Finetech Lambda Flipchip Bonder Operations

Finetech Lambda is a die bonder with sub-micron placement accuracy for fine pitch devices. Some applications are - flip chips and flip chip assemblies, optoelectronic components, micro electromechanical systems (MEMS), micro optoelectronic mechanical devices (MOEMS), sensors, bare chips, surface mounted devices etc.

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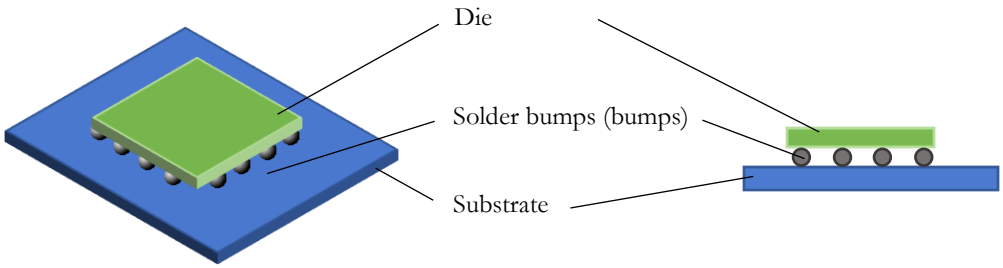
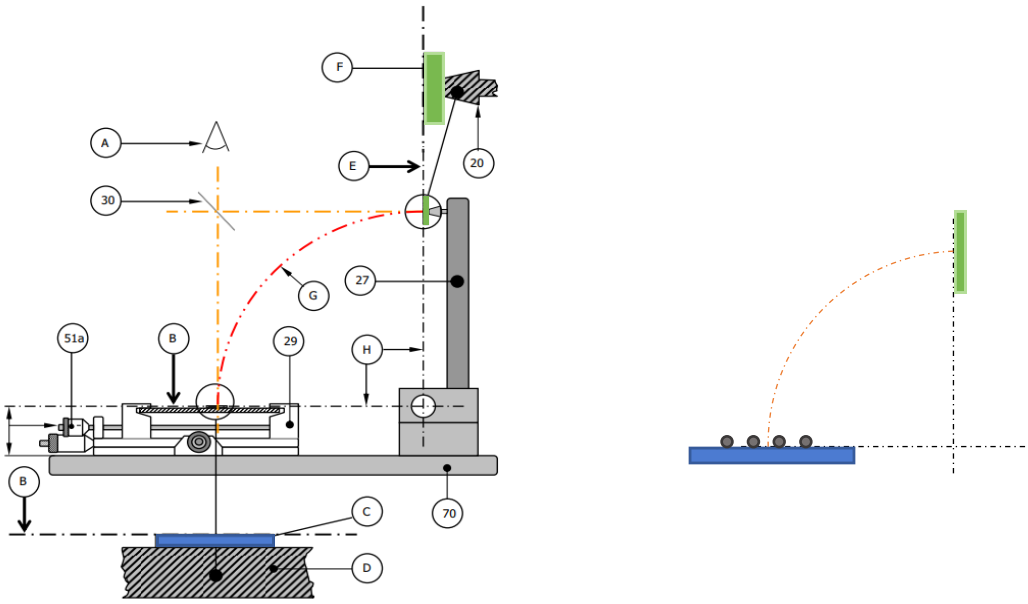
Terminologies



Working principle



The key capability of the flipchip bonder is to align (in *x*, *y*, and *z*) between the die and the substrate. The main components of the tool are a table that holds the substrate and can be adjusted in *x*, *y* and *z* directions, and a movable arm that holds the die.

x and *y* alignment is done with a beam splitter (**component 30** in the illustration above), which optically overlays the images from the substrate and the die to show the relative position between the two surfaces. By moving the table, the substrate can then be aligned to the die.

z alignment is achieved through positioning the bonding surfaces of the die and the substrate in the same plane when the movable arm is lowered. The plane is designed to be the focal plane (**plane B above**) of the camera that observes the two surfaces. The substrate is brought into the focal plane by adjusting the *z* height of the table so that the bonding surface appears in focus on the camera.

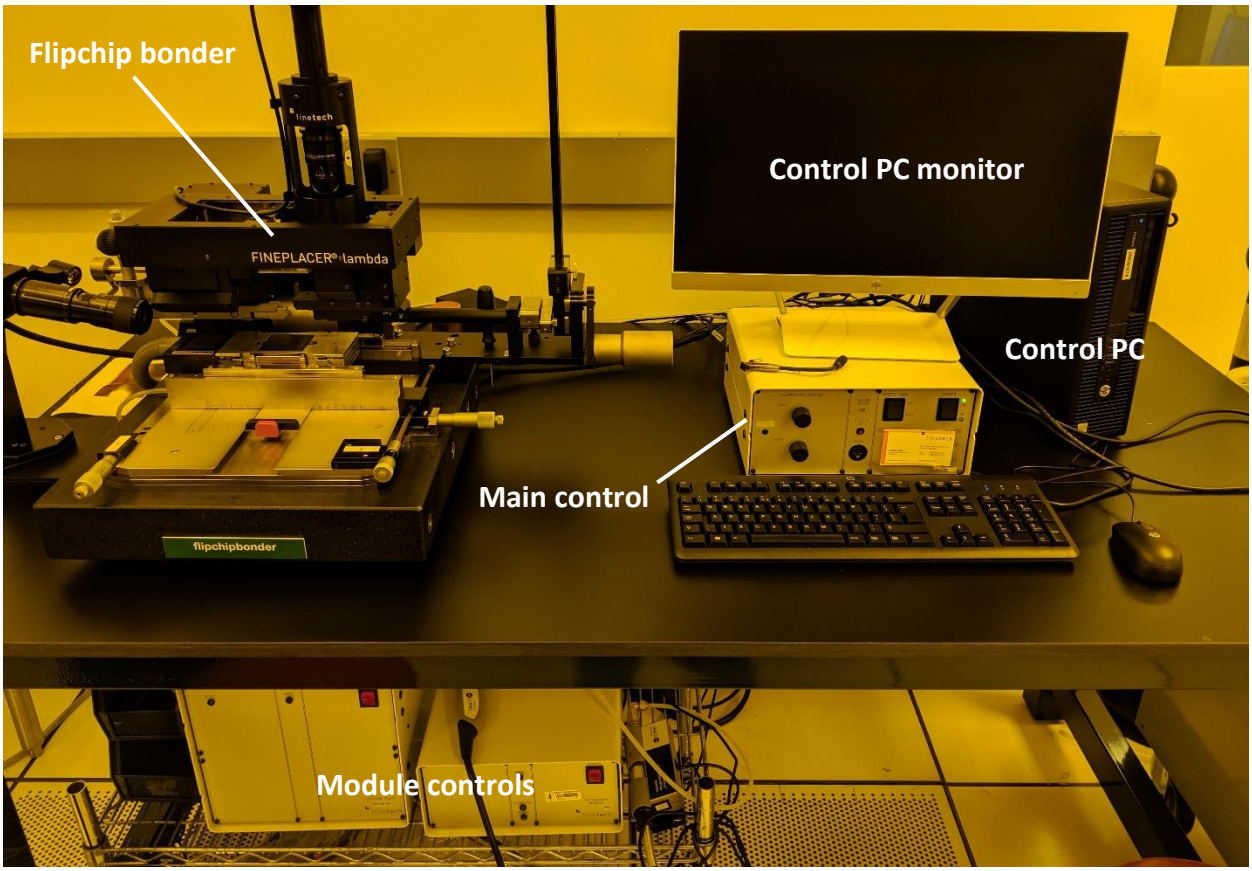
The die is brought into the focal plane by positioning the bonding surface of the die in the **plane E** shown above, so that when the force arm is lowered the bonding surface will be in **plane B**. Aligning the die with plane E is achieved through the 22-mm requirement, which is shown in detail in **Section A and C** of **Operation procedure.**

Tool Capabilities

1. Types of bonding process
    a. Contact and heating
    b. Contact and ultrasound
2. Substrate sizes
    a. 50mm x 50mm heated substrate plate –
        i. Maximum substrate plate temp 400°C
        ii. Maximum heating ramp rate 20°C/sec
    b. Heated 100mm round substrate plate
        i. Maximum substrate plate temp 400°C
        ii. Maximum heating ramp rate 6°C/sec
3. Die Pickup Tool
    a. Heated die pickups
    b. Vacuum die pickups
4. Force Module (interchangeable)
    a. 0-20N
    b. 0-100N
5. Inert Gas Chambers- Contact staff for gas options/ connection
    a. Dimensions of opening – 16 mm x 26 mm and 6 mm x 8 mm
6. Ultrasound Module
7. Gap Adjustment Module
8. Fume Collection
9. Gel Pack Module

Tool components

Flipchip bonder: this is the functional

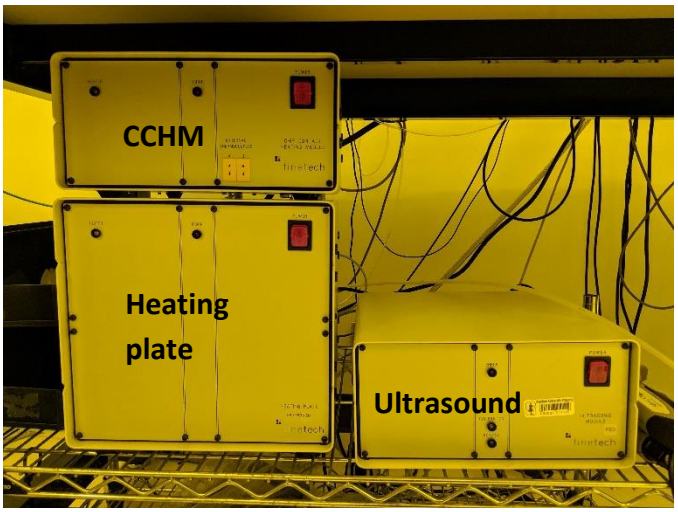


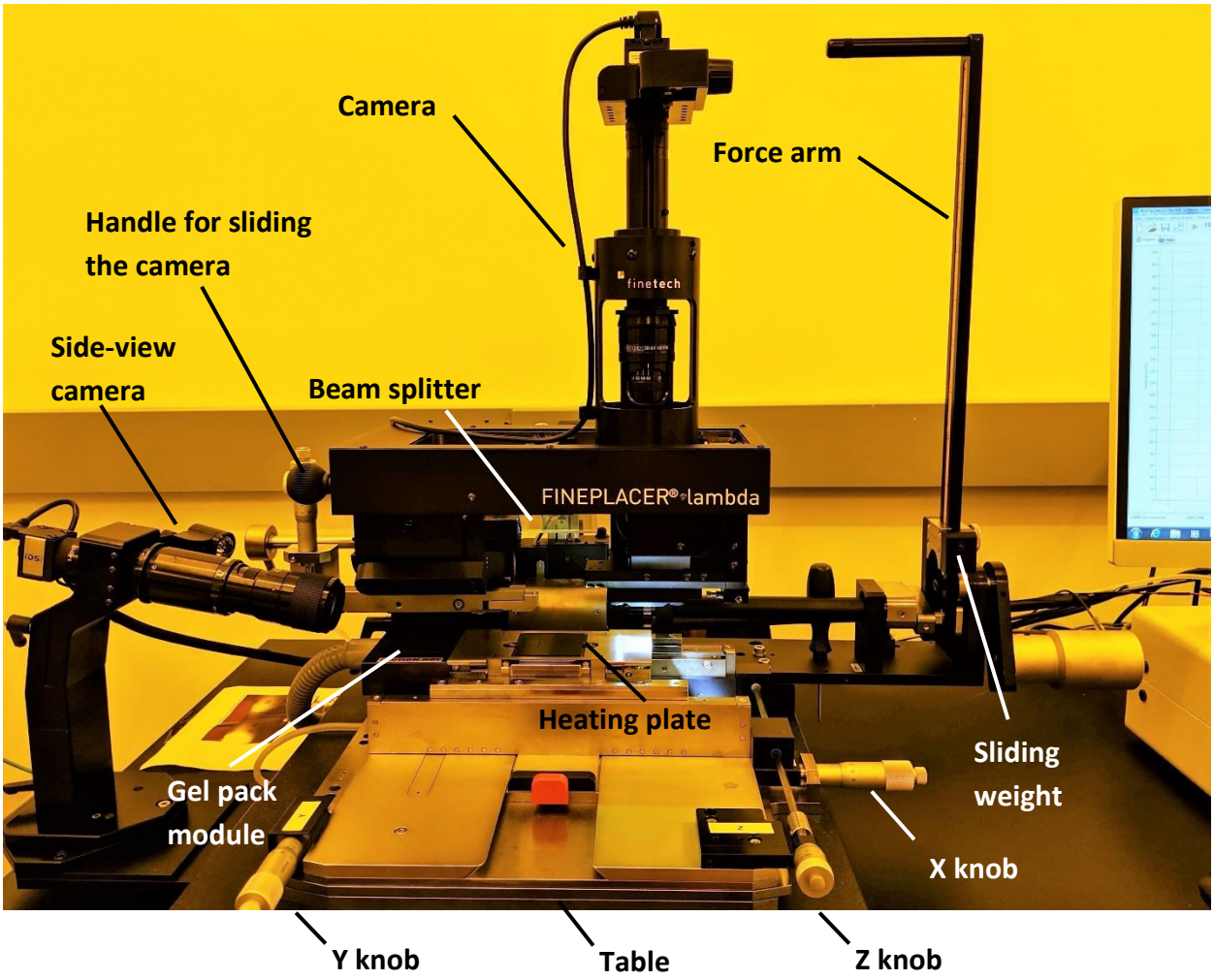
component of the tool

Control PC: bonding process is edited, controlled and monitored by the control PC

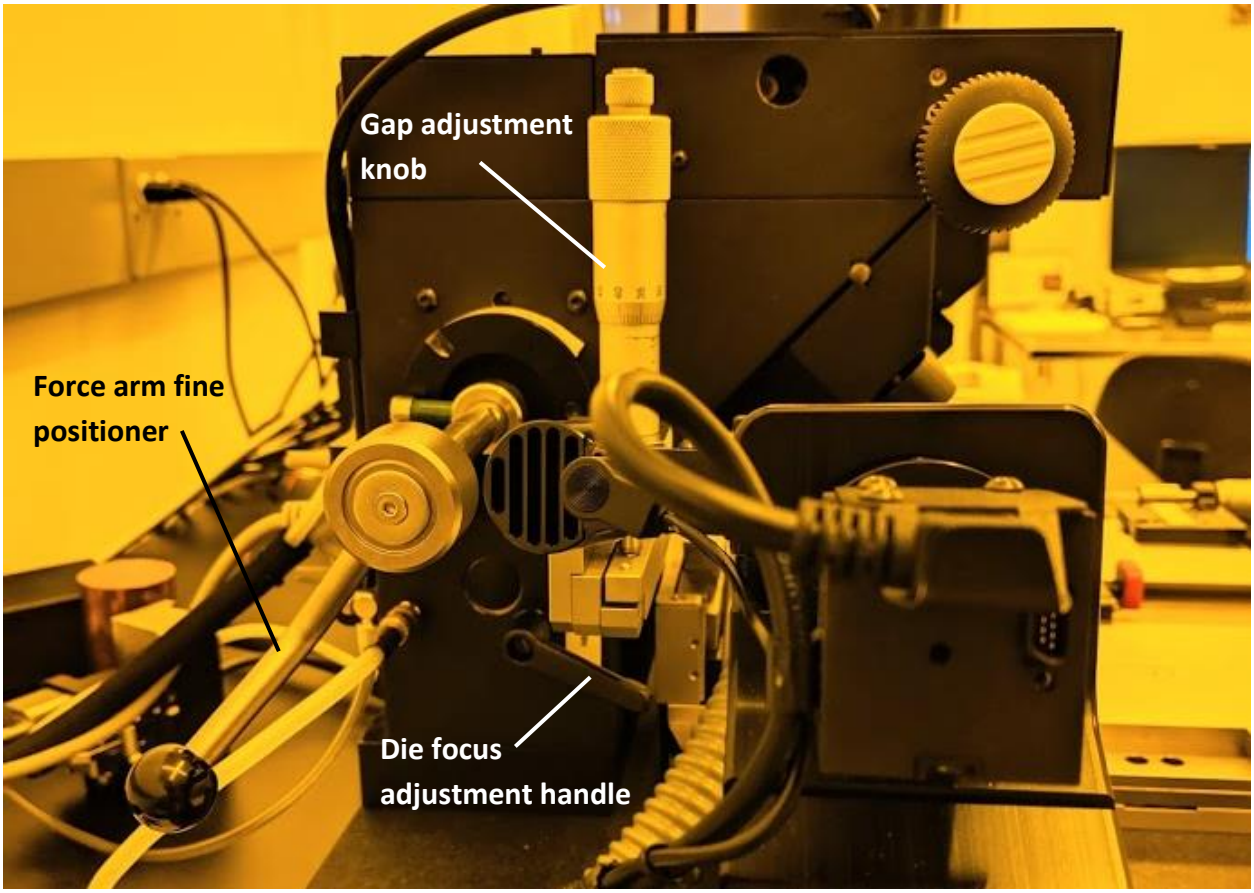
Main control: this can be treated as the main power switch for the flipchip bonder

(right) Module controls: the three modules (heating plate, chip contact heating module—CCHM, and ultrasound module) of the tool are individually controlled by each of the three module controls here.





On the floor: two pedals that control the head vacuum and air cushion for floating the table


Gap adjustment knob
Force arm fine positioner
Die focus adjustment handle

Beam splitter: combines and reflects the image from the surfaces of the substrate and the die.

Camera: images the optically combined surfaces (by the **beam splitter**) of the substrate and the die.

Die focus handle: adjusts the focus of the die.

Fine positioning arm:

Force arm: places the die onto the substrate and applies a compressive force that is adjustable by the **sliding weight**.

Force arm fine positioner: lowers or lifts the force arm by a small amount when it is in horizontal position. This is used to prevent hard impact when the die is brought into contact with the substrate.

