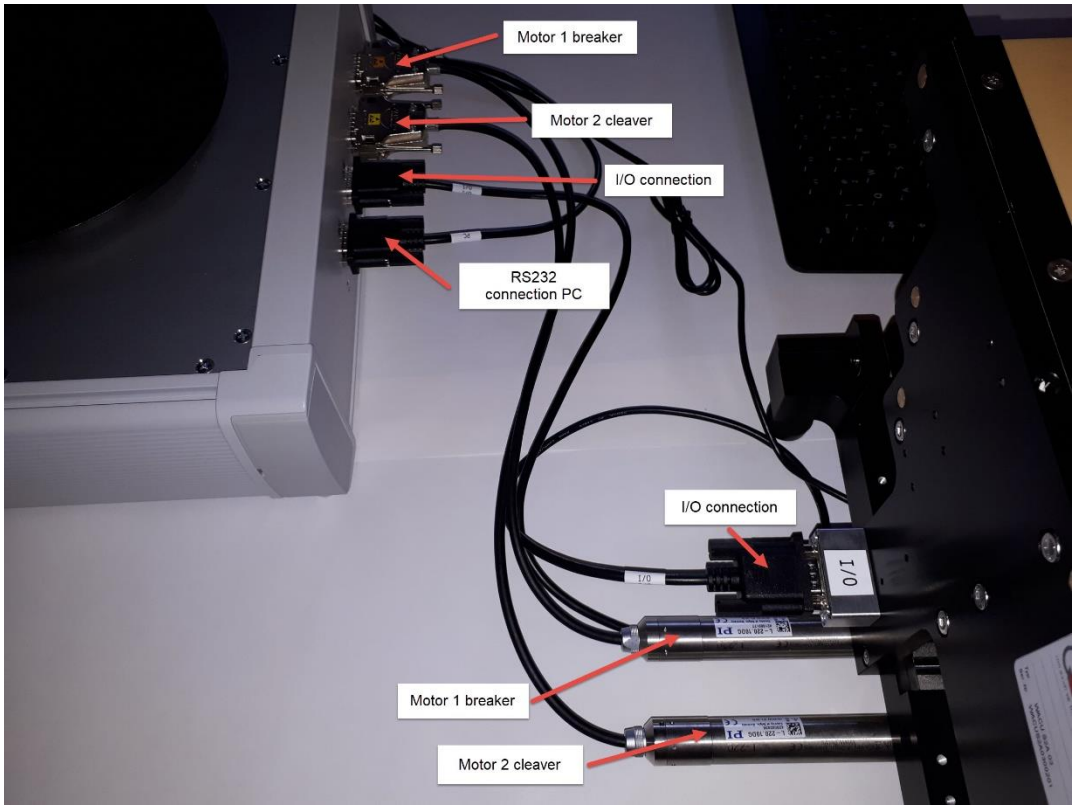


Image 2

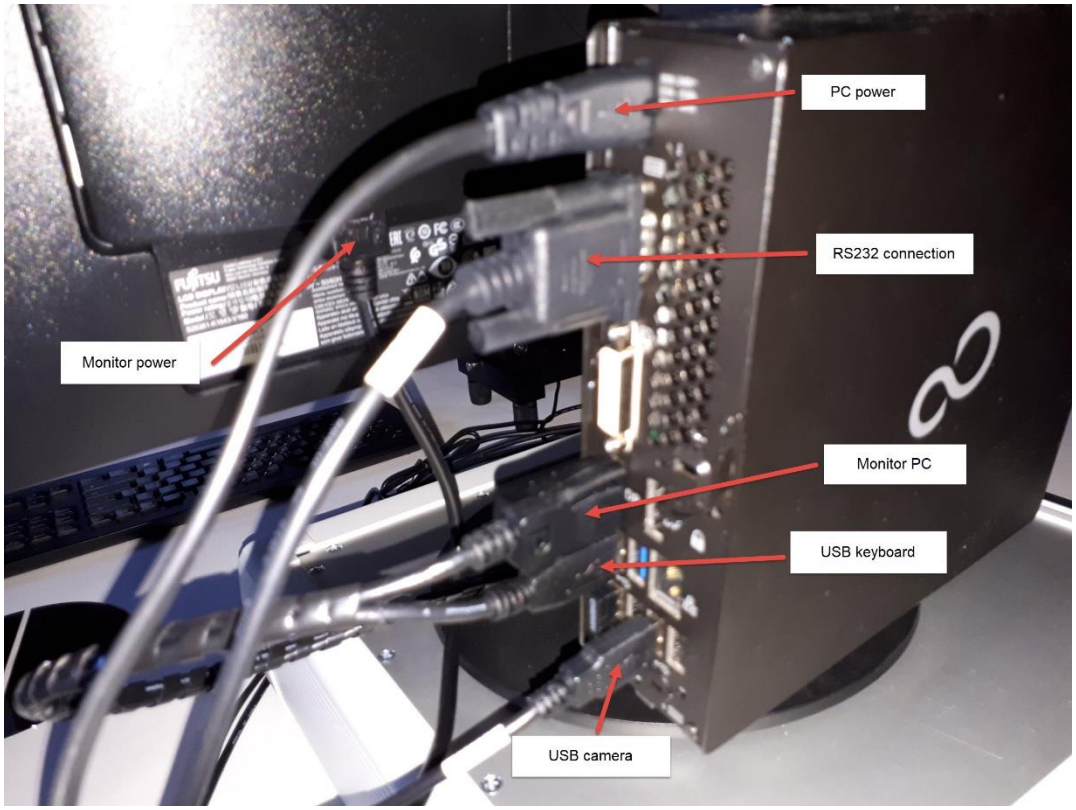


Image 3

1.2 Technical data SWM.01

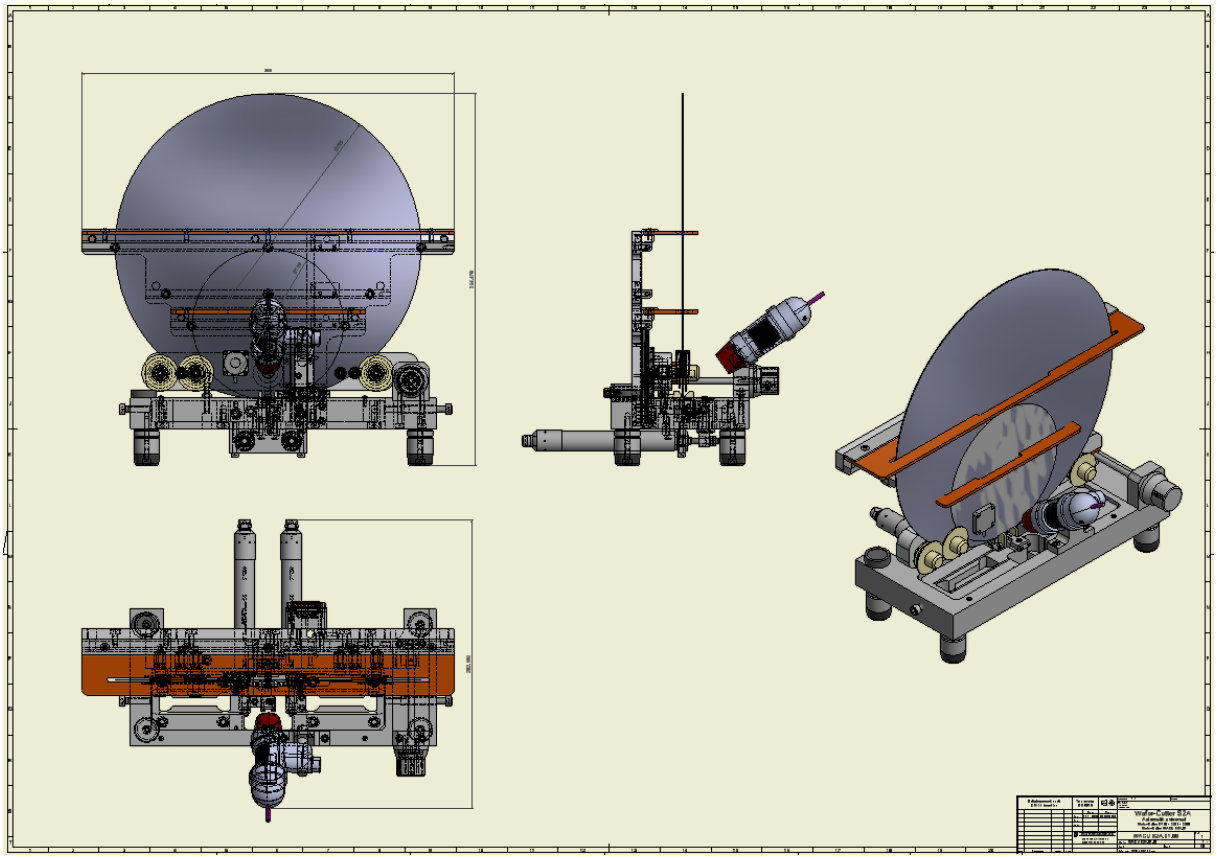


Image 4

Dimension:
W x D x H = 800mm by 800mm by 600mm

The unit is designed to be placed on a table.

Power electronic with servo drive: 1A/90-240 V AC (90 ~ 164VAC, 47 ~ 63 Hz)
Power control PC: 100-240 V AC / 1.5-0.8 A
Screen: 100-240 V AC

Connection electrics:

Voltage	240 V
Power line frequency	50/60 Hz
Power connection	TN-S power, L, N and PE
Connection type	3 x Cold appliance plugs

1.3 Process requirements

Device parameter:

- Wafer cleaver for 6, 8 and 12" wafers in crystal direction
- Wafer thickness range 0.35 to 1.0 mm

Environmental parameter:

- Suitable for use in clean room
- Room temperature 22°C ±5°C
- Relative humidity 5% - 60% non-condensing
