

TPT HB05 Wire Bonder

Before use, the bonder must be logged on in FOM. This will power up the bonder, LED illuminator, camera, and monitor. If you get stuck, or find the tool in an unusable state, please notify the facility staff know.

General Guidelines for Use

- The bonder can be configured for aluminum or gold wire bonding. Each uses its own spool and bond tool(s). Ball bonding can also be performed with gold wire. It will normally be configured for aluminum wedge bonding; consult with facility staff if you need to reconfigure the bonder.
- The stereo microscope has an adjustable focus and zoom, and is equipped with a CCD camera. The camera is useful for training and collaboration but the stereomicroscope is generally more useful. For viewing through both eyepieces, select the VIS setting. A dial on the left side of the LED illuminator adjusts the illumination level.
- The heated stage allows substrate temperatures up to 250° C. A substrate temperature of ~100°C is recommended for gold wire bonding, but gold wire users have typically been successful without heating. Please use caution when using elevated stage temperatures, and do not leave a hot stage unsupervised.

Control Panel Operation and Parameters

System and bond settings are adjusted using the LCD screen. Turning the dial toggles between parameters, as indicated by a yellow border. Pressing the dial allows the parameter to be adjusted, as indicated by a flashing red border. Turn the dial to select the desired value, then press again to set. The Clamp button manually opens and closes the clamp to allow maintenance/rethreading.

Bond Parameters (for Bonds 1 and 2)

- US – Ultrasonic power, in arbitrary units
- Time – Duration of ultrasonic application, in milliseconds
- Force – Downward force applied by bonding tool during bond (Tests with a force gauge indicate the actual applied force in grams is approximately $12 + 2/5 \cdot \text{Force}$.)

Other Parameters

- Prog – Active program number; there are 20 program slots in memory
- Clamp – Graphical indicator of whether clamp is open or closed (Note – The clamp will automatically close after ~1 minute if left open; this is indicated by a beep.)
- Heater status and temperature – Icon indicates stage or tool (the latter is not available on our bonder) heating. Numerical indicator shows current stage temperature (°C), or set point during

editing. Top circle indicates stage heater status (grey = off, red = heating up, yellow = near setpoint, green = setpoint reached).

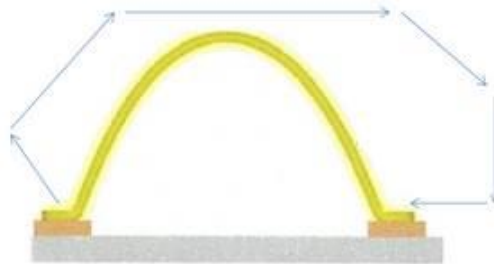
- Bond type – Wedge or ball bonding
- Tail mode – Clamp Feed (wedge bonding) or Table Tear (ball bonding)
- Tail – Length of wire left hanging from tool after a bond is finished (arbitrary units)
- Feed +- - Length of wire fed in or out of tool by pressing Up or Down on control puck (arbitrary units, different from tail length units); essentially, this manually adds or subtracts from pre-set tail length.

Bonding Procedure

- 1) The ideal surface height for bonding is ~79 mm. The system's sample/heating stage can be raised or lowered by loosening the silver thumbscrew on the side of the main body near the bottom, and then rotating the base (one turn of the base corresponds to a 1 mm height change).
 - a. Bonding is triggered at a specific height of the lever/tool; ideally, this should be slightly below the bonding surface such that the tool touches down on the surface, then the bond is initiated with a small additional downward press of the lever.
 - b. If the surface is too high, the tool face that applies the bond will not be parallel. Ultrasonic is less efficient and tool settings may need to be changed. Bonds will not be consistent.
- 2) Set the bond parameters using the control panel as described above. Finding the appropriate values specific to your materials and samples may take some experimentation. If you have a surface to which you cannot bond consistently, you may want to make the first bond on that surface.
- 3) Align the first bond using the positioner (left hand), and bring the lever down until the bond engages. If the first bond fails, press red reset button on the control puck in order to go back to the Bond 1 settings. You may also need to press the down button on the control puck to get a clean section of wire to bond with. Repeat #3 with adjusted parameters.
- 4) Slowly bring the lever up. Once the tool is no longer in contact with the surface, try to draw the wire through the tool at a 45° angle by simultaneously raising the tool and pulling the sample towards you. If you raise the tool straight up, the wire won't feed freely through the tool and will probably pull up your first bond.
- 5) Align the second bond using the positioner and bring the lever down until the second bond engages and the wire breaks free.
- 6) Raise the lever high enough to trigger the instrument to feed a new tail of wire for the next bond. If ball bonding, the EFO arm will engage and spark to initiate a ball for the next bond.

Other Notes & Tips

- Creating a successful bond requires the wire to be aligned under the tool so the 'tail' is pointing straight back towards you. If it points away from you, down, or to either side, you can press the down button on the left-hand controller in order to feed out more of a tail, which will tend to orient itself properly.
- The bond path will be very low and flat if you simply move in a straight line between bond points. Going past the second bond location and then coming back can create higher loops. It takes some practice to develop the technique. The drawing below shows TPT's recommended tool path.



- It will sometime be necessary to re-thread the wedge tool. After passing vertically through the center of the tool for most of its height, the wire comes out of the back (near the bottom). This end then feeds through a hole at the very bottom of the tool that is oriented down and forward. Open the clamp using the controller, and feed the wire through the hole using fine tweezers.
- If the wire breaks within the tool, open the clamp and swing it out to the left. Feed the wire down into the tool from above, use tweezers to grab the wire 1-2 mm above the tool opening, feed the wire in 1-2 mm at a time, until it comes out near the bottom. Pull enough wire through the tool to remove any kinked portions of wire before threading the wire through the final hole.
- A sheet is posted by the bonder summarizing the stored programs. Feel free to use any available slots. Please record them on the sheet, and do not edit other users' programs.