Gel pack module: can be used for holding flux gel that needs heating

Heating plate: holds and applies heat to the substrate.

Side-view camera: images the side view when the force arm is lowered.

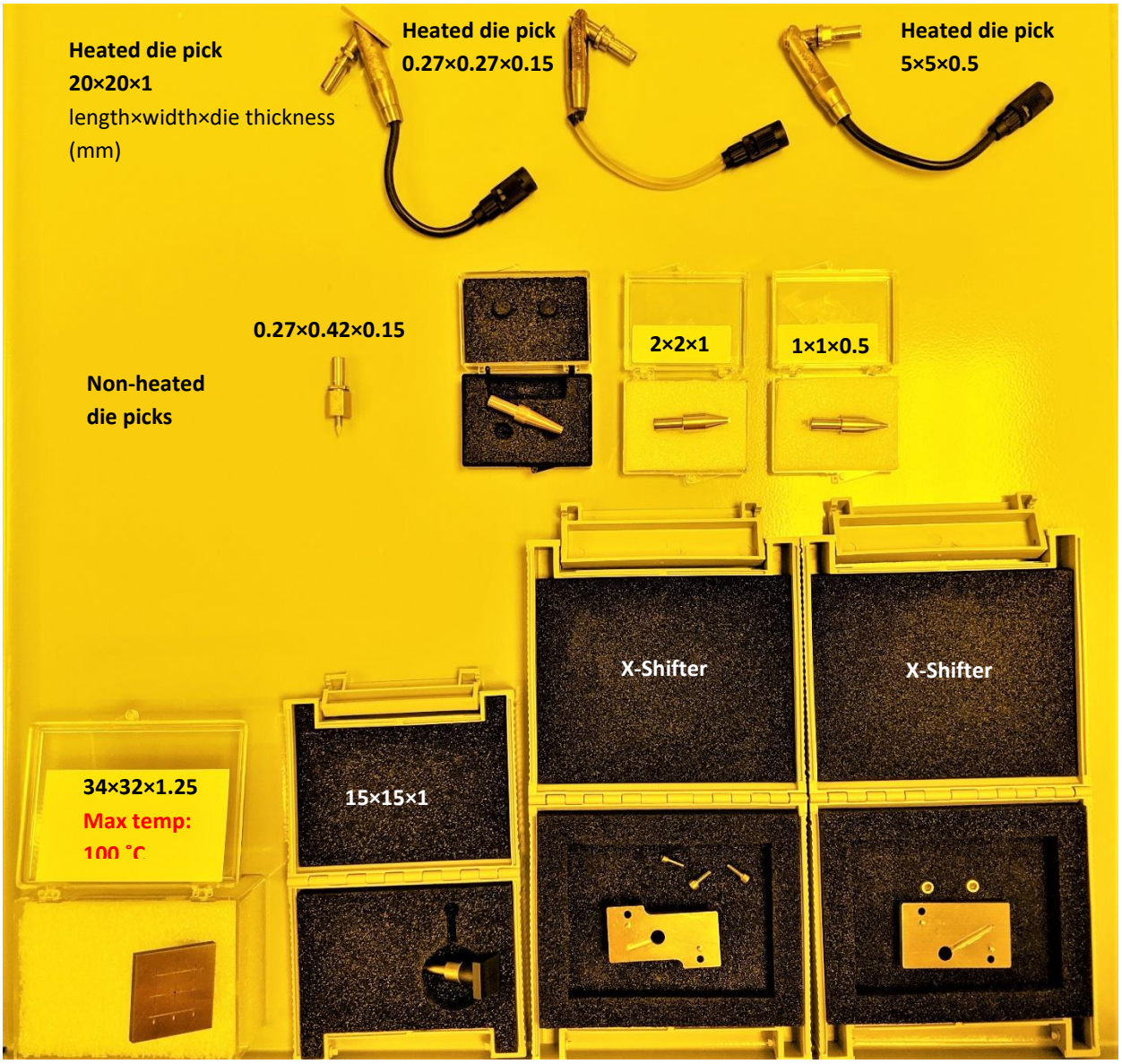
Sliding weight: controls the amount of force that is applied during bonding.

Table: base of the heating plate. The table can be floated by an air cushion that is activated by the **TABLE FLOAT pedal** to coarsely adjust the position of the heating plate.

X, Y and Z knobs: finely adjust the X, Y and Z position of the heating plate. X and Y knobs can be used as handles when floating or rotating the table.

Gap adjustment knob: adjusts the gap between the die and the substrate. Details of the gap adjustment module is available in **Section "Using the gap adjustment module"**.

Accessories



The pictures show the various **die pickups** and **X-shifters** that are avaialble for the tool. The positions of the components in the first picture match that of their containers in the second picture.

The accessories are stored in the top drawer of the cabinet next to the tool. The code for the drawer's lock is available upon request.

Operation procedure

A. IMPORTANT: the 22 mm requirement

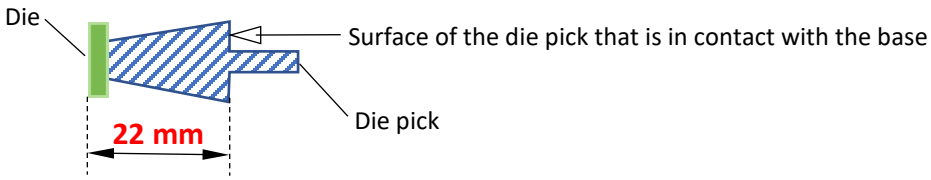
The bonding surfaces of the substrate and the die must be levelled to ensure uniform contact and successful bonding.

Surfaces are levelled, good contact

Surfaces are not levelled, poor contact

Good levelling between the two surfaces is achieved through: 1. bringing the surface of the substrate into focus on the camera; 2. making sure that the 22-mm requirement is met—this is done differently depending on if you are using the CCHM or the ultrasound module.

For CCHM, the 22-mm length is measured from the bonding surface of the die to the surface of the die pick that is in contact with the base. For ultrasound module, this is done differently, and the instruction is in **Section C** of "**Operating procedure**".



The tool picks at SNF were manufactured for certain die thickness, which is indicated by the third number of the size specification for the die picks. For example, a die pick with specification 5×5×1 means that only dies measured 1 mm in thickness will meet the 22-mm requirement.

Currently the maximum thickness that the die picks can allow is 1 mm. If you have a die that is thicker than 1 mm, you will not be able to meet the 22 mm requirement. There is, however, a trick that may apply to your process, and this can be found at the webform for unusual processes.

Spacers of different thickness. You can combine multiple spacers to reach the desired thickness

If you have a die that is thinner than the specified thickness, you can still meet the 22-mm requirement by adding spacers to the die pick. For example, if you have a 0.5-mm die, and the die pick specifies 1-mm thickness, you need to add 1-0.5=0.5 mm of spacers.

The spacers go to the back of the die pick. To add a spacer, slide it down the rod that mounts the die pick to the base.

It is acceptable if you are off the 22-mm requirement by <100 µm.

After you are done with the spacers, **it is your responsibility** to take them off the die pick, and store them back to the proper position on the strip of spacers.

B. Bonding with the chip contact heating module (CCHM)

With CCHM, a compression force maintains the die and the substrate in contact while the solder is reflowed at elevated temperature and joins the two surfaces.

Pre-start checking

1. Check that the switches on the three modules are **turned ON**.
2. Check that the **heating plate** and the **die pick** is empty and clean. If not, you may wipe it down with a clean room wipe dipped with acetone or isopropanol alcohol.
3. Attach the die pick that you will use to the die pick mount. Detailed instruction is in **Section** **"changing the die pick on CCHM"**.

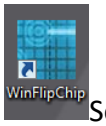
Pre-start checklist

- Die pick·····IN POSITION
- Heating substrate·····EMPTY AND CLEAN
- Three modules·····ON

Tool start-up

4. Enable tool from badger. The badger interlock controls the monitor of the control computer.

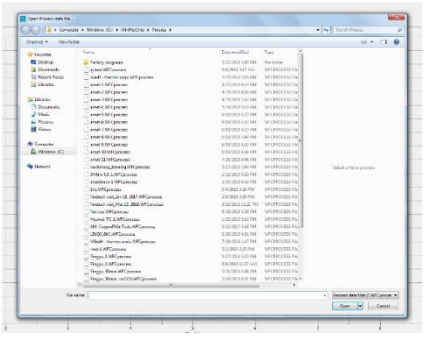
5. Check that the power switches for the three module controls are turned on. Then turn the main power on. This will turn on all the modules.

6. Turn computer on and start WinFlipChip. 

Sometimes the previous user may forget to turn off the computer or close the software. In this case you may directly open the software and load your protocol.

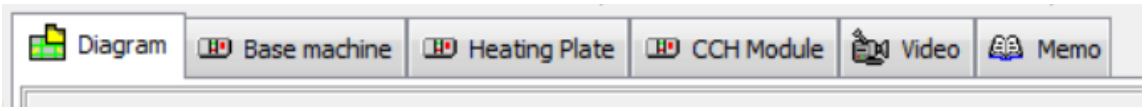
7. In the login screen, type in your name for operator, choose "Modification mode" for the Program mode. The password is "finetech".

8. “Open Process Data File” window will pop up. Choose the Process data file (*.WFCprocess). If this is your first time using the tool, you may choose to open another user’s profile and save it as your own profile. Please make sure not to overwrite the original file.

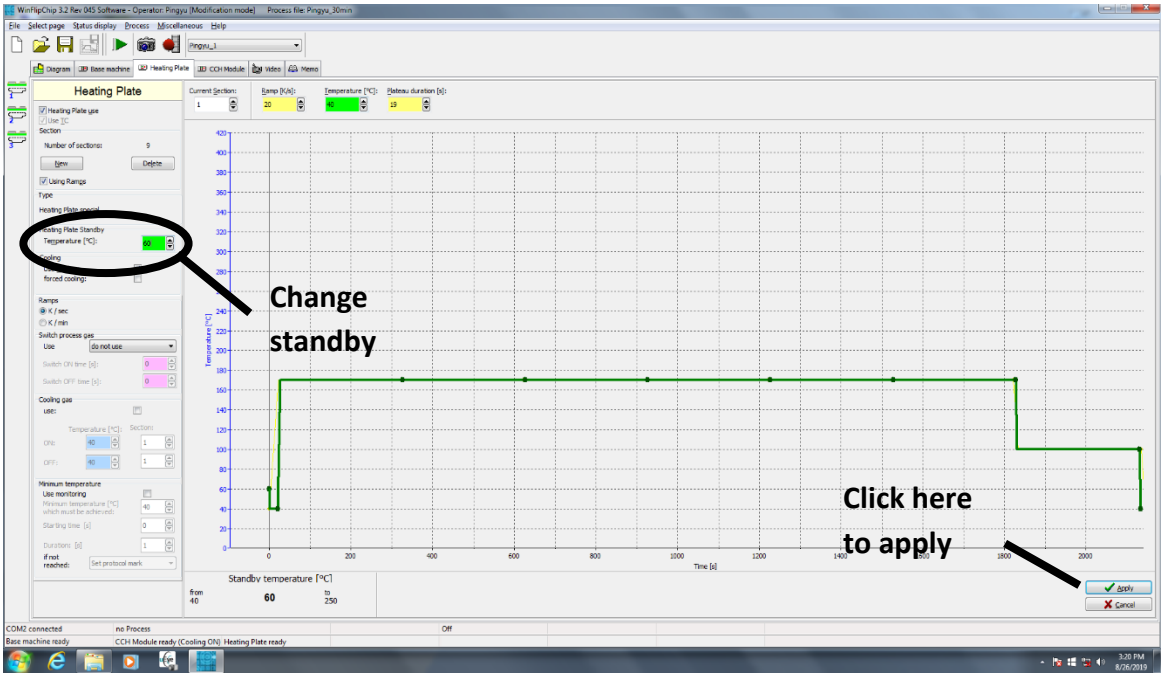


Process editing

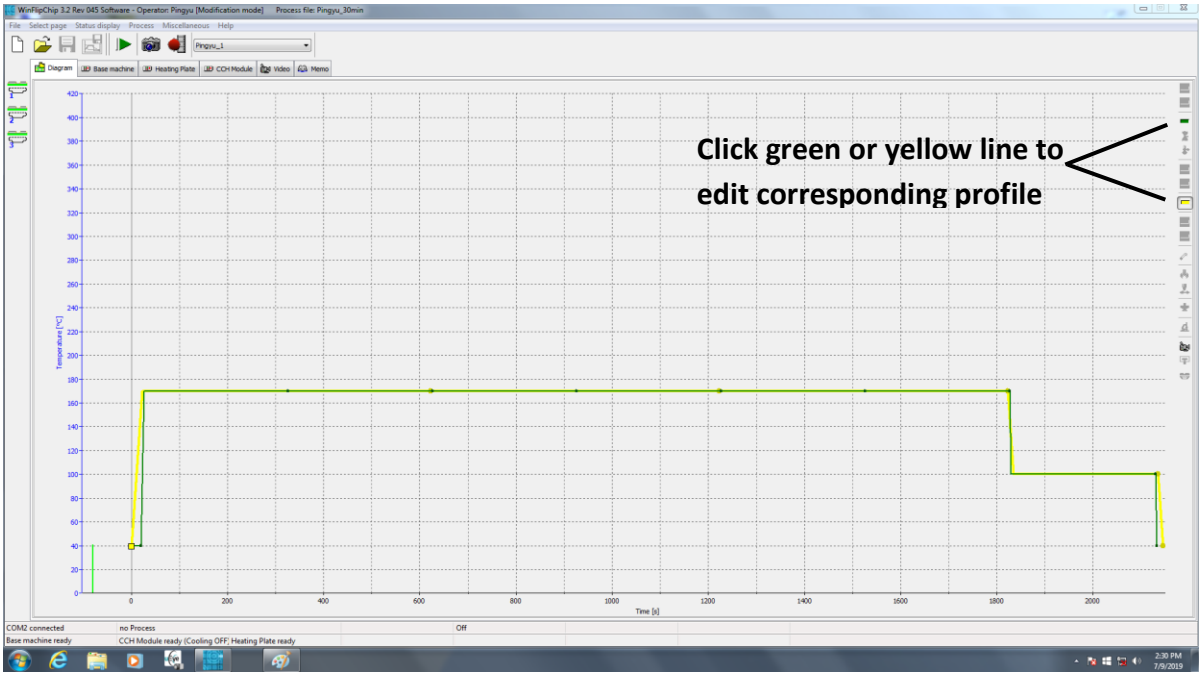
9. The software has six tabs that we work with when controlling the flipchip bonder: Diagram, Base machine, Heating Plate, CCH Module, Video, and Memo.

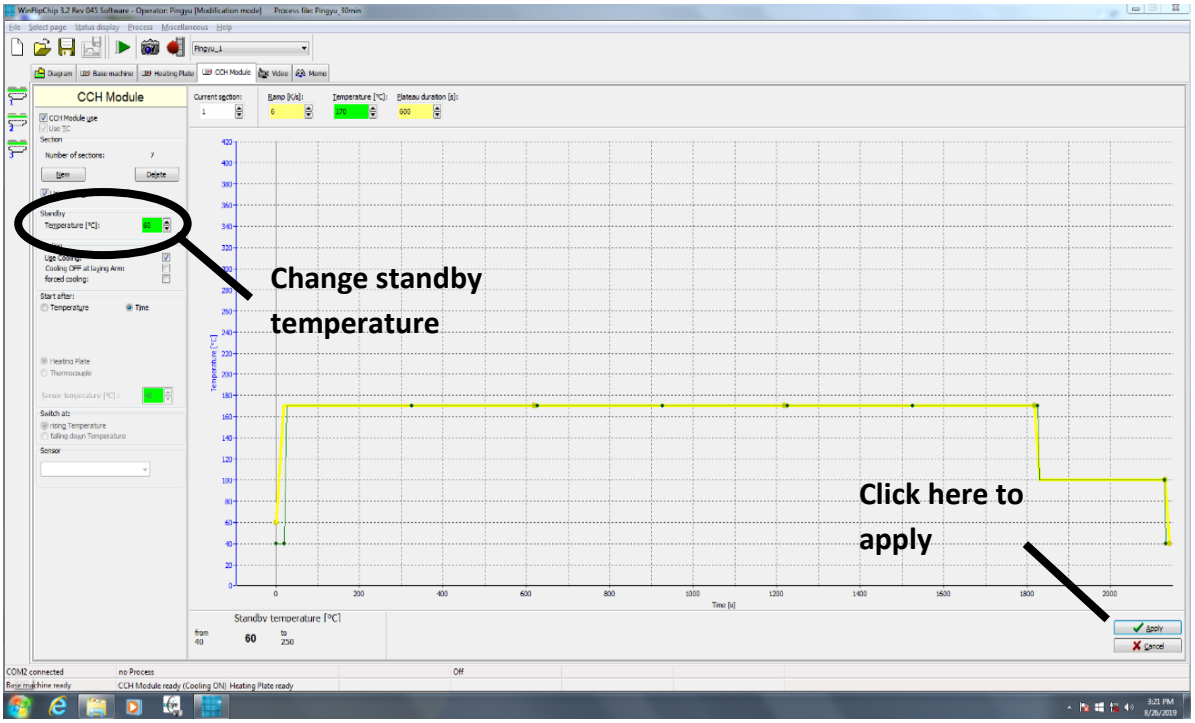


10. Set the stand-by temperature of the heating plate and the CCH module.
    i. For heating plate, go to tab “Heating Plate”, change the standby temperature under section “Heating Plate Standby”, and click “Apply” at the bottom right corner to apply the settings.
    ii. For CCH module, go to tab “CCH Module”, change the standby temperature under section “Heating Plate Standby”, and click “Apply” at the bottom right corner to apply the settings

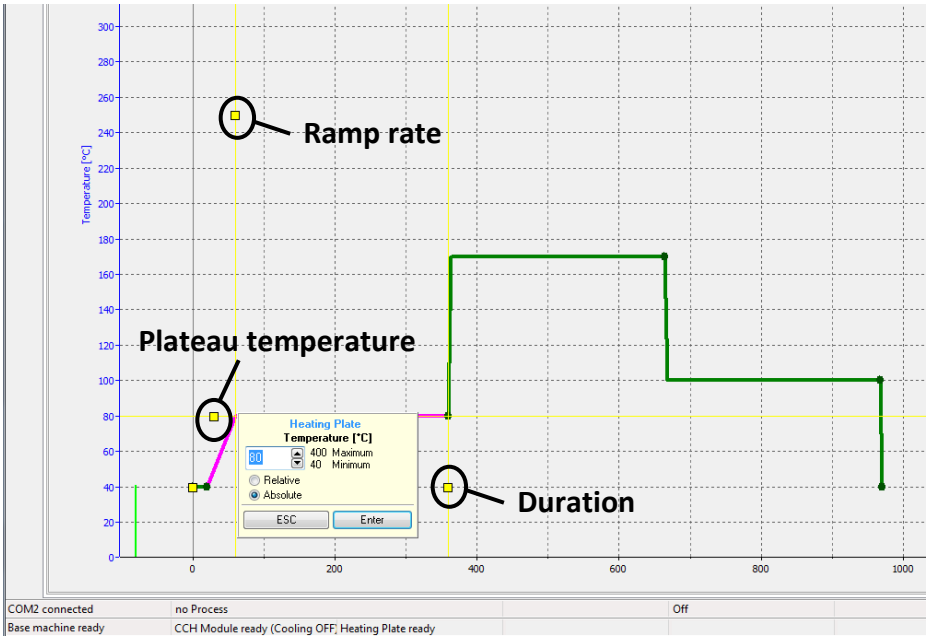


11. Set up the temperature profile. The “Diagram” tab shows the temperature profile (yellow trace: chip heating contact module; green trace: heating plate) for the bonding process. To edit the profile, click on the corresponding colored icon on the right.





