Tip install:
Tool gauge: The 750 wedge tool has a 580 tool drop (as labeled on the gauge).

Threading: Clamp opens wide by manually pressing down on spring at the left of the head.
While running: hold down switch to interrupt auto mode after next bond.

If go button presses by error, keep holding, and switch mode from run to stop. RunHome. Back to Run.

Rethread
Hit go to bring down tool into view. But, hit cancel because tool is down.

Even for ball bonding, hit go will vibrate tool and makes it easier to move wire along.

Rethread à Run (can pick off longer wires with tweezers) à

Menu: Align and scan bonds: go to wire #
Switch to scan vs bond: scan: look for opens, reposition pads, switch to bond: bond one.

Typical bonding parameters, per Brandon:
1mil wire: 25gram
Soft substrate: 25-40 msec
Power normally 2-2.5, here we had 3.8 (due to flexing in pcb)
140C.
Bond 1: 3.8 power, 35gr, 46ms.. bond2: 40gr

Excessive force dampens the ultrasonic.
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General items:
Zero-zero coordinates are at the top left side of the tool. So tool starts out away from 0,0.
Wire types: each wire has two sets of bond parameters and settings for loop configuration. If the chip needs different types of wires (e.g. staggered wires that require different loops, multiple chips with different bond parameters, etc), then multi wire types are used. Wire length itself is adjusted by the tool depending on alignment, and does not necessarily require new wire types.

Tool Startup:
Turn on power: - Heater and controllers (three units below the work surface). Turn on PC.
Airflow should always be on (hissing), to keep wire and parts clean.

Software initializes. Homes motors. The Process should be done within half a minute.

To create a new device (job to bond e.g. PCB to chip, etc):
File/New Device.
Provide name and preferences (uncheck 1 type per wire, check two bonds per wire). Never use "Loop height relative to former bond", it risks crashing the tip. Number of chips is N chips + 1 (so typical 2 if one chip is to be bonded), because substrate counts as a chip (chip #0). Number of wire type types 1. Number of bonds for all wire types is 2 (because we checked box). "Select Chip for this Bond": If the wire starts on the chip and goes to the substrate, then use "chip 1" for bond 1, and "chip 0" for bond 2. Ok and message should pop up device completed. If errors made, hit close to discard and restart the new device (since edits of fields already entered are not permitted).

Next, we need to identify the substrate and the chip. After that, we need to define the wires.

Coordinates-Chip:
1. Moving the stage: Right click and move the camera above the chip. Left click for fine control moving.
2. Find a feature on the substrate that is easy to identify (a corner) of a stand-alone mark. Use inner and outer intensity to adjust lighting. Outer is good for rough surfaces (e.g. PCB), inner for reflective (e.g. Chip). Use Up/Down buttons to focus the camera.
3. Hit run for the tool to find height. Can go up and down for a better focus. Head moves down until touches. Find elevation should be checked, so the tool moves the head down until pressure sensed and height is measured.
4. Go to another mark on the substrate, ideally far away from the current one. Precision of the position is not extremely important, because fine alignment is done by the image recognition. Second point the tool doesn't tap down because it already established the height with the first point.

(The XY calibration is probably not needed, and may overwrite the tool coordinate system with the chip's coordinates) recalibrate the XY scale.

Next we need to establish the bond to video alignment. Machine/Camera-to-Tool-Offset
1. Starts with the rewire/bond off position. Move to a large dummy area where the tool can tap down after rewiring and for bond-off. Hit go, head comes down and established height. When reached, hit go again to accept.
2. Locate center of the bond. (screenshot)This aligns the bond to the video camera cross-hairs Hit go. The offset (bond to camera) should not shift too much. Retry or hit go.

Next align the rotation:
1. Find a distant unique feature, and hit ok. The tool then rotates the stage, and we find the same feature again. This allows correction for the substrate position, because when the stage rotates, the center of rotation of the stage different from the center of rotation of the substrate.
2. The tool then goes to the center and does a rotation. The image position should not shift during this rotation.

Pattern Recognition:
1. Images/Chip -- (#6): Find the substrate alignment feature and hit go. To cancel out, go Run/Home.
2. PatternID-New. Adds the set of yellow red boxes. Yellow is the view it searches for a pattern, and red is the pattern it tries to find. So if the pattern lands outside the yellow area, it won't see it. If yello area is too big, it may find multiple versions of the pattern and get confused.
3. Save image. Box with score shows up. Should be in upper 900's to indicate good fit (since it fits itself). Move stage around and hit Test Image to see if it can find the feature and verify it fails when feature not present. Adjust threshold as needed, based on the scores that the Test Image box shows, so that only correct images pass.
4. Hit Go and repeat for the second feature. New Pattern, same procedure as before.
5. Hit Go and now do the same for the chp. Refocus if needed, and do the same for the chip.
6. If rework is needed, go to Images/Chip, and use the arrows on the top left to select the right chip and position (rather than stepping through everything again).