- Ambient air free of aggressive media (risk of corrosion)

1.4 Risk assessment - Evidence documentation (EN ISO 12100:2010)

The device complies with the CE Machinery Directive 2006/42/'EC
(For evidences see Appendix C)

2. Safety instructions / Installation / Commissioning

Caution! Read the instruction manual before commissioning

2.1 Safety instructions

Observe the safety instructions on the meter:

Warning of dangerous, electrical voltage
In the workroom, marked this way, only persons who own the necessary expertise (qualified electricians or persons trained in electrical engineering) are allowed to carry out work.

2.2 Installation

The cleaving tool is delivered with complete necessary components and operating instructions.
The cleaving tool contains highly sensitive electronic and mechanical components and must not be subjected to any major vibrations in transport.

Caution:

Check the unit components for transport damages!

Connect the unit to properly earthed sockets only!

Housing parts must be removed by a specialist only!

Procedure:

2.2.1 Take out the cleaving tool with accessories from the transport packaging.

Check components and packaging for damages.

2.2.2 Place the tool on a suitable table.

Level the cleaving tool with the supplied vials or a suitable spirit level respectively, by adjusting the height of the device feet to a horizontal operating position.

2.2.3 Connection of the unit components:

2.2.3.1 Control PC with display and keyboard (control terminal):

- The control PC is attached to the rear of the display. The control PC is connected via a cold appliance socket to the power supply.
- The display is connected via a cold appliance socket to the power connection.
- The keyboard and mouse are operated wireless via radio.