The temperature profile consists of several segments, each defined by three parameters: ramp rate (K/s), plateau temperature (˚C) and duration (s). The parameters can be edited by dragging or right clicking on the yellow squares. **The maximum ramp rate for the substrate is 20 K/s, and that for the die pick is 6 K/s.**



Set-up checklist

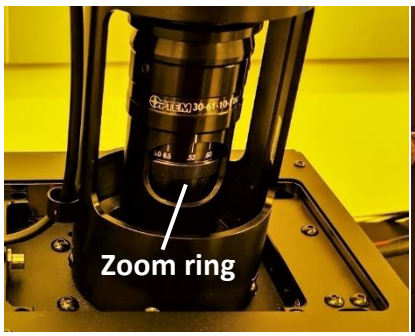
- MAIN CONTROL·····ON
- THREE MODULES ·····ON
- CONTROL COMPUTER·····ON
- TEMPERATURE PROFILE·····SET

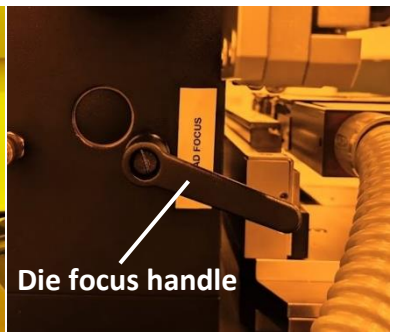
Initial positioning

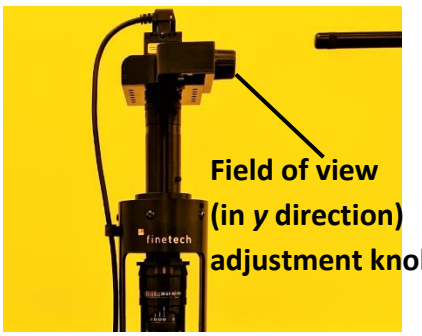
12. Switch to **Video** tab. The video tab shows the image captured by the top-down (when the force arm is in upright position) or side-view (when the force arm is lowered) camera. Slide the **camera** to the leftmost position by pulling the handle to your left.

13. Zoom out the camera using the **zoom ring** and turn on lighting only for CCHM. Center the field of view in *y* direction by adjusting the **field of view adjustment knob**. You will feel a click if the field of view is centered.

14. Use the **die focus handle** if the CCHM is terribly out of focus. You should see a cross that is the vacuum holding slot on the CCHM near the red cross on the screen. If not, you need to realign the CCHM (Instructions are in **step 6** under subsection "**Changing back to CCHM**" in **Section C of "Operation procedure"**).
15. While holding the **X and Y knobs** of the table as handles, step on the **table float pedal**. You will see a red dot shined by the camera blinking on the heating plate. Move the table so that

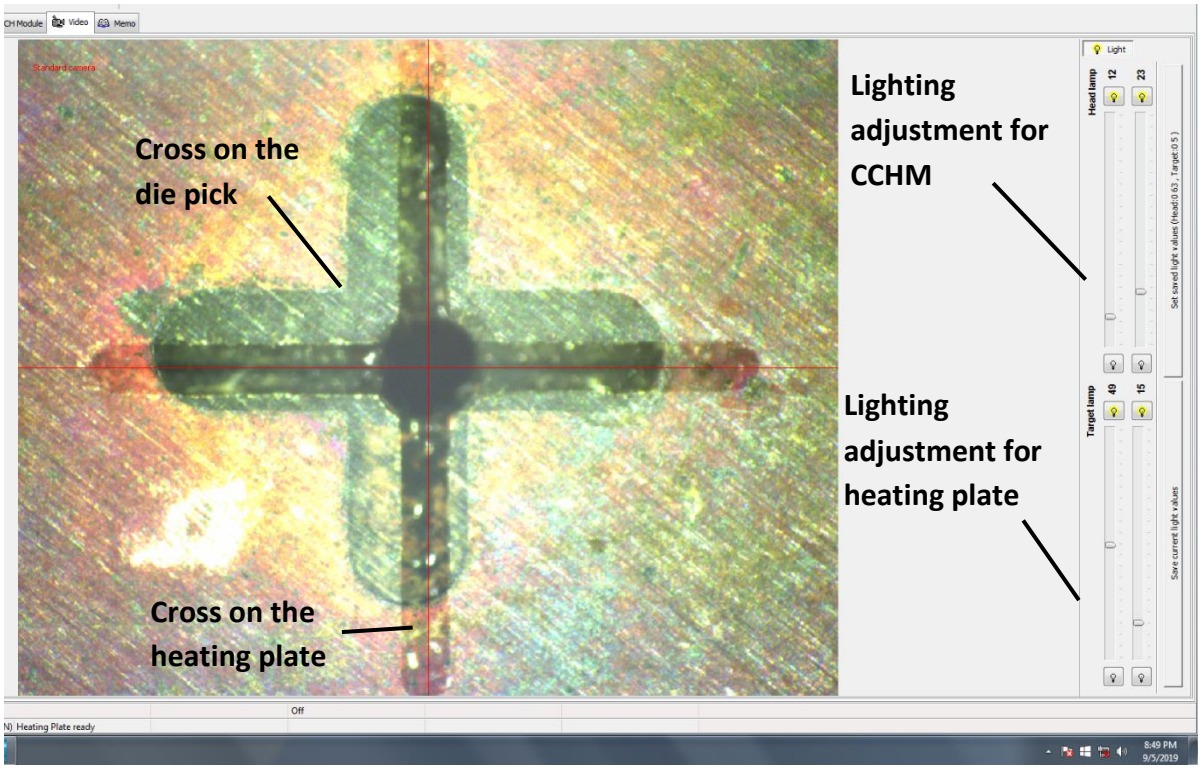






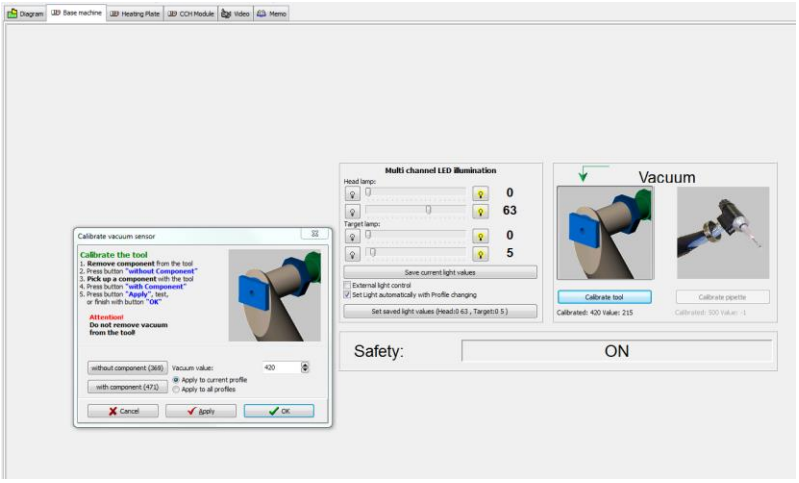
the red dot is near the center cross of the heating plate. Release the table float pedal.

16. Use X and Y knobs to finely adjust the position of the heating plate, so that the center cross is near the red cross shown on the screen. Use the **Z knob** to bring the heating plate into focus. Adjust lighting under the **Video** tab, and you should now see something like this on the screen:



CCHM vacuum calibration

17. Under tab **Base machine**, click **Calibrate tool** -> **without component**.

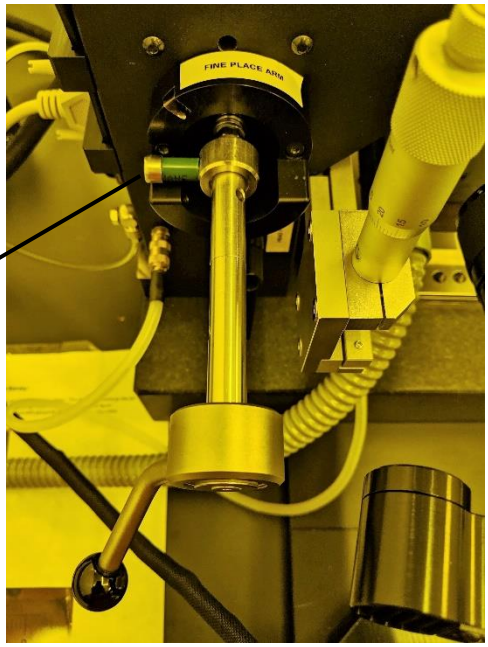


18. Gently position the die onto the center cross of the heating plate, the bonding side **facing down**. Slide camera to the rightmost position.

19. Check that the **fine positioner** is in default position.

Green bar pointing to your left: default position—the die pick is lifted at a small distance from the substrate;

Green bar pointing to your right: lowered position—the die pick is fully lowered



20. Pick up the die. Lower the force arm, so that the vacuum on the die pick will pick up the die that you positioned in **step 13**. If the die is not picked up when the force arm is fully lowered, use the fine positioner to keep lowering the tool until the die is picked up.

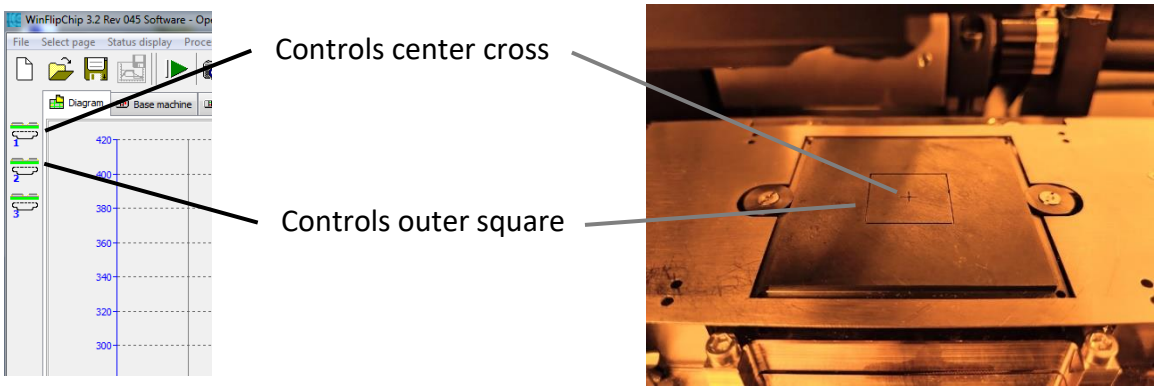
21. After the die is picked up, position the fine positioner back to default position, and lift the force arm to vertical position. The die is now secured onto the die pick.

22. Under the same dialog box as in **step 12**, click **with component**, and then **OK** to close the dialog box. The vacuum for the die pick is now calibrated.

Alignment between substrate and die

23. Position your substrate onto the heating plate. Make sure that the substrate is roughly centered about the center cross of the heating plate.

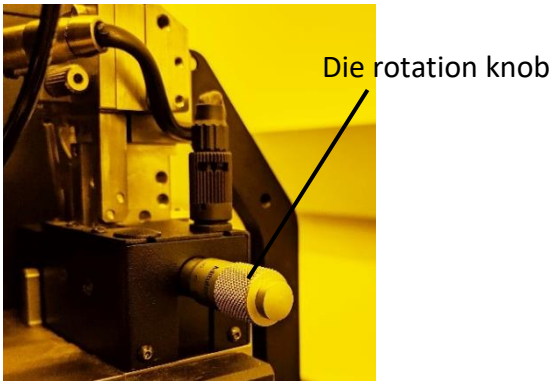
24. Secure the substrate with heating plate vacuum. This is done by clicking the buttons shown below. You may choose to enable just vacuum 1 or both 1 and 2, depending on the size of your substrate.



Substrate and die placement and alignment

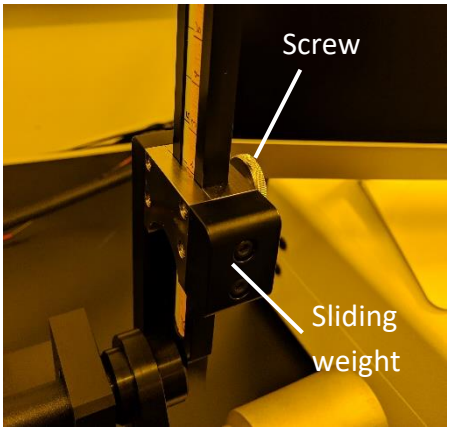
25. Bring the substrate into focus using the Z knob. When focusing, make sure that the camera is zoomed in all the way.

26. Bring the die into focus using the **die focus handle**. Same as in the step above, make sure that the camera is zoomed in all the way.



27. Align the substrate to the die.
    i. For X and Y alignment, use a combination of the table float pedal and X and Y knobs, same as the centering procedure described in **step 10**.
    ii. For rotational alignment, you may either: hold onto the X and Y knobs and rotate the heating plate, or rotate the die pick using the **die rotation knob**.
    iii. Iterate between step (i) and (ii) until the die and the substrate are aligned.

28. For oversized substrate, the camera will not be able to observe the entire surface and alignment may be difficult. This can be solved by using an **X shifter**, and you can find the instruction in **Section "Using the X-shifter"**.



29. Set the sliding weight on the force arm to apply a desired amount of bonding force. This is done by first loosening the screw, then sliding the weight to desired force amount, and tightening the screw to lock the weight in place.

30. Turn the **gap adjustment knob** to the marked line for normal processes. If you would like a gap between the die and the substrate during the bonding, you may set the knob to your desired position. For details of the gap adjustment knob, please see **Section "Using the gap adjustment module"**.

31. Slide the camera to the rightmost position.

Pre-bonding checklist

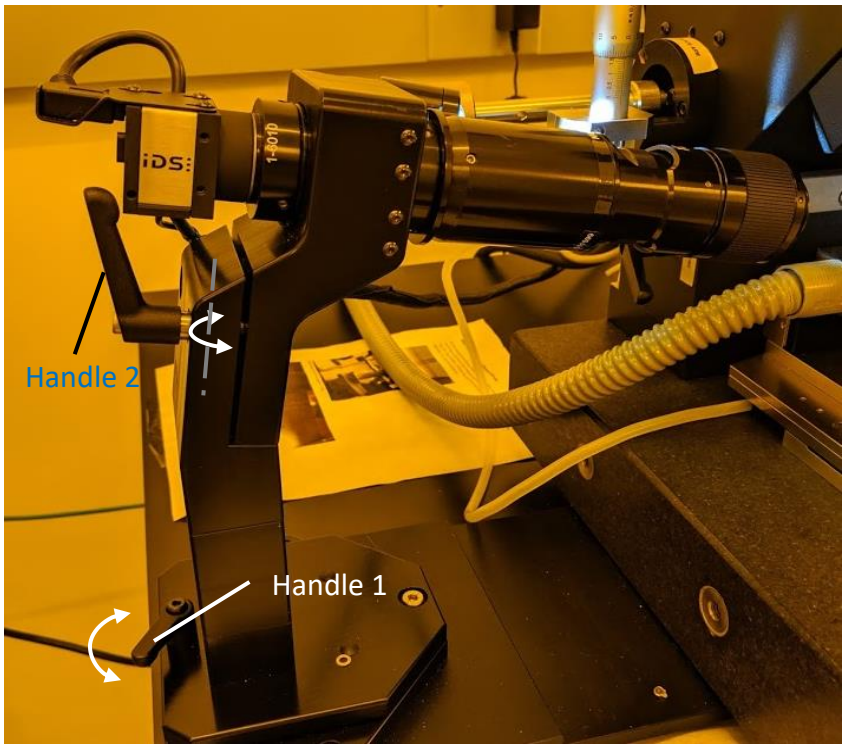
- Vacuum·····CALIBRATED
- Vacuum status LED·····ON GREEN
- Force arm sliding weight·····SET
- Substrate and die·····MOUNTED AND ALIGNED
- Force arm fine positioner ·····DEFAULT POSITION
- Z-stop knob·····SET
- Control computer·····ON

Bonding

32. If flux is needed during bonding, you may apply it now. The instruction on applying the flux and collecting the fume can be found in **Section "Using flux"**.