Add wires:
1. Coordinates/Bond: Add wire. We add these are a periodic set (even if they're not, since we can modify them later). (#9) Choose the number of wires, the type (usually 1 unless more types are needed), and start ID (1 or 1+N if N wires previous created).
2. If different bond conditions are to be tested on a large solid area, the simpler option of N wires at constant step can be used (so specify one point, then add N wires at a particular pitch and direction)
3. Move stage to the first wire position on chip. Hit Go
4. Move stage to first substrate position, Hit go.
5. Move stage to the last wire position on chip. Hit Go
6. Move stage to last substrate position, Hit go.
7. (#10) Now the tool added the wires and linearly interpolated the positions between the start and finish points. We can then fine-adjust the individual wire locations. (#11) View Wire shows the locations created, good to verify that everything looks reasonable.

8. Goto wire 1 (or other position). Change the Align Box sizes to roughly coincide with the pad (to make it easier to center the crosshair to the pad). Move stage to adjust position (e.g. if bond needs to be fine adjusted, but also if it should actually go somewhere else). Hit go to get to the 2nd bond, adjust the same way.
9. Cycle through as many wires as needed to adjust or check. Add more wires if needed (e.g. for different edge of the chip).

Image/Bond can be used to do fine adjustment (image recognition) of the actual bond pads. We don't usually need this, since the bond pads are not that small (and we already fine adjusted them in the previous steps).

(#12) Edit wire data: This should now show the bond off location, and the wire types with wires we defined. Modify the wire type's loop parameters. Good defaults are:

**Bond 1 (chip)
Search = 0.006 (default)
Z before Y = 0.025
Back bend = 0 (default)
Loop = 0.04
Liftoff angle = 90 (default)
Approach speed = 0.05 inch/sec
Loop speed = 0.8 inch/sec
Liftoff speed = 0.5 inch/sec
Settling time = 5 ms
Chip ID = 1 (the chip)
Channel = 1 (there are 30 ultrasonic power settings, we need 2, one for each surface. Power settings can be viewed by Browse Channel)

**Bond 2 (substrate)
Search = 0.006 (default)
Approach speed = 0.05 inch/sec
Settling time = 5 ms
Y offset = 0 (default)
Clamp code = 1 (default) - no need to change this normally
Chip ID = 0 (the substrate)
Channel = 2 (out second bond power settings)

Wire type properties: no need to change anything. All unchecked. Read manual for this.

Ultrasonic Channel settings can be edited on the main page, using the channel (1 to 30) and modifying power/time/force. Power is normally 2-2.5, for poorly mounted PCB we used 3.8 (due to flexing). Temperature 140C (should have set this way earlier).

On flexible PCB--Chip settings we used: Bond 1: 3.8 power, 35gr, 46ms.. bond2: 40gr

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Now we're ready to start. Edit/View Wire to verify that bond diagram looks correct. Then, verify that wire is threaded and good. If the wire is not threaded:
1. Hit Re-thread. Tool goes to the re-thread position.
2. Hit Go once, and press go until tip shows up in screen. Rethread wire if needed (see Rethreading SOP).
3. Go to bond off.

Hit "RUN" with search pause selected. Tool goes to position of first bond. Important settings: "Detect missing wire" is helpful when doing autobond, so should be checked (to interrupt bonding if wire is unthreaded). "Skip Align this Workpiece" should initially not be checked, because we want the tool to align everything first. After

the first bond, we can check this to avoid re-aligning every time (since nothing has changed). If alignment fails, we get the option to manually position and align. It is therefore useful to have chosen alignment marks that are easy to locate (e.g. corner of a pad rather than the center).

Go starts first bond. Hit go again to do 2nd bond. Use Prev/Next to navigate between different wires. If all looks good, can use Auto Bond and Go.

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Rework/Checking: To see where each bond is supposed to land, use the Run/Align and Scan Bonds. This shows the top view of the pads and allows one-off adjustments to the bond positions (won't impact the device when saved). Also can switch to "bonding mode" to allow immediate rework. This is a good way to fix missed wires, because in the scan mode we can adjust the bond location (to hit a clear section of the pad and avoid the point where the previous bond failed). This method is as close to manual wire bonding as the tool can do. However: any adjustments made will only shift the XY location of the pads, and won't adjust the rotation. And, it seems that sometimes the fine adjustments are forgotten??? So switching from search to bond mode is probably better than exiting and re-running Coordinates/Wire.

Between coordinates/wire and run/align scan, we can play a lot of tricks and manually adjust the positions of bonds. But, it shouldn't be used to fix systematic misalignments.

When done, close the program (save your device periodically), and power down the PC. Turn off the three units below the work surface. Leave compressed air on as it keeps the tool clean.