2.2.3.2 Connection of the servo-control, microscope-camera and I/Os:

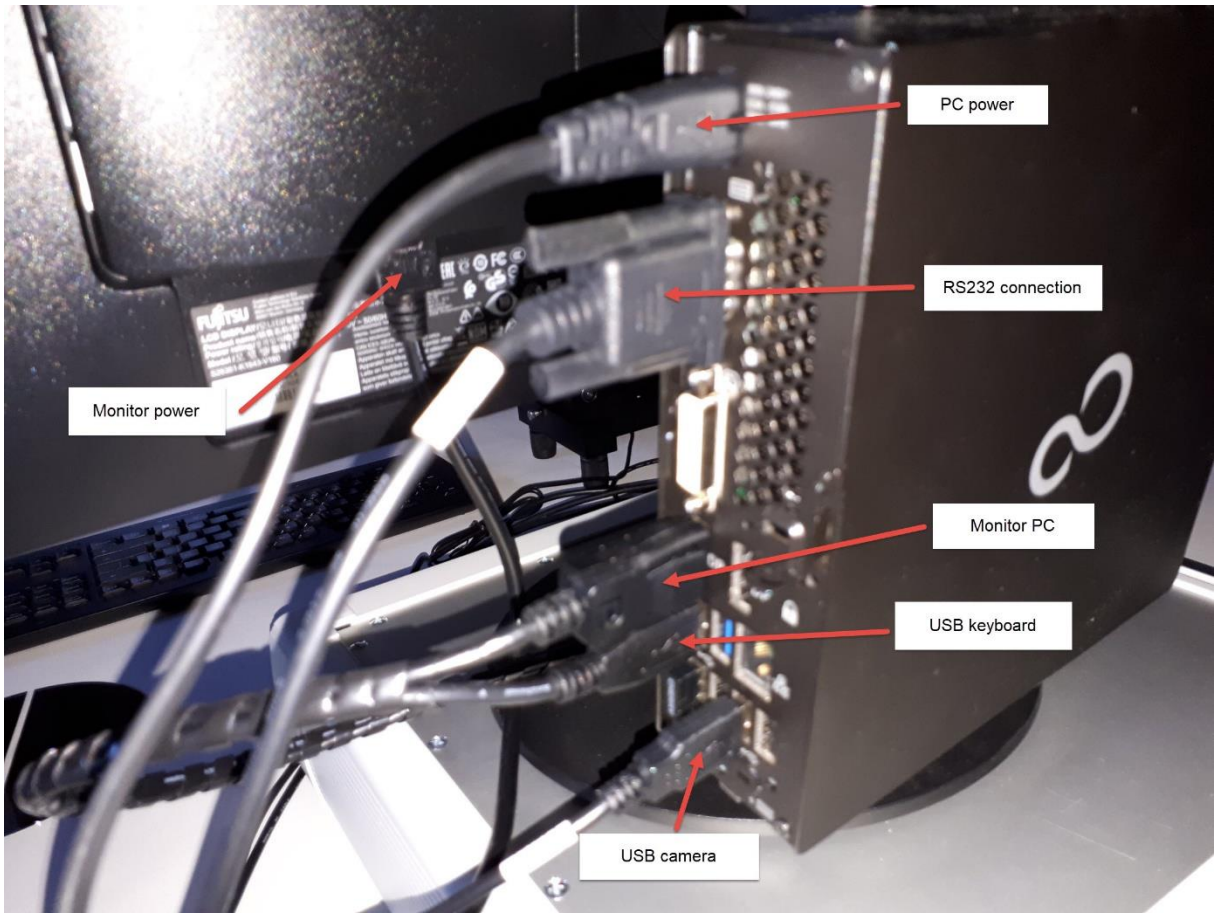


Image 3

The unit control is also connected via a cold appliance connection with fuse insert to the voltage supply.
The two servomotors are connected directly to the servo controller according to the plug marking.
The microscope-camera is connected via the USB cable to the control PC.
The IOs to monitor the wafer sizes and wafer thickness measurement are connected via a 9-pole D-SUB cable to the control.
See image 1 page 6

2.3 Commissioning

The cleaving tool consists of following components:

- Display and control PC with keyboard and mouse
- Cold appliance cable for the control PC
- Cold appliance cable for the display
- HDMI cable display
- Keyboard with USB-controller-plug and mouse

- Cleaving tool with three wafer-catch elements for 6, 8 and 12" wafer
- Servo-control for the two drives
- I/O cable for control
- Cold appliance cable for control
- Two motor cables from the servo-control to the motors
- RS232 cable to connect the servo-control to the PC via USB converter
- D-Sub 9-pole cable to connect the I/Os to the control
- Microscope-camera with USB cable for connection to the control PC

- Software to control the cleaving tool

The cleaving element of the cleaving tool is correctly positioned on delivery.
The cutting edge of the cleaving element must move exactly towards the center of the backward stop pin of ceramic.