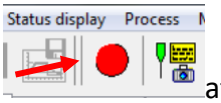
33. Bring the die into contact with the substrate. This is done by first lowering the force arm to horizontal position, and then slowing rotating the fine positioner to fully lower the force arm.

34. You may use the side-view camera to monitor the die-substrate contact. Two handles control the viewing angle of the side-view camera, as shown below.



35. Click the "Start" button to start the temperature profile.

36. During any time of your process, you may record video or take pictures using the **side-view camera**. Detailed instructions can be found in **Section "Saving pictures and videos from your process"**.

37. You may stop the temperature profile by clicking the "Stop" button 

at any time during the process. The tool will cool down to stand-by temperature.

Releasing the bonded assembly and finishing up

38. Once the process finishes, the tool will automatically cool down the bonded assembly to stand-by temperature. Wait until the tool fully cools down before retrieving your device.
39. Release the die. Press the “HEAD VACUUM” pedal, and make sure that the Vacuum status LED is **blinking** and in color **yellow**.
40. Gently rotate the fine positioner to default position. Lift the force arm to vertical position.
41. Release the substrate from the heating plate by clicking the buttons shown in **step 20**.
42. Remove your device from the tool. Wipe down the heating plate using a clean room wipe dipped with acetone or isopropyl alcohol if there is any residue left behind.
43. Save the process as you wish, turn off the tool using the main switch, close the control program, and shut down the computer.
44. Disable tool on Badger.

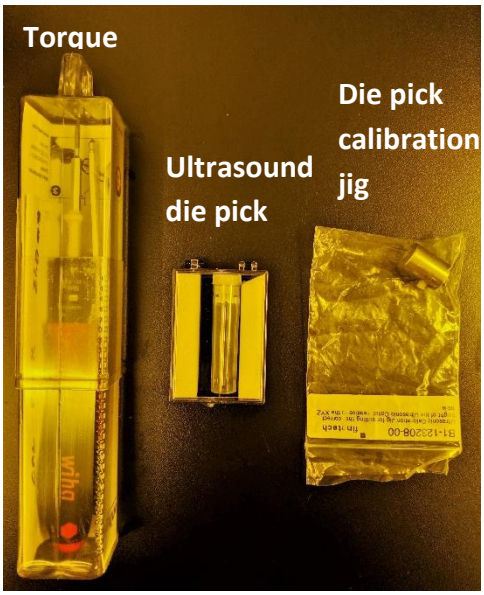
Bonding with the ultrasound module

With the ultrasound module, when the die and the substrate are in contact, an ultrasound vibration is introduced to the die to help break through the oxide layer and reflow the solder to join the two components. Heating may be applied to assist reflowing.

Changing the CCHM to the ultrasound module

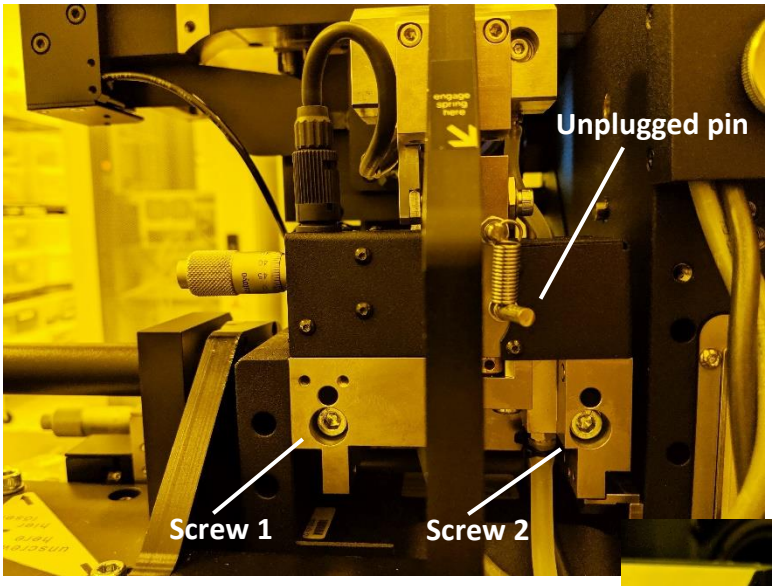
To use the ultrasound module, you need to swap out the CCHM that is by default installed on the tool.

1. → Collect the tools needed for changing the module, which are stored in the middle drawer in the cabinet next to the tool.

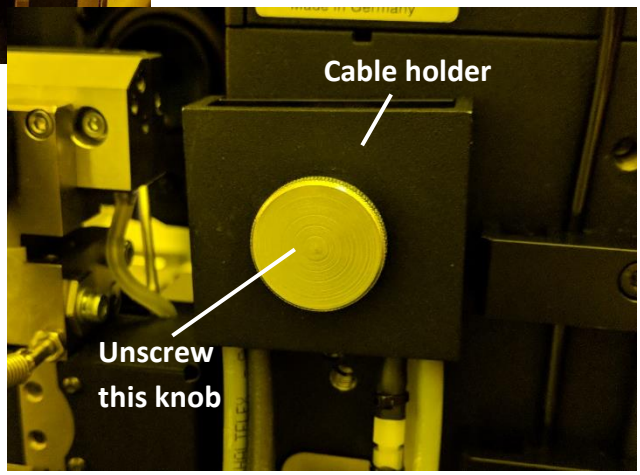


2. Unplug the pin that connects the force arm to the CCHM.

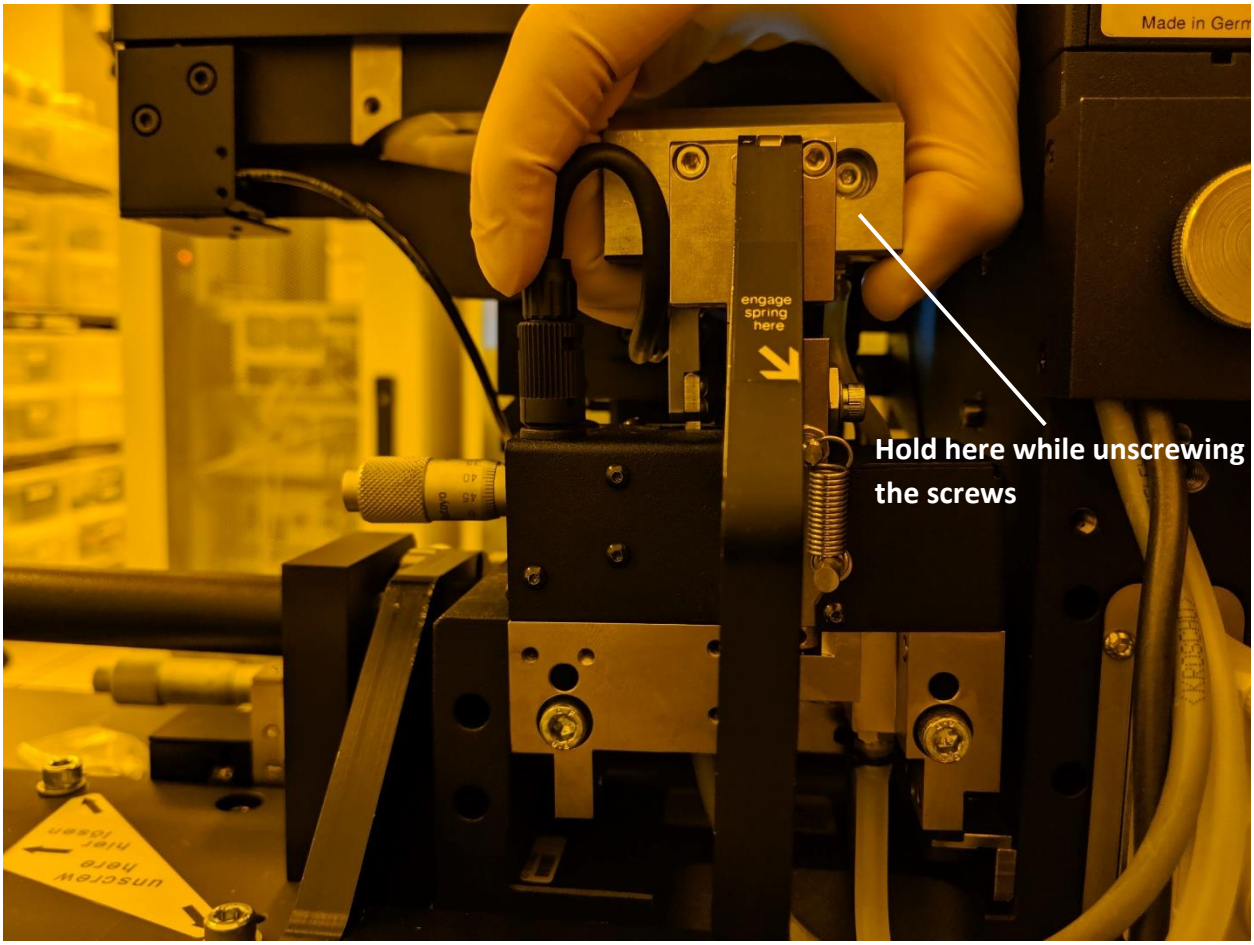
3. ↓ Locate the two screws to be unscrewed (labelled below).



4. → Unscrew the cable holder from the tool, by rotating the knob counterclockwise. Once the cable holder comes off, set it aside on the table.



5. While holding the base of the CCHM as shown below, unscrew the two screws. Note that the fully loosened screw will remain in the screw hole on the tool.

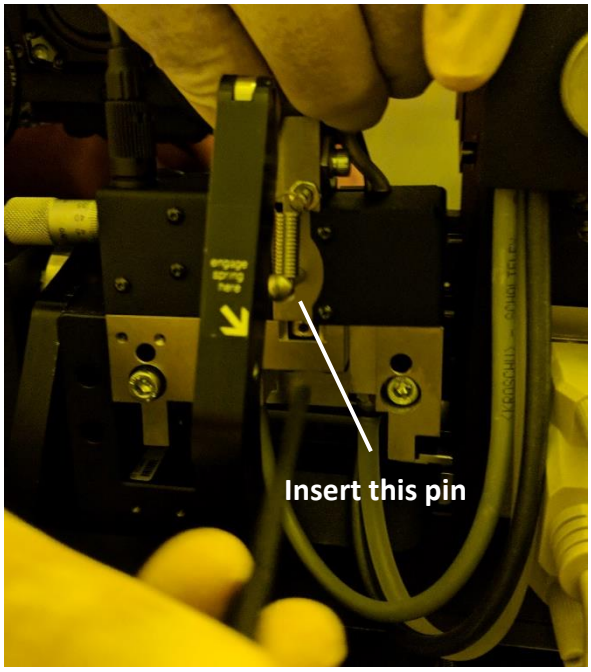


6. Once the screws are fully loosened, carefully lift the and remove it from the tool.

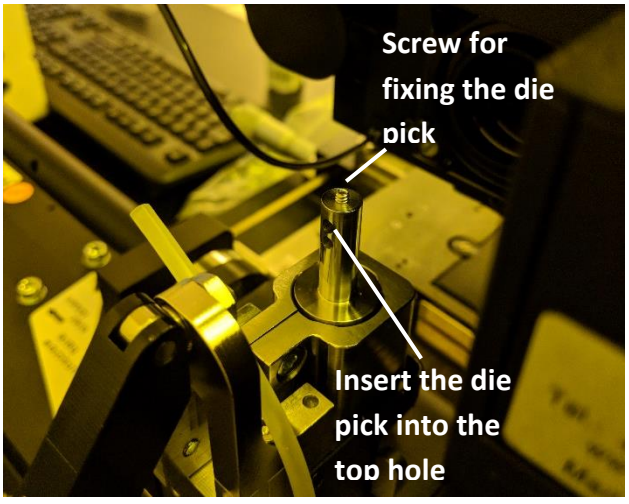
CATION: the force arm may fall down and damage the tool when the CCHM is removed. To prevent this from happening, hold the force arm in the upright position when removing the CCHM. When the CCHM is removed, carefully release the force arm to see if it will fall. If the force arm cannot stay in the upright position by itself, set the sliding weight to half the maximum weight to hold the force arm in place.

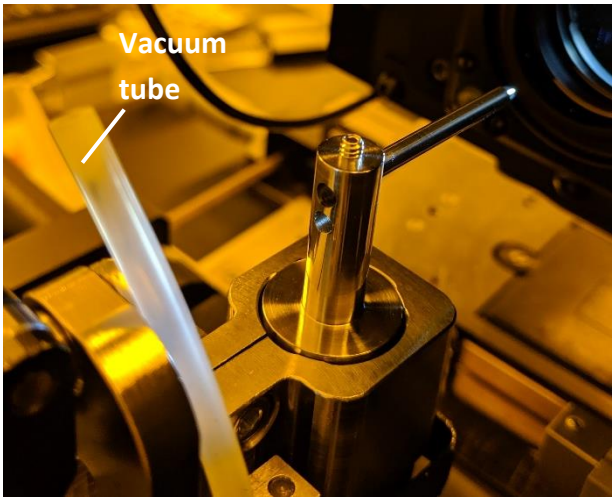
7. Pick up the ultrasound module from the table. The ultrasound module is installed in the same way as the CCHM. Align the two screws to the holes on the tool, and tighten them with the wrench.

8. Insert the pin to the force arm.

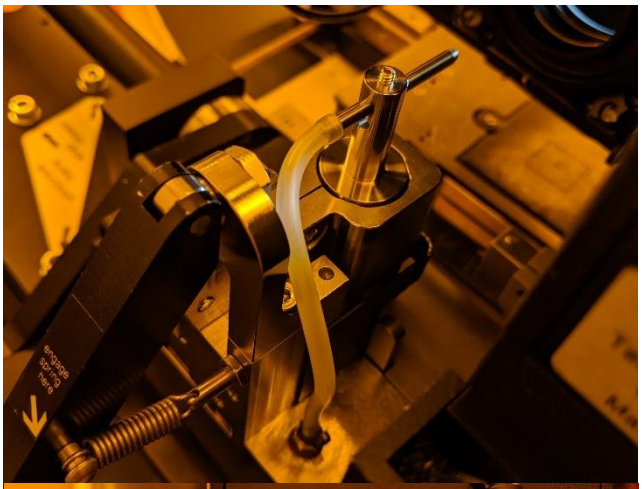


9. Take out the ultrasound die pick from its storage tube, and insert it into the hole on the transducer. If the die pick cannot be inserted into the hole, loosen the screw on the top with the torque wrench. Be careful not to fully loosen and drop the screw.

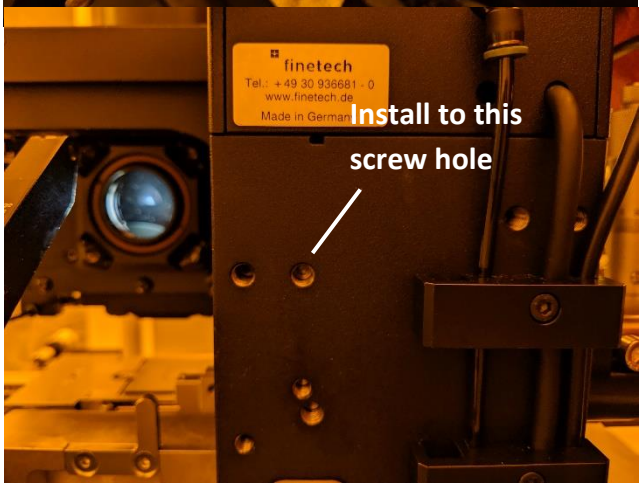




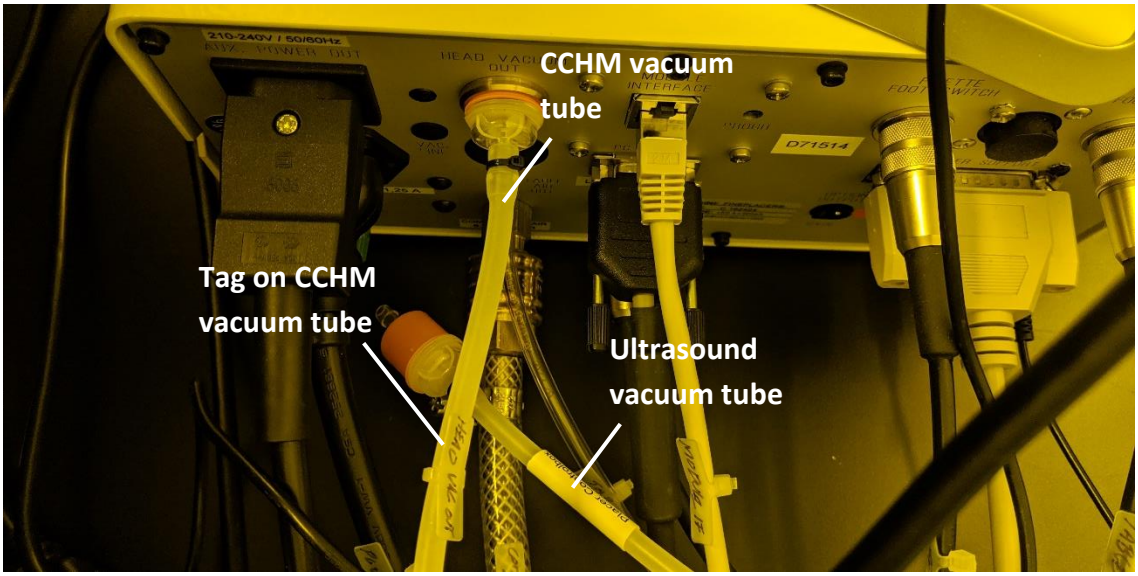
10. → After the die pick is inserted, do not yet tighten the screw. First connect the vacuum tube to the back of the die pick.



11. → Attach the cable holder for the ultrasound module to the tool. Install the holder to the screw hole indicated on the right.



12. Pull out the vacuum tube for the CCHM on the main control. Insert the tube for the ultrasound module. The vacuum tube for the CCHM has a tag labelled “HEAD VAC OUT”.



Calibrating the die pick height for the 22-mm requirement

1. Make sure the camera is at the rightmost position, and the standby temperature of the heating plate is set to 40 ˚C.

2. Place the **die pick calibration jig** on the heating plate.

3. Lower the force arm, make sure that the ultrasound transducer is sitting on top of the calibration jig.

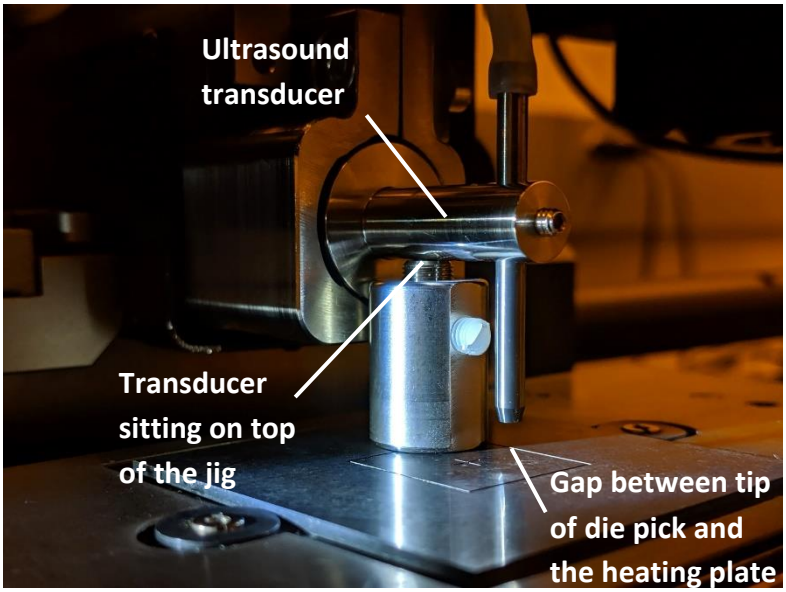
4. Adjust the position of the die pick such that there is enough space for the die that you are going to bond.

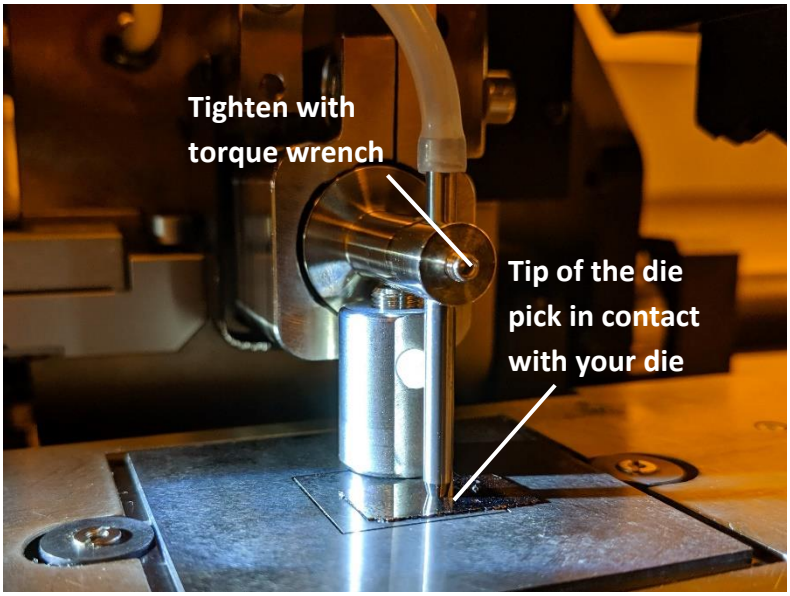
5. **Disable the vacuum for the die pick using the head vacuum pedal**. Place your die faced down on the heating plate.

6. Adjust the position of the ultrasound die pick, such that the tip of the die pick is just in contact with your die.

7. Use the torque wrench and tighten the screw until one click to fix the position of the die pick.

8. The position of the die pick is now calibrated to meet the 22-mm requirement, but only for the die that you used for the calibration.



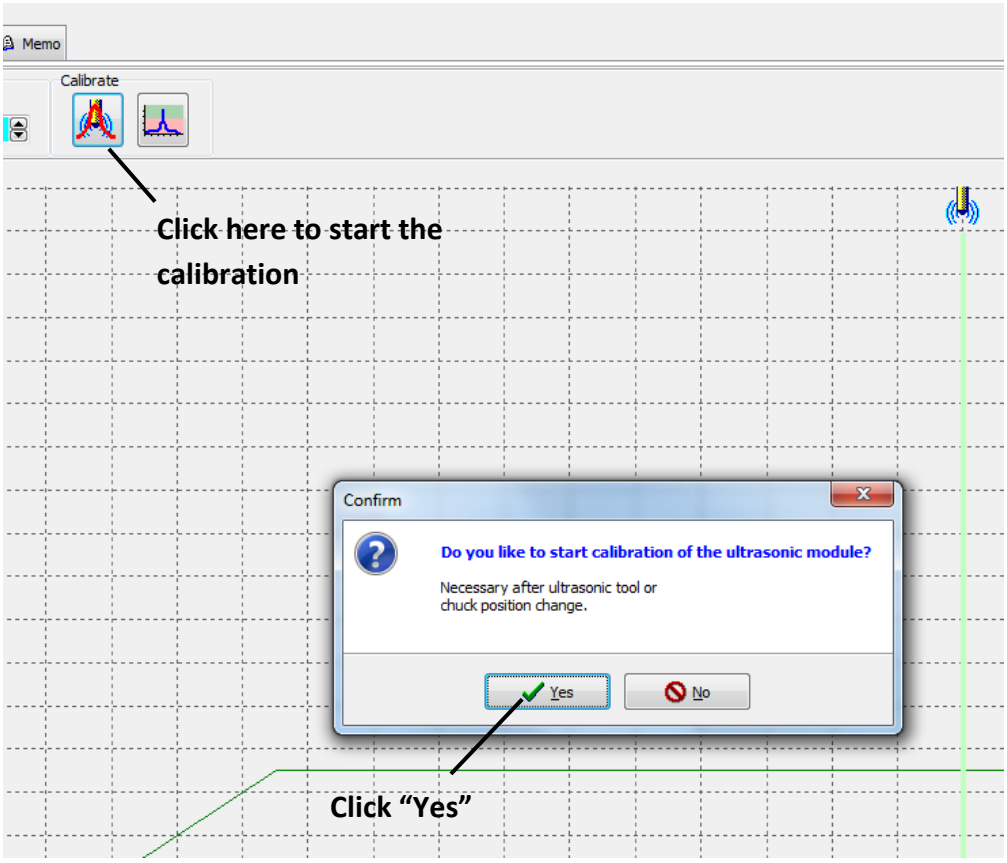


CAUTION: if you have dies of different thickness, make sure to perform the calibration, using the die that you plan to bond, **every time** before you do the bonding process.

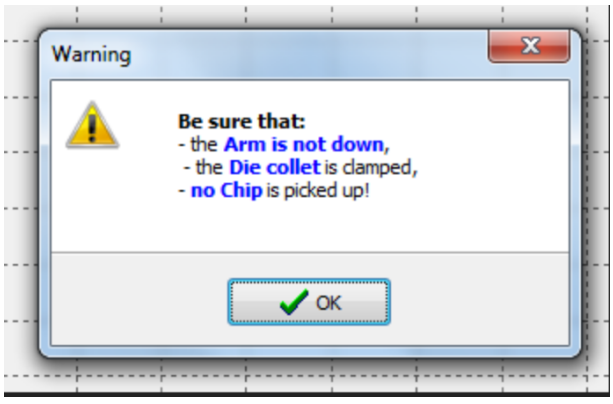
Calibrating the ultrasound transducer

Every time after you calibrate the ultrasound die pick for the 22-mm requirement, you should calibrate the ultrasound transducer.

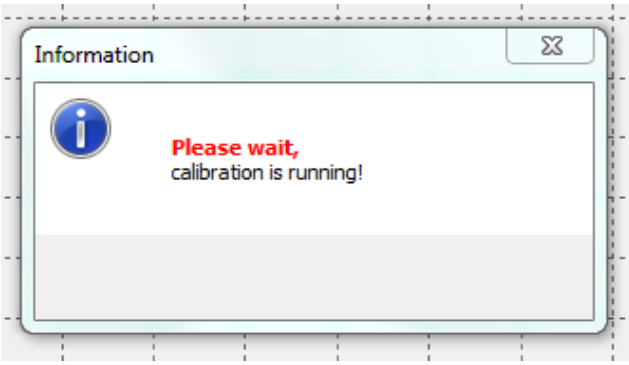
1. Go to the “Ultrasonic Module” tab on the control software.



2. Make sure that these requirements are met, then click “OK”

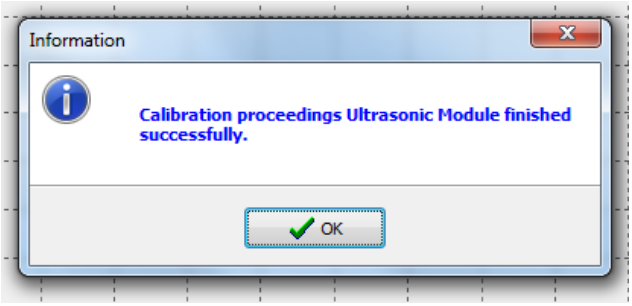


3. Calibration in process…

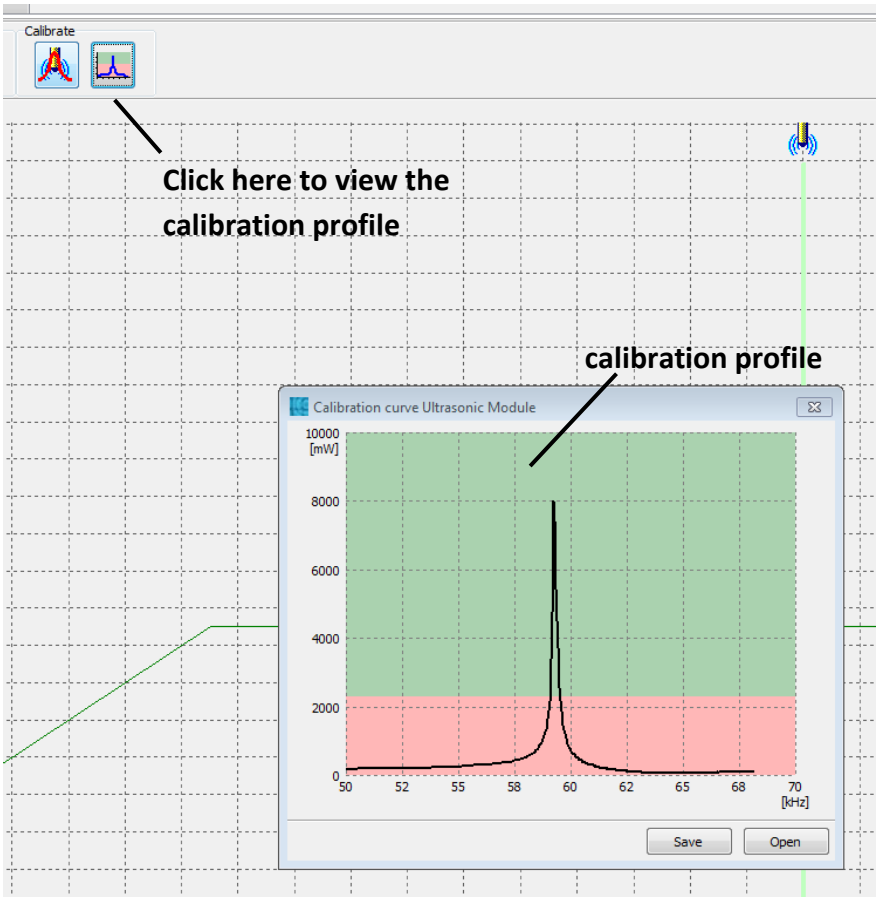


4. If the calibration is not successful, report problem on Badger and contact Usha.

5. If the calibration is successful, you will see this notification. Click “OK”.



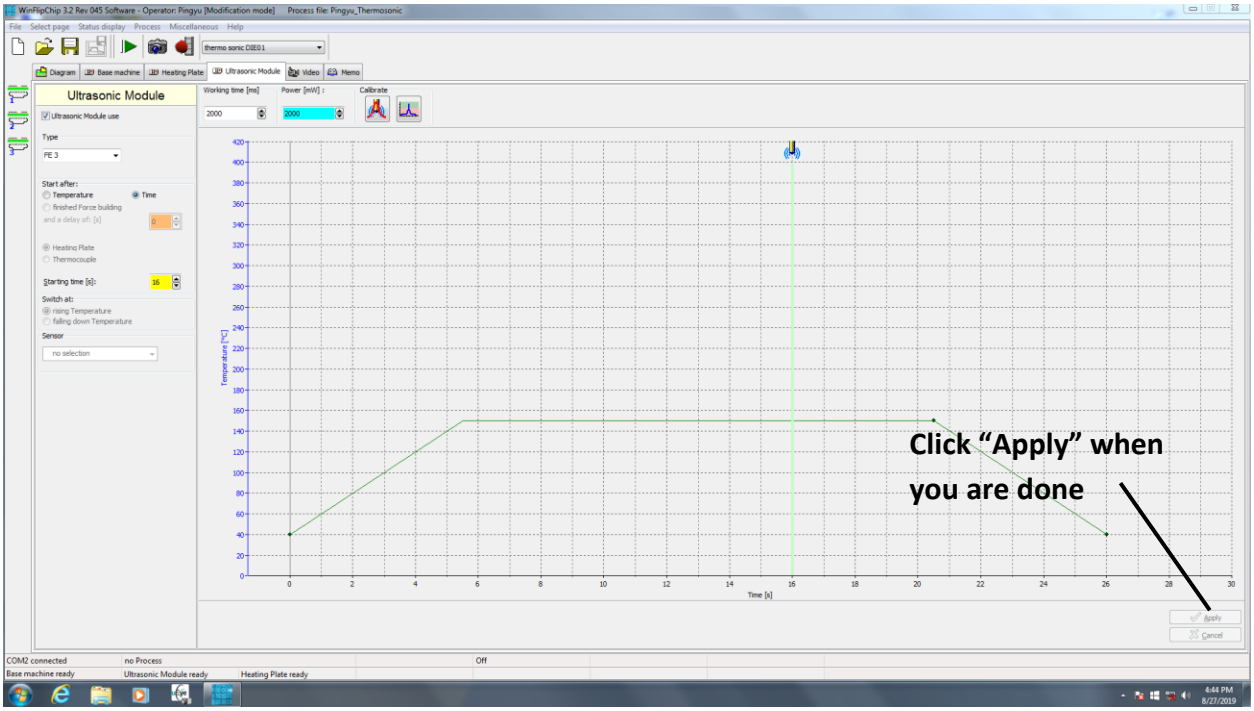
6. You can view the calibration profile.

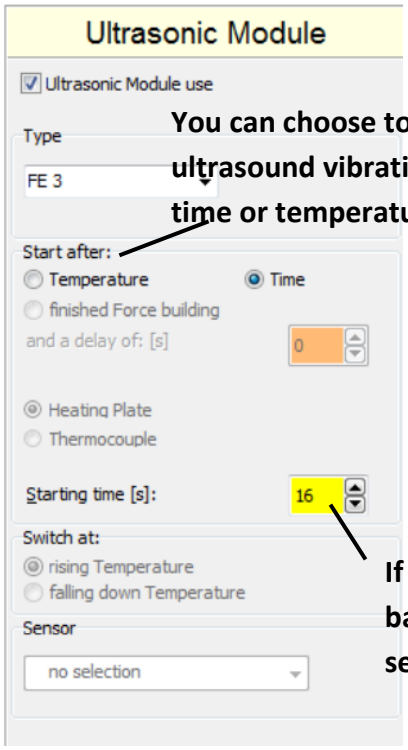


Editing the profile

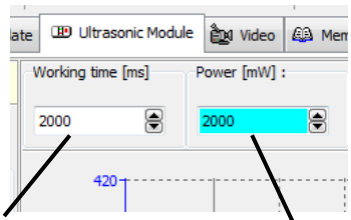
If you wish to heat the substrate, you may adjust the temperature profile as shown in **Steps 9-11 in Section B of "Operation procedure"**.

To adjust the parameters on the ultrasound module, see illustration below.





You can choose to start the ultrasound vibration based on time or temperature



This sets for how long the ultrasound vibration will last

This sets the power of the ultrasound

If you choose to start based on time, you can set the starting time

After you complete the steps above, you may start aligning your die to the substrate and start the bonding process. The procedures are the same as steps 12-16, 18-21, and 23-44 in **Section B** of "**Operation procedure**".

Changing back to CCHM

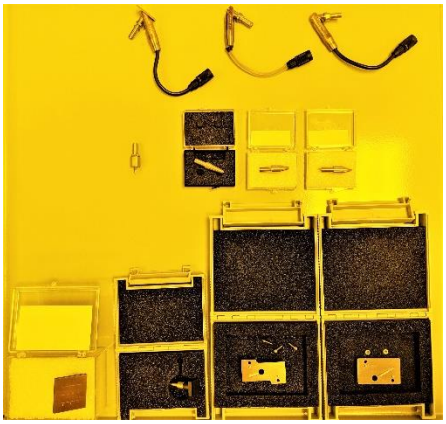
When you are done with the ultrasound processes, **it is your responsibility** to change the ultrasound module back to the CCHM.

1. Make sure that the force arm is in the upright position. Pull out the pin that connects the force arm to the ultrasound module.
2. Disconnect the vacuum tube from the die pick.
3. Loosen the screw that fixes the die pick, then pull out the vacuum die pick and store it in the storage tube.
4. Follow the same procedure as steps 3-8 in the section "**Switching between the CCHM and ultrasound module**" above.
5. After you install the CCHM, slide the camera to the leftmost position and observe the image captured by the camera.
6. If the cross of the die pick is far away from the center of the screen, you need to re-center the CCHM. This is done by slightly loosening the two screws that fix the CCHM, adjusting the position of the CCHM until the die pick is centered, and finally tightening the screws.