The correct position can be checked as follows:

- Tuck the two insert rollers to the outer position of the pivot bearing (12" wafer position).
- Clamp the wafer catch-element for 12" wafers to the uppermost support position.
- Set the wafer carrier with the insert rollers on the rotary wheel to the upper position and insert the 12 “wafer.
- Turn the wafer carrier to the lower end position
- Push the wafer cleaver by hand onto the wafer surface
- The wafer must now stand in the gap of the wafer catching element parallel to the slot and must not touch the edge of the slot.
  If this is the case, the lateral position of the wafer cleaving element is correctly set.
  If the position of the cleaving element not correct, please carry out the setting according to the instruction in chapter 4.1.3.

Establish cable connections:

- Connect the control-PC to the power supply.
- Connect the display to the control PC via an HDMI-cable.
- Connect the display via the cold appliance plug to the power supply.
- Switch on the keyboard and mouse (connect the USB-controller keyboard to the USB-port control PC).
- Connect the control PC with the RS232 cable / USB-converter to the servo-control.
- Connect the controller to the power supply.
- Connect the cleaving tool motors via two D-Sub 26-pin cables to the servo-control.
- Connect the I/Os cleaving-tool via the 9-pin D-Sub-cable to the control unit.
- Connect the microscope-camera via a USB cable to the control PC.

Level the cleaving tool with the help of vials/spirit level on the work table to ensure the load free cleaving of the wafer. The setting can be made at the feet of the cleaving tool.
Set the cleaving tool to the desired wafer diameter (wafer-catching element and insert rollers).

The cleaving process is automated and computer controlled. The cleaving tool automatically recognizes for which wafer size the cleaving tool is configured. The cleaving process is started via the control PC.

To commission the WACU.S2A.03 cleaving tool the following essential steps are necessary:

1. **Switch on the power supply.**
2. **Configure the cleaving tool according to the wafer size.**
3. **Insert, align and lower the wafer.**
4. **Start the cleaving function via control PC.**
5. **Remove both wafer halves after the automated cleaving process.**

3. Operation / Function

3.1 Application Procedure

- Set the cleaving tool to the desired wafer diameter (wafer-catch element and insert rollers).
- Turn the wafer carrier with the insert rollers to the insert position (upper end position) using the turning button.
- Place the wafer into the catch element of the cleaving tool and turn the wafer into breaking position (marked crystal direction). The position can be set via the indication on the display.
- Lower the wafer carrier again.
- Start the cleaving process via the software menu navigation (the wafer size is recognized automatically).
- The cleaving process is automatically controlled by the software.
- Take out the cleaved wafer from the catch element again.

3.2 Control measures

- Check sporadically whether the wafer does not touch the gap of the catch element during the cleaving process.
- Wear of the cleaving wheel can be recognized by the result of the cleaving quality.
- The exchange or rotation of the cleaving wheel is described in Section 4.1.3.

4. Maintenance / Service

4.1 Maintenance work

4.1.1 Safety instructions for maintenance

Service and repair work must only be carried out by the manufacturer or trained specialist personnel.

4.1.2 Maintenance Cleaving Tool

Silicon splinters are produced during the cleaving process. These accumulate at the cleaving point.
These splinters should be removed at regular intervals.

4.1.3 Adjustment of the cleaving element

The cleaving element consists of a carrier with the cleaving wheel. The cleaving wheel is clamped in the carrier with a screw. After loosening the screw, the splitting wheel can be turned and the worn part of the cutting edge can be replaced. If the cleaving wheel is completely worn out, the entire carrier element with the cutting edge can be exchanged.
To do this, the worn support element is unscrewed and a new element is inserted. In order for the setting positions of the cleaving tool to remain correct, the rear stop of the carrier element must rest against the fastening flexure bearing. The new element is fastened again with a screw.
To check, configure the cleaving tool for 12" wafer, insert this wafer into the cleaving element and lower the wafer into cleaving position. Then push the cleaving element forward by hand towards the wafer until the wafer is fixed between the ceramic stop pin and the cleaving wheel. The wafer should then stand plane-parallel to the cleaving edge of the catch element. If this is not the case, the cleaving wheel must be moved sideways so that it moves absolutely towards the center of the ceramic pin.