Changing the die pick on CCHM

The flipchip bonder has many die picks (see right) that you can choose based on the size of your die and if you need to apply heat to the die.

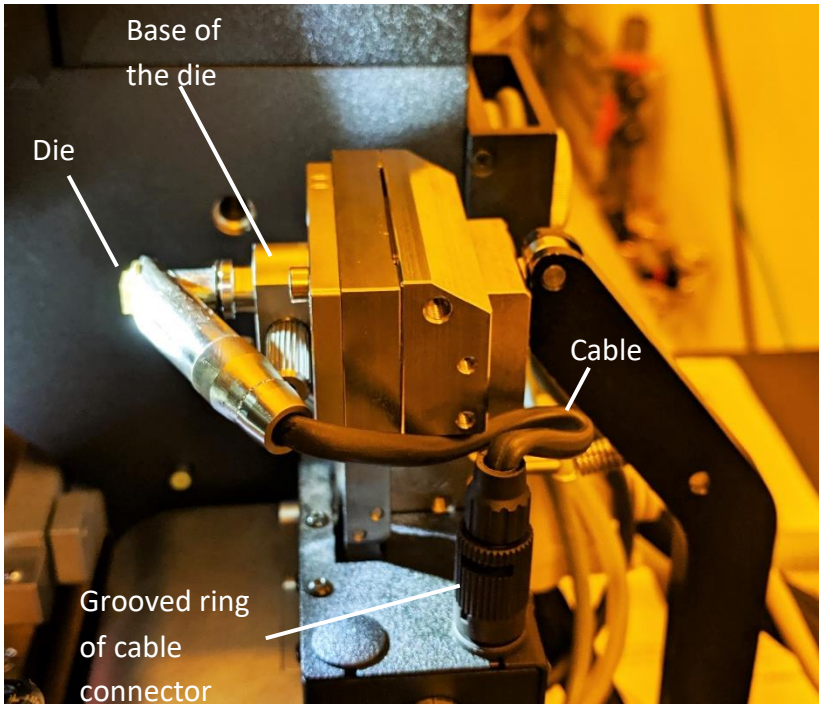
The die picks are stored in the tool drawer next to the tool, and the code for the drawer lock is available upon request.

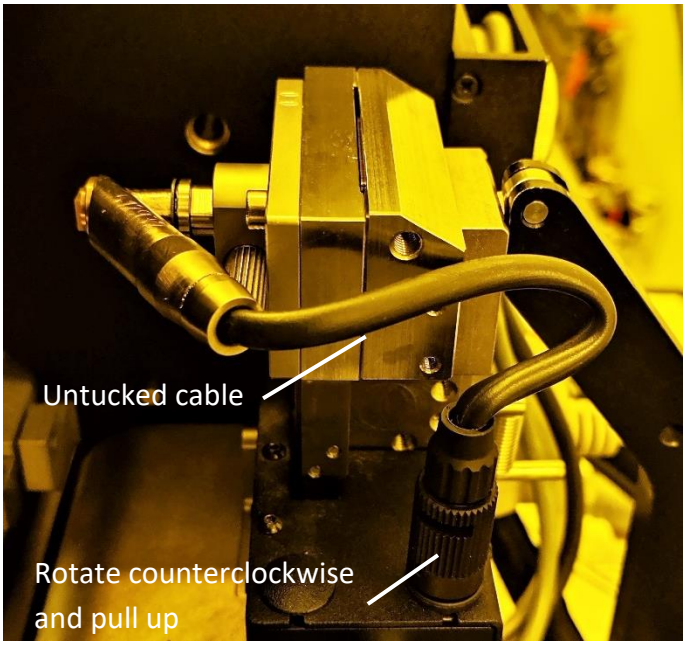


CAUTION: do **NOT** change the die pick if the tool is turned on. You may burn yourself as the die pick is heated to standby temperature when the tool is turned on. Changing the die pick should ALWAYS be done when the tool is turned off.

Removing the mounted die pick

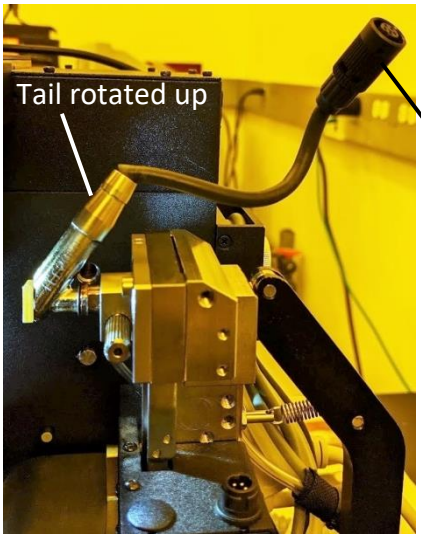
1. When you enable the tool, there should be a die pick already mounted on the base, as shown below. Pay attention to how the cable is twisted and tucked under the base of the die pick.

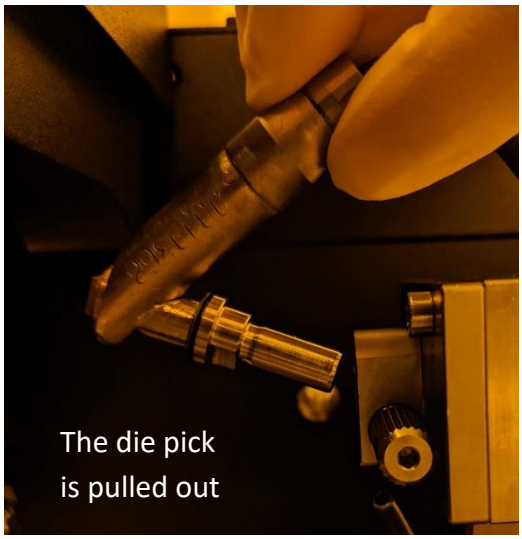




2. To disconnect the mounted die pick, first untuck the tucked cable from under the base. Then release the cable connector, by rotating the grooved ring on the cable connector counterclockwise to the unlocked position and pulling up the connector.

3. With the cable released, rotate the tail of the die pick so that it's facing up. This will expose the screw that is holding the die pick in place. Use the screwdriver to loosen the screw and hold onto the metal bar and pull out the die pick. The die pick is now released from the tool.





IMPORTANT:

1. The previous user may have used the spacers on the die pick but did not put them back. If this is the case, please measure the thickness of the spacers that you find on the die pick and

put them back into the correct slot on the strips for the spacers.

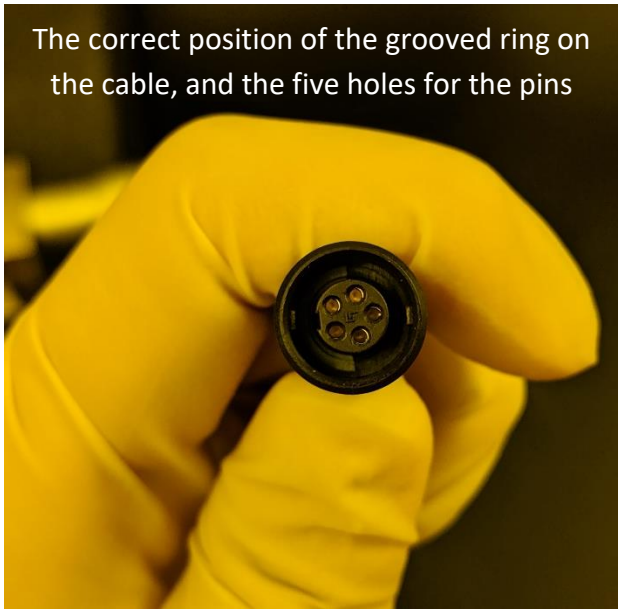
2. Before you mount the die pick of your choice, make sure that your die and die pick meet the 22 mm requirement (See **Section A** of "**Operation procedure**").

Install the die pick

1. Insert the die pick into the base, with the metal bar facing up.
2. Connect the cable to the connector.

IMPORTANT

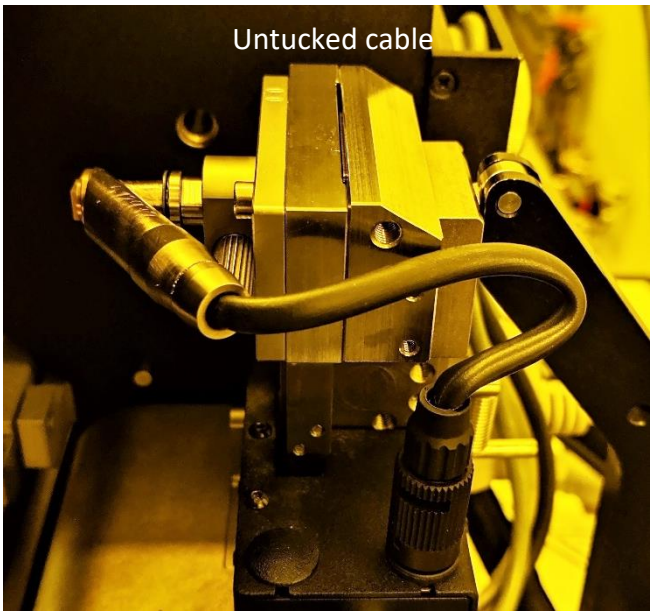
i. The cable must be inserted into the connector with the correct alignment.
ii. Note that the connector has five pins, and the cable's connector has five corresponding holes.
iii. The grooved ring on the cable should be rotated to and held at the unlocked position while connecting the cable to the connector. Make sure that the holes are aligned with the pins.
iv. The cable should be inserted without the need of excessive force if the connector is correctly aligned. Do **NOT** force down the cable if you have difficulty inserting the cable. **The connector can be easily damaged.** Pull out the cable and double check the position of the grooved ring and the alignment between the holes and pins.

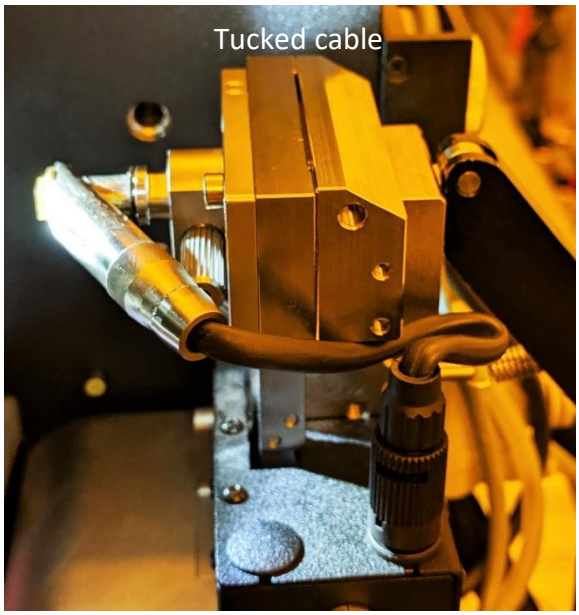

The correct position of the grooved ring on the cable, and the five holes for the pins

The connector on the tool has five pins

3. **Gently tighten the screw for the die pick. You only need to slightly tighten the screw. Never tighten the screw with excessive force, as it will damage the parts inside the base.**
4. Rotate the die pick, so that the tail of the die pick is facing in the same direction as the screw.

5. Tuck the dangling wire under the base.



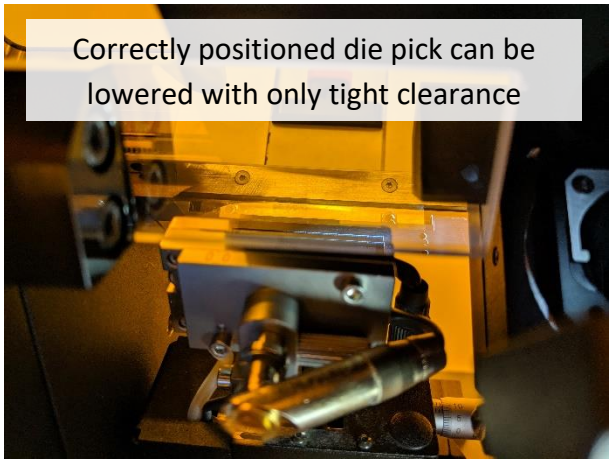


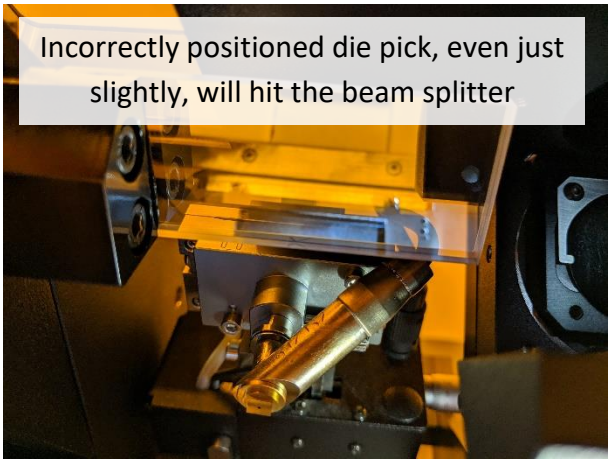
IMORTANT

After you install the die pick, remember to check that the die pick will not bump into any part of the tool, especially the beam splitter, when the force arm is lowered.

To check that the die pick will clear, move the camera to the rightmost position, then slowly lower the force arm, while KEEP A CLOSE EYE ON THE DIE PICK TO SEE IF IT WILL CLEAR**.**

Incorrectly positioned die pick will bump into the tool, making the force arm unable to be lowered, breaking the expensive beam splitter, or ruining the alignment of the beam splitter.



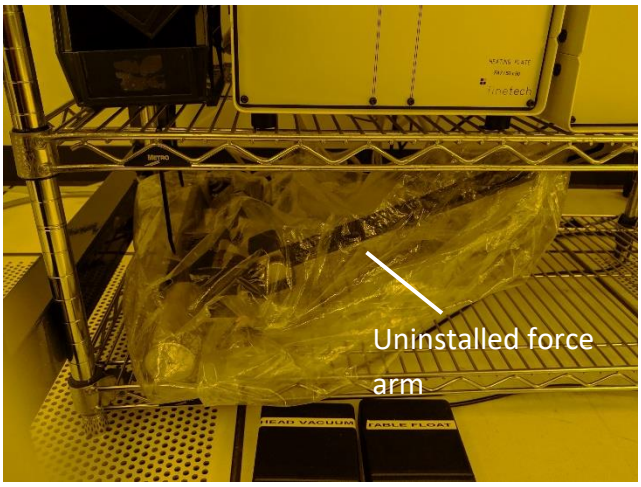


Changing the force arm

Use extra caution when you are changing the force arm. They are very heavy.

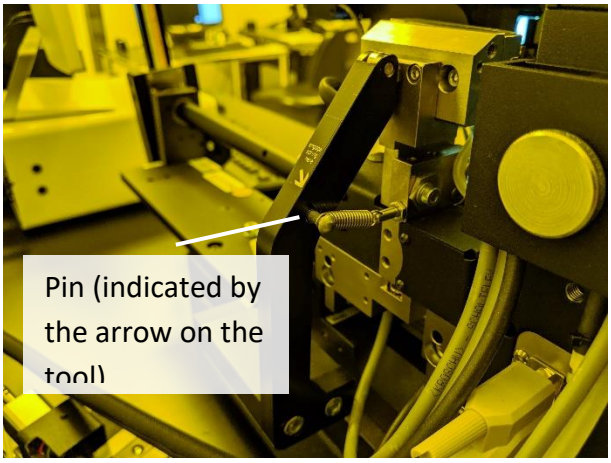
There are two force arms available for the tool. One applies the force in the range of 0-20 N; the other is in the range of 0-50 N.

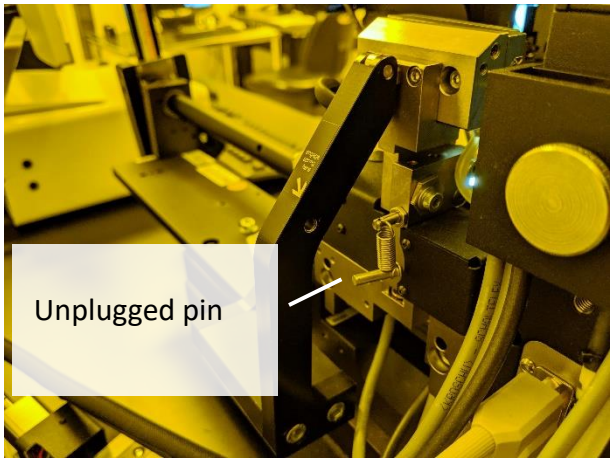
The uninstalled force arm is stored in a plastic bag on the shelf that is below the tool.



1. To change the force arm, first set the sliding weight to zero.

2. Then unplug the pin that connects the force arm to the base of the die pick. The hook is located at the back of the tool.



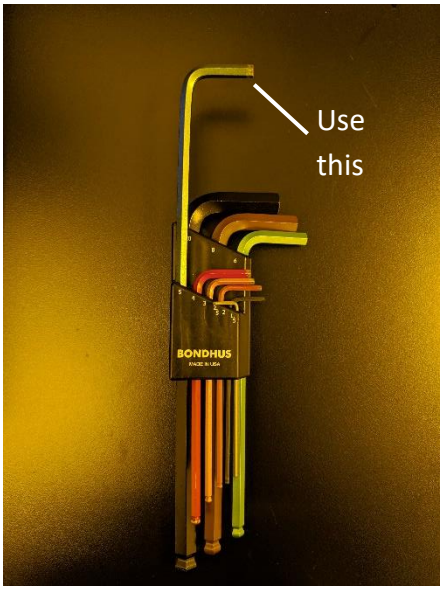


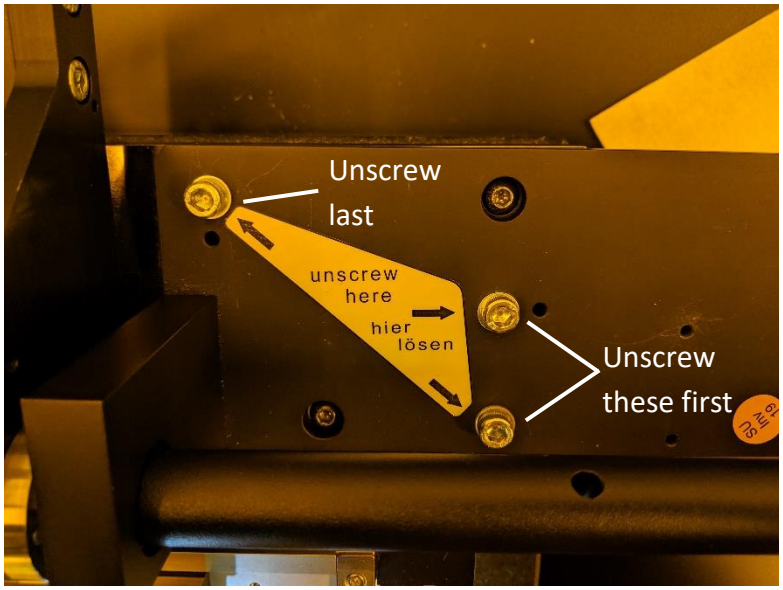
3. Once the pin is unplugged, loosen the screws that hold the force arm in place.

4. The screws are located on the right, near the back of the tool, and can be accessed from the front.

5. The screws take a 5-mm Allen wrench, which is stored in the top drawer next to the tool.

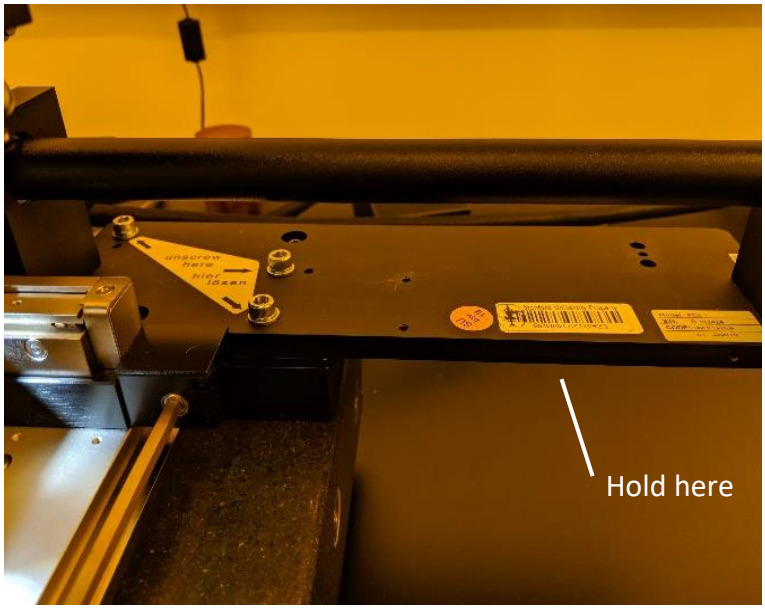
6. The screws should be loosened following an order. Otherwise the force arm may fall off unexpectedly and damage the tool.
7. First loosen the two screws on the right.



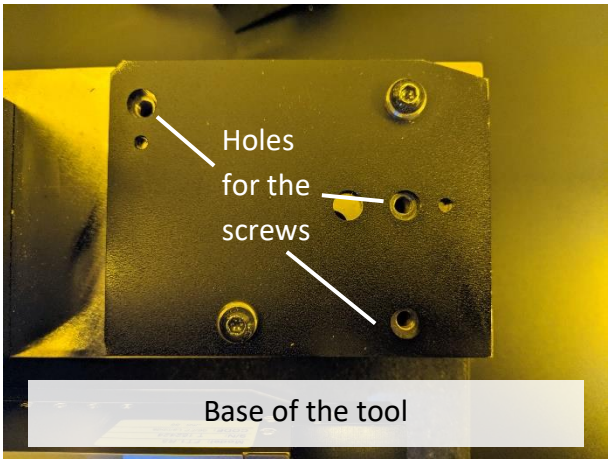


8. Next, while firmly holding from underneath the force arm, unscrew the last screw.
   IMPORTANT: it is crucial that you hold the force arm firmly. The force arm is very heavy and can fall off very easily and damage the tool.

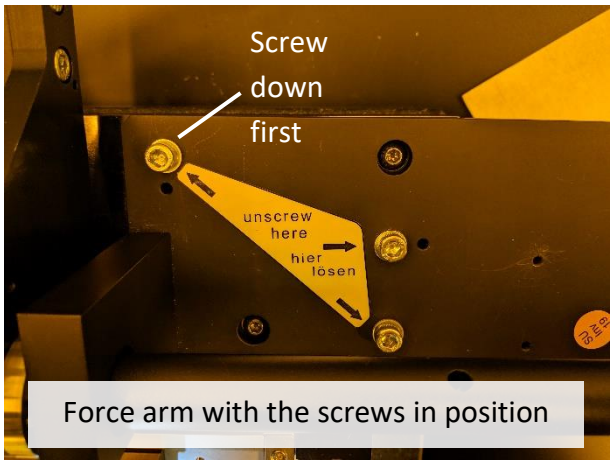
9. Carefully remove the force arm from the tool.



10. To install the other force arm, place it in position, with the three screw holes on the force arm matching the holes on the tool, and the two holes on the force arm matching the screws on the tool.



Base of the tool

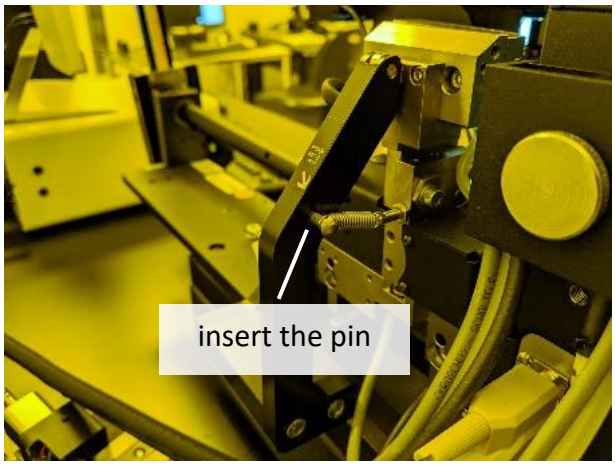


Force arm with the screws in position

11. Once the force arm is in position, screw down the first screw, followed by the remaining two.

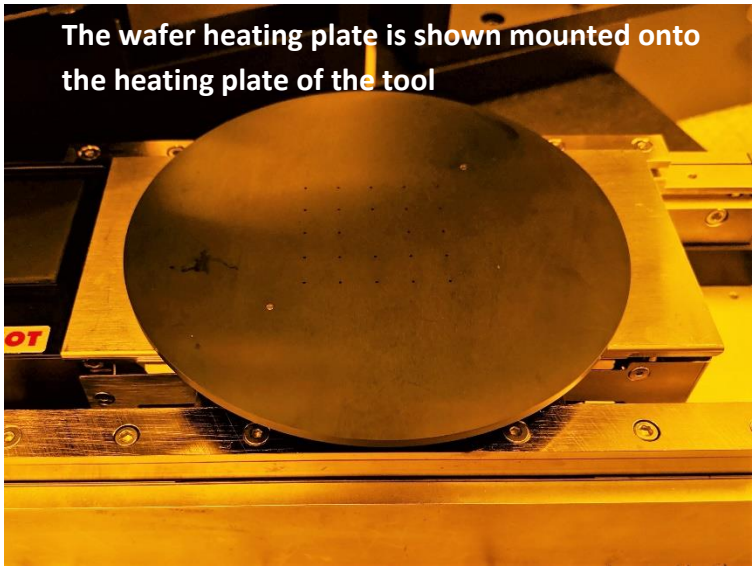
12. Insert the pin into the force arm.

13. Store the uninstalled force arm properly, in the plastic bag and on the shelf.

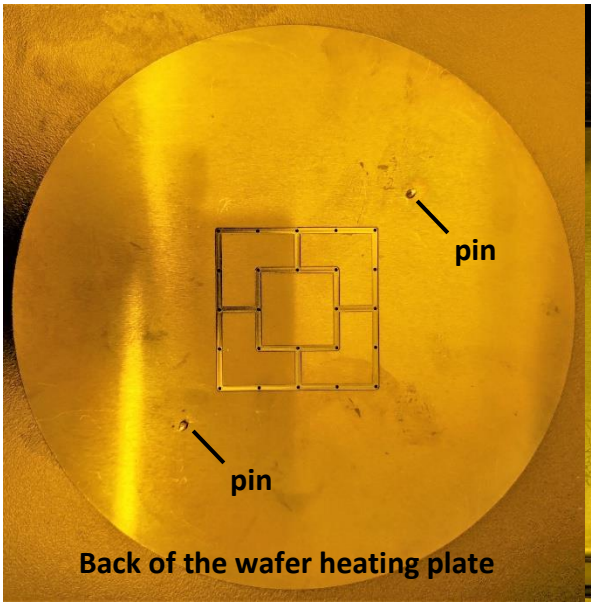


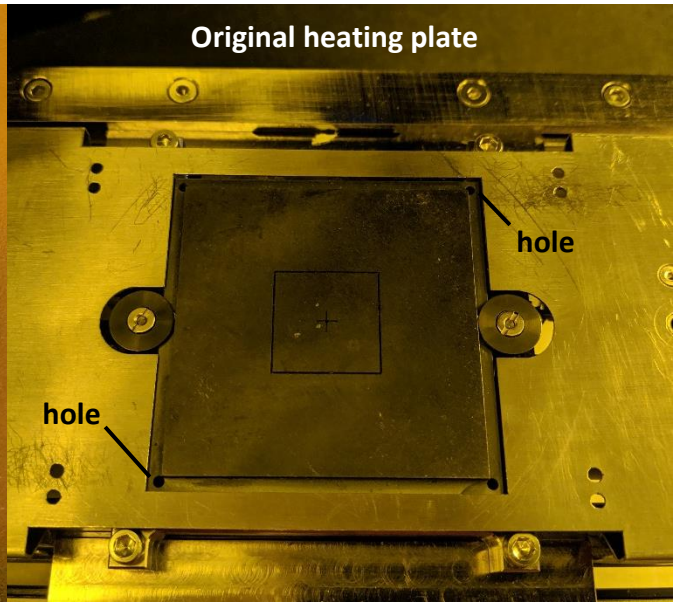
Adding the 100-mm wafer heating plate

The tool can accommodate a 100-mm (4-inch) wafer on the heating plate. There is a heating plate that can be added to the heating plate and hold the 4-inch wafer.



To mount the wafer heating plate, simply position the wafer heating plate, such that the pins on the back of the wafer heating plate are inserted into the holes on the original heating plate.





Calibration of alignment

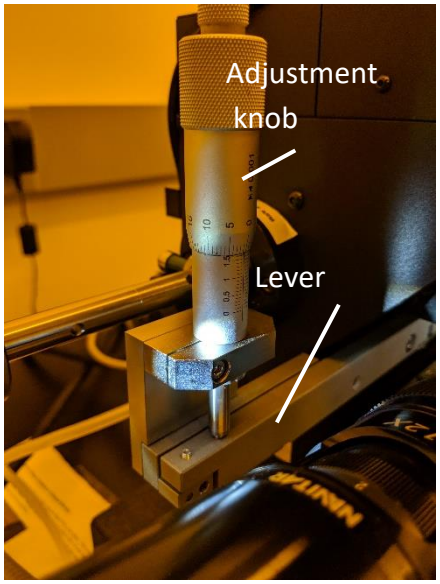
For information on calibrating the X-Y alignment, please contact Swaroop Kommera for instructions.

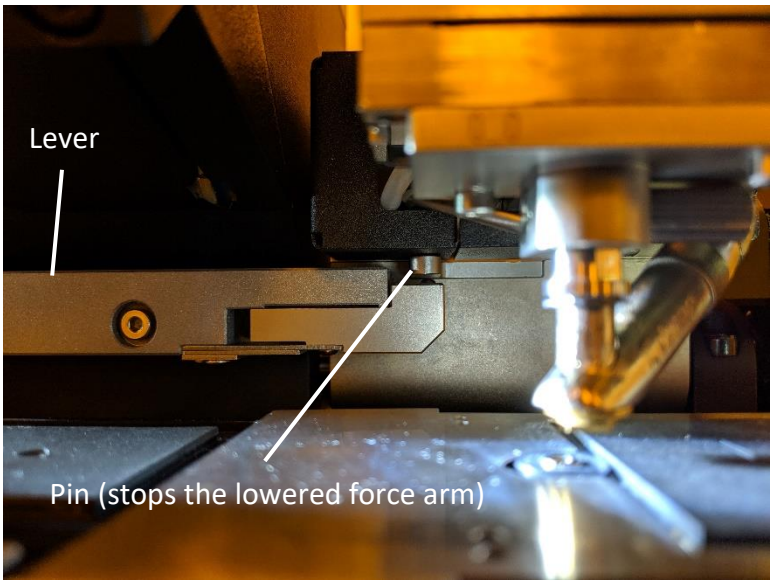
Using the gap adjustment module

In some cases, you may wish to maintain a gap between the die and the substrate (see right) during the bonding process, so that the solder would not be squashed and flattened out.

This can be done using the gap adjustment module.

The module is a lever that is installed on the tool. The adjusting knob moves one side of the lever up or down, which lifts or lowers the die pick, therefore adjusting the gap between the die and the substrate.





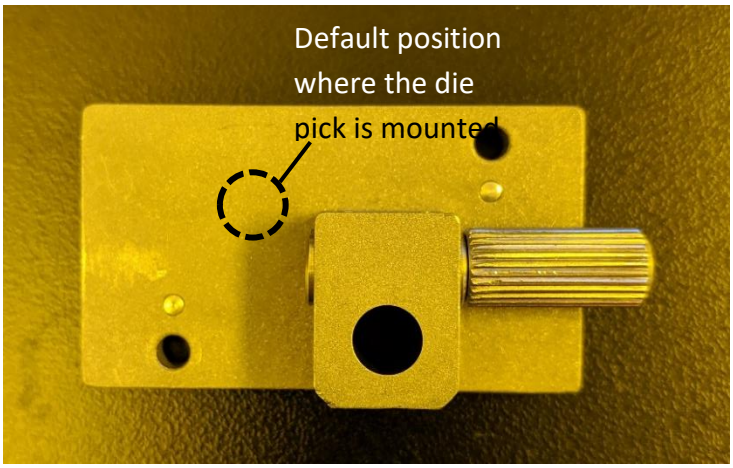
The default position on the knob is marked by a black line, which is 1.61. Default position means that there is no gap between the die and the substrate. Rotating the knob counterclockwise decreases the gap distance, and clockwise increases the distance.

The marks on the adjustment knob is for a rough estimation of how much gap you will get. For example, if the mark shows 1.66, that means you have a 50-µm gap between your die and the substrate.

ATTENTION: if you adjusted the gap distance for your process, please return the knob to default position when you are done.

Using the X-shifter

If you have a relatively large die, the camera may not be able to observe certain regions on the die that is to your left.

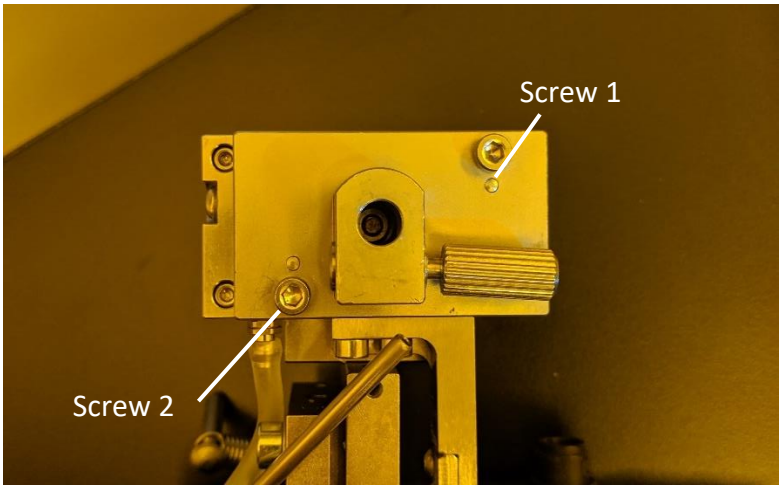


An X-shifter will shift the X-position of the die to your right, so that the entire die can be observed by the camera for alignment purposes. This is achieved by shifting the position where the die pick is connected to the base.

Currently the tool has an X-shifter that can shift the die to your right by 7.5 mm, and 7.5 mm downwards.

CAUTION: when bonding a large die, make sure that the die won't hit the beam splitter when the force arm is being lowered.

1. To use the X-shifter, you need to first remove the original base for the die pick.



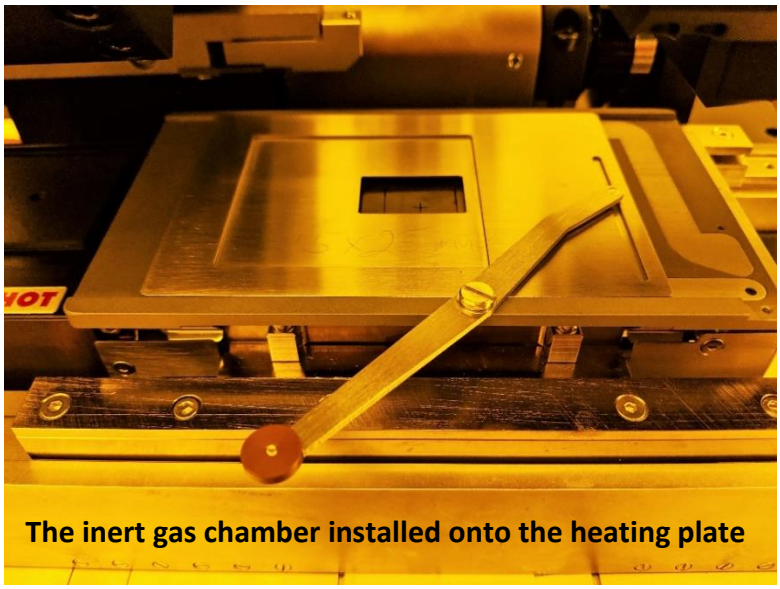
2. With the die pick removed and the CCHM removed from the tool (instruction for removing the CCHM module is in Section C of "**Operation procedure**", unscrew the two screws with a 2.5-mm Allen wrench.
3. Replace the original base with the X-shifter, and fix it into place with the two screws.
4. Install the CCHM module back onto the tool, and install the die pick of your choice, and the X-shifter is ready for your process.