Adjustment of the cleaving wheel to the center of the ceramic pin:

The cleaving wheel is fixed to the left flexure bearing. To adjust the cleaving wheel, the complete flexure bearing with the screwed-on cleaving wheel must be moved sideways.
In a first step, the stop screw on the left is turned as much that it is in contact with the flexure bearing in order to have a reference value of the starting position.
Now the fastening screws (4 pieces) must be slightly loosened (the position of these screws is - at the bottom next to the adjustable feet on the first device and reachable from above on the other devices). Depending on whether the flexure bearing has to be moved to the left or to the right, this stop screw can be turned forwards or backwards. The flexure bearing is pushed to the stop screw and tightened again slightly. A test as described above shows whether the correct position has been reached. If this is not the case, the process has to be repeated.
Finally, the fastening screws of the flexure bearing are tightened again.

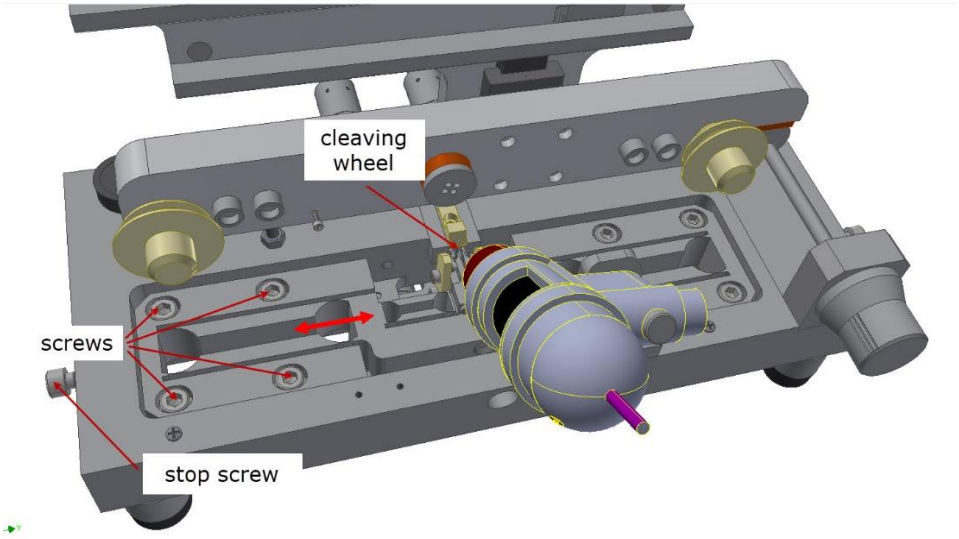


Image 6

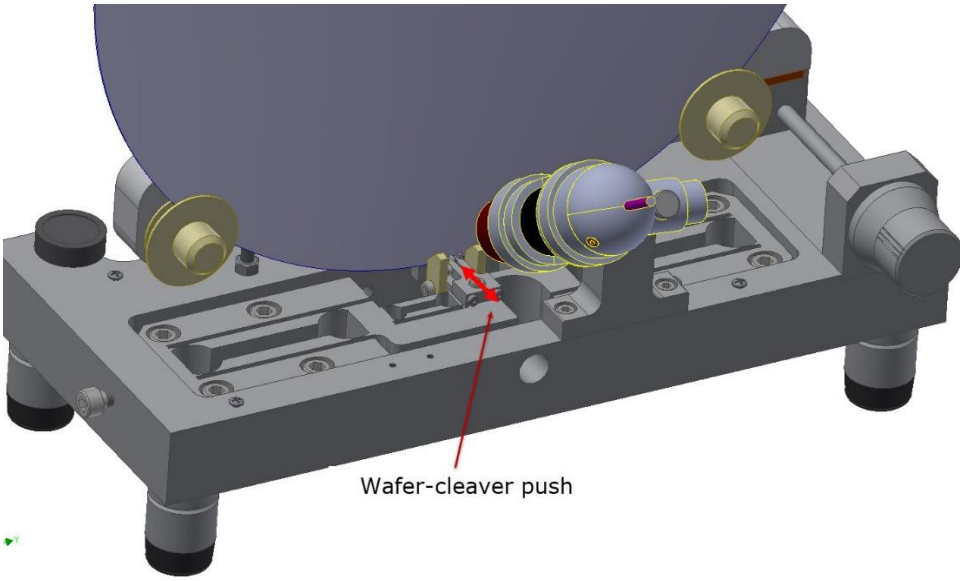


Image 7

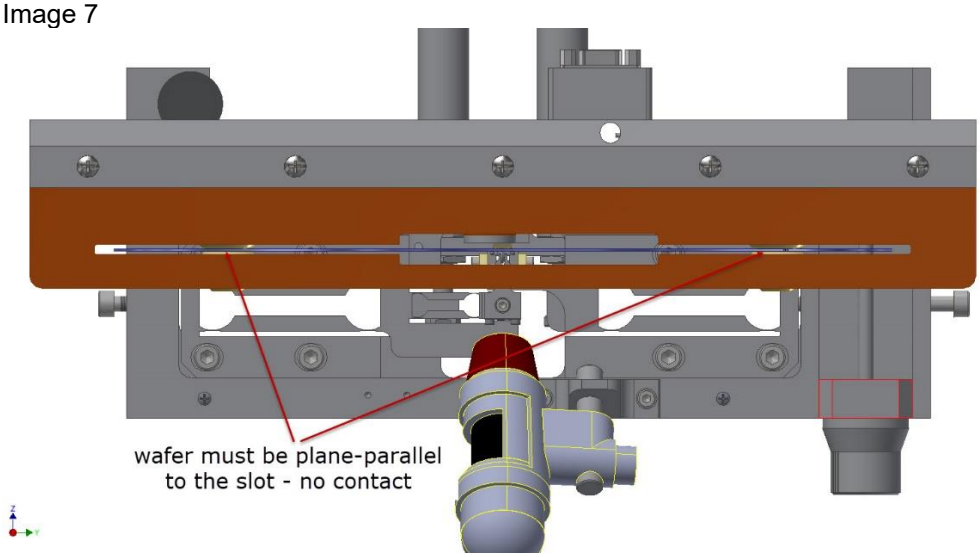


Image 8

4.1.3 Setting the quality of the break line - parameter description