Since your die is moved to your right, the camera will **NOT** look at the center of your die when it is in the leftmost position. Slide the camera on the track to observe different portions of your die.

Using the inert gas chamber

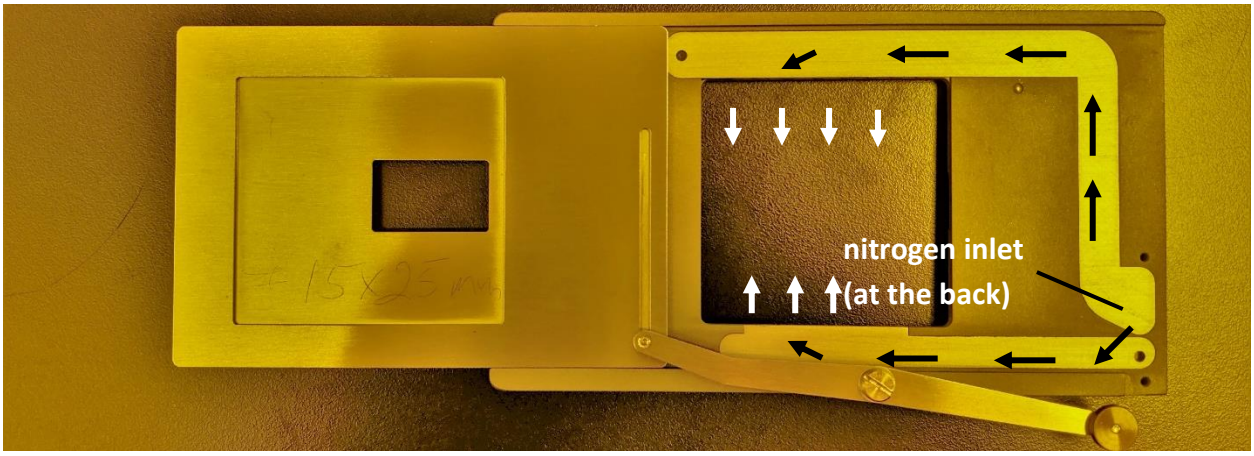
An inert gas chamber can be installed onto the heating plate. Nitrogen can be flown through the chamber during the bonding process to provide an inert environment preventing oxidation of the solder.

The chamber has a lid that can be opened to load the substrate, and closed to minimize contact with air when inert gas is flown. The lid has an opening that allows the die to contact the substrate.

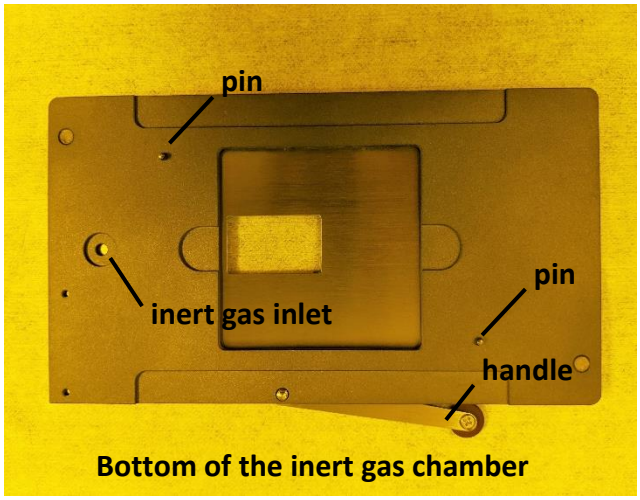


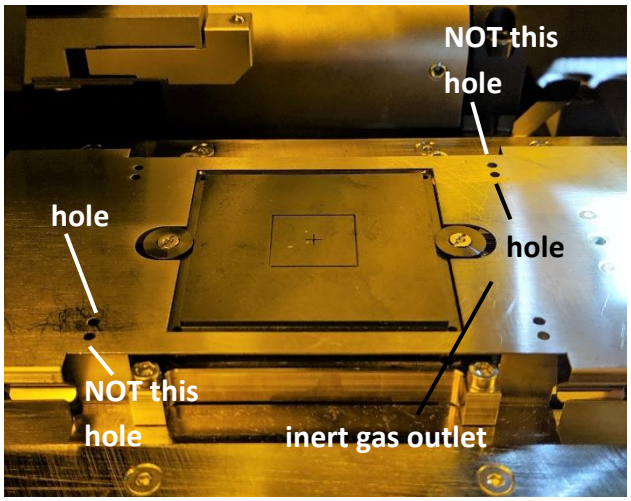
The inert gas chamber installed onto the heating plate

Nitrogen is flown into the chamber through the tracts shown below. By constantly flowing nitrogen and closing the lid, the remaining air inside the chamber is pushed out from the window on the lid, and an inert environment is established. The picture below shows how the inert gas is routed and flown into the chamber.

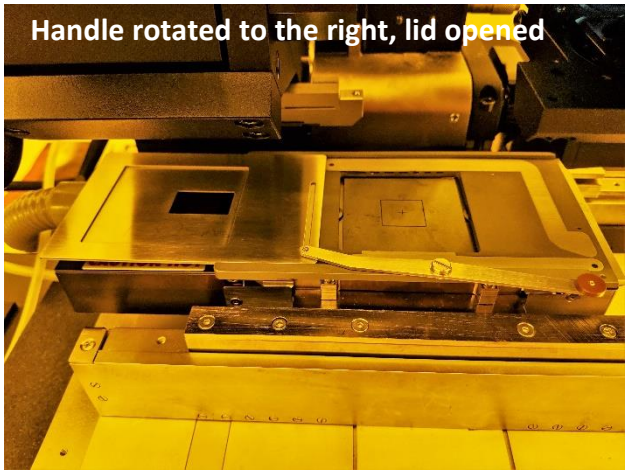


To install the inert gas chamber, with the handle facing toward you, align the pins at the bottom of the chamber to the holes on the heating plate. If properly installed, the inert gas chamber will sit onto the heating plate firmly.

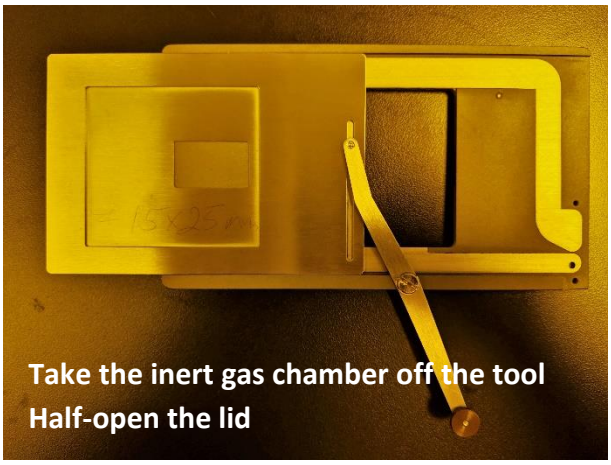


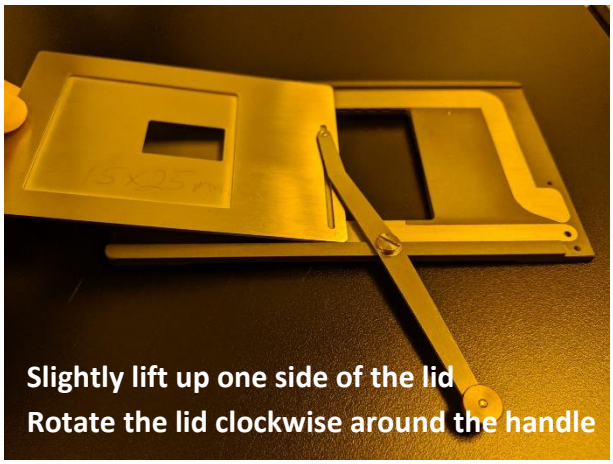


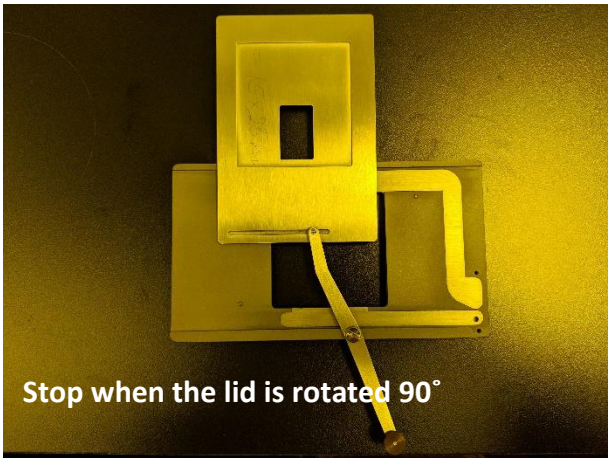
Once installed, you can use the handle to open and close the lid. Open the lid when loading the substrate, and close the lid during alignment, contact, and bonding. For best inert environment, with the lid closed, let the nitrogen flow for several minutes before the bonding process.



There are two lids with different openings available. To change the lid, follow the procedure below.







To install the lid, simply reverse the steps above.

Using flux

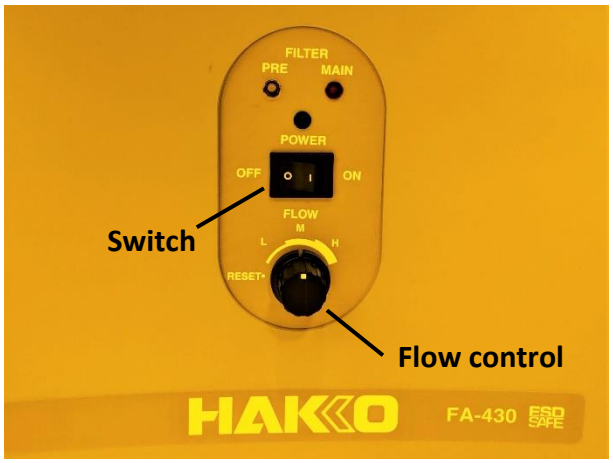
Flux can be used to remove oxide that has formed on the solder bumps.

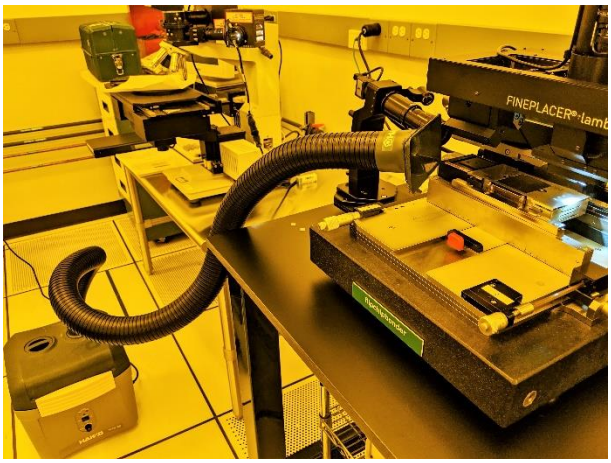
You may apply the flux to the surface of your substrate right before you bring down the die and start the bonding process. This is because flux applied before alignment may get in the way of the camera and obstruct the features that you use to do the alignment.

Make sure that the flux will not flow onto the heating plate, as this will contaminate the surface of the heating plate.

Flux may generate toxic fume when heated. In this case, you should use the exhaust vacuum machine that is placed next to the tool to collect the toxic fume.

To use the machine, turn on the switch on the front panel. Place the tubing as shown below to collect the fume. Adjust the flow rate as you wish.

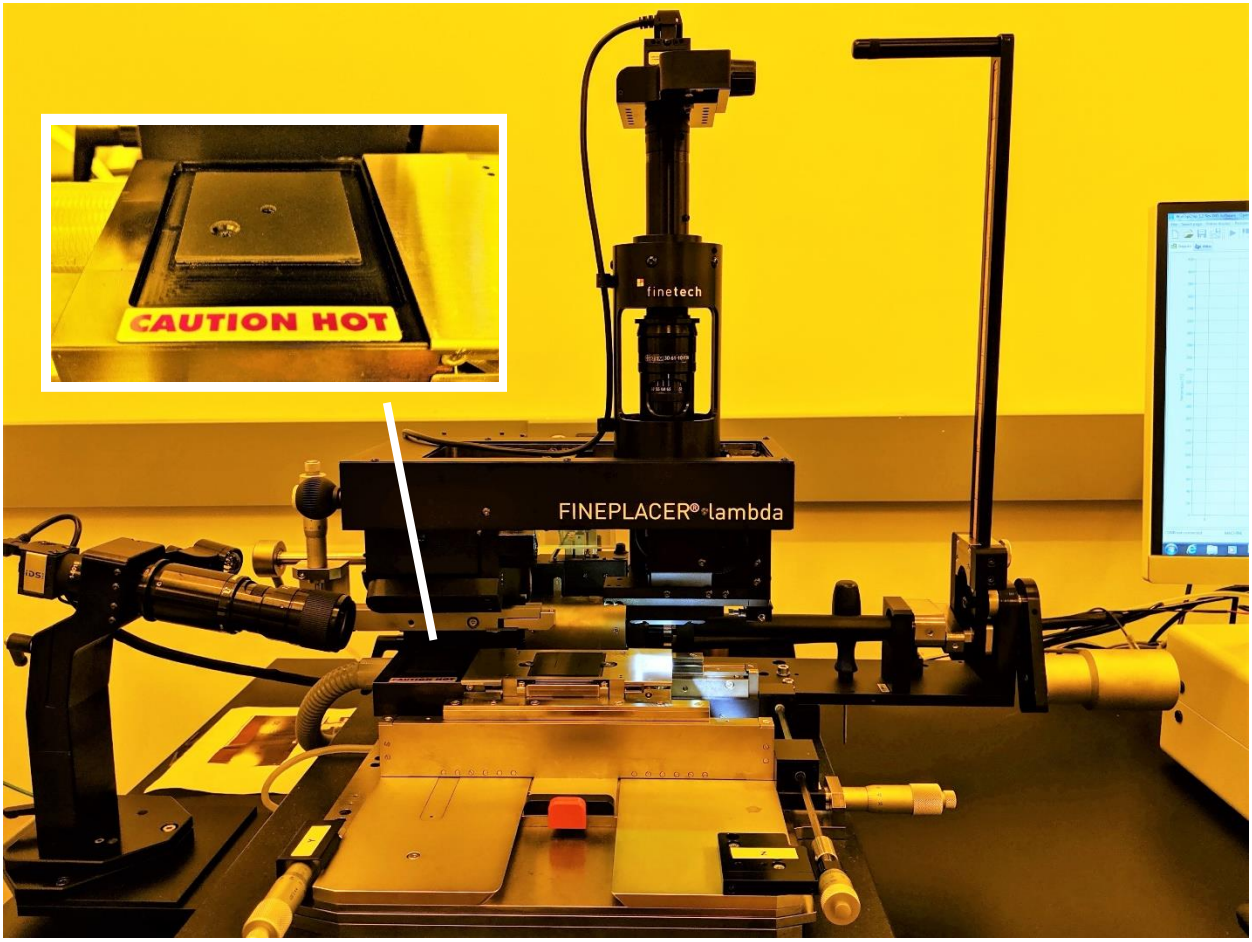




Using the gel pack module

If your die is stored in a gel pack, you may use the gel pack module on the tool to take out the die more easily.

1. Place the gel pack onto the platform shown below.



2. Turn on the vacuum for the gel pack module by clicking the third button of vacuum control on the control software.

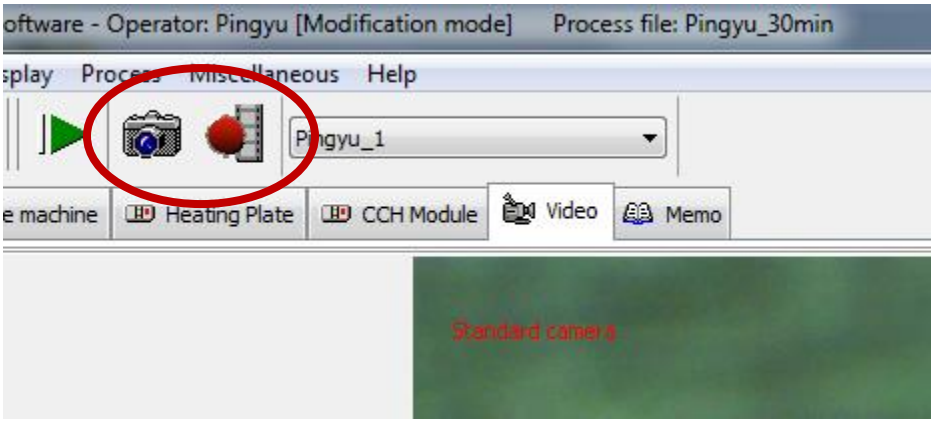
Controls vacuum of the gel pack module

3. The vacuum pulls down the gel in the gel pack, making the die much easier to be picked up by the die pick.

4. Float the table, and with the camera at the leftmost position, position the gel pack underneath the camera.
5. Align the die that you want to pick up to the die pick.
6. Make sure that the vacuum for the die pick is on.

7. Move the camera to the rightmost position and lower the force arm to pick up the die.
8. Once the die is picked up, you can continue your process as usual.
9. Remember to disable the vacuum for the gel pack module before you remove the gel pack.

Saving pictures and videos from your process



You can record from the activated camera at any time during your process.

To save a picture, click the camera button.

To start recording a video, click the recording button. Remember to click the button again to stop recording. Otherwise you will generate a huge video file.

The photos and videos are saved to C:\WinFlipChip\SaveAllPics.

Acknowledgement

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