In order to achieve optimal crushing results, it may be necessary to adjust the parameter of the crushing process. These are stored in the file system in the form of XML files and can be edited with a text editor. The default folder is ./param/actuator.xml.

Please note that incorrect parameter sets
can lead to the destruction of components.

Parameter description

C:/Qtec/WafCat2Ui/conf/actuator.xml.

TransitVelocity [µm/s]:
Describes the speed with which the scoring wheel or the two break pins are moved outside of breaking attempts. Typically, this size has no influence on the crushing result.

CutVelocity [µm/s]:
Describes the speed at which the wafer is notched.

BreakVelocity [µm/s]:
Describes the speed at which the actual breaking process of the wafer takes place.

DepthOfPenetration [µm]:
Describes the depth of penetration into the wafer during the notching process.

CutterParkingPosition [µm].
Describes the parking position of the scoring wheel of the wafer surface. Typically, this size has no influence on the crushing result.

BreakerBreakPositionFromPositiveMax [µm]:
Describes the position that is approached in order to break the wafer. This position is approached with the speed set in the "BreakVelocity" parameter. This value is measured from the positive end position and is typically 13450 µm.

BreakerParkDistanceFromBreakPosition [µm]:
Describes the parking position of the two breaker pins measured from the breaker position. Typically, this size has no influence on the crushing result.

4.2 Spare parts

Standard spare parts for the cutting-angle-measurement unit:

Carrier with cleaving wheel

5. Error treament

Procedure in case of errors:

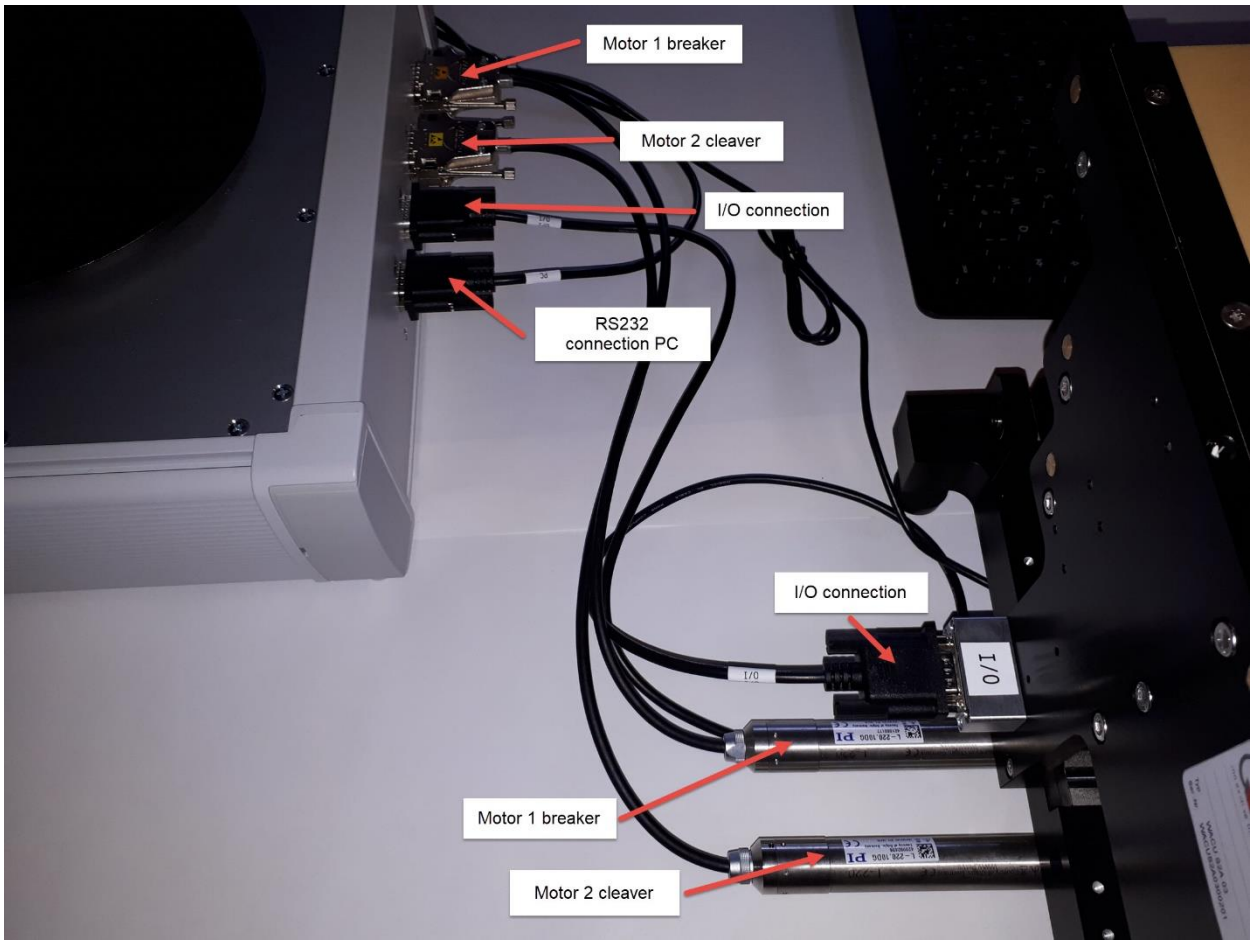
1. **Notify Siltronic Maintenance**
2. **Notify Q-tec about errors**
3. **Troubleshooting (possibly via telephone support, technician deployment)**

6. Options

6.1 Accessories

6.2 Interfaces (PC, printer, host; ...)

6.3 Software modules



7. System Components

8. EMSR-technology

Appendix A

Technical specifications

Appendix B

Access authorizations

Appendix C

Evidence documentation Risk assessment

Appendix D

Measurement examples

Appendix E

Data of Lubricants

None