Equipment Manual

for the

Wafer Substrate Bonding Unit

(4 inch version)
To be read carefully before use

1. The operator should be fully aware of the use of the machine according to the Operations Manual.

2. The machine must be placed in an adequate working position, providing level, stable support and adequate ventilation. All functions on the machine and any connected equipment must be in working order.

3. Be sure that the supply voltage corresponds to the voltage stated on the machine. The machine must be earthed.

4. Establish that rear air outlets are completely unobstructed.

5. Before loading samples, ensure that the installation test procedure has been completed.

6. Ensure that the correct operation of the head locking screws is fully understood.

7. Observe the current safety regulations for handling, emptying and disposal of the waste materials and fluids.

8. Before opening the machine or working on any terminal connections, always turn off the power, remove the plug or cable, and ensure that the bonding heads are closed and at or near ambient temperature.

9. When working with the machine, always remember that the heating system parts require extra care due to the system operating temperature.

The apparatus/machine is designed for use with consumables supplied by Logitech. If subjected to misuse, improper installation, alteration, neglect, accident or improper repair, Logitech will take no responsibility for damage(s) to the user or the equipment.

Dismantling of any part of the apparatus/machine, in case of service or repair, should always be performed by a qualified technician (electromechanical, electronic, mechanical, pneumatic, etc.).
LEGEND (Figure 1 and 2)

1. Process Data display and touch panel controls
2. Vacuum/pressure gauge
3. Applied pressure gauge
4. Air supply regulator
5. Chamber air/positive pressure inlet
6. Sample air inlet
7. Bonding head
8. Bonding diaphragm
9. Sample chamber
10. Vacuum connector
11. Oil vapour outlet
12. Water inlet*
13. Water outlet*
14. Mains On/Off switch (Figure 2)
15. Positive pressure inlet connector (Figure 2)
16. Swing bolt (Figure 2)
17. Thumb screw (Figure 2)

* Note: on the single-station unit the water inlet is to the rear of the water outlet.
Figure 2: Single-station Wafer Substrate Bonding Unit

LEGEND (Figure 1 and 2)

1. Process Data display and touch panel controls
2. Vacuum/pressure gauge
3. Applied pressure gauge
4. Air supply regulator
5. Chamber air/positive pressure inlet
6. Sample air inlet
7. Bonding head
8. Bonding diaphragm
9. Sample chamber
10. Vacuum connector (Figure 1)
11. Oil vapour outlet (Figure 1)
12. Water inlet*
13. Water outlet*
14. Mains On/Off switch (Figure 2)
15. Positive pressure inlet connector (Figure 2)
16. Swing bolt (Figure 2)
17. Thumb screw (Figure 2)

* Note: on the single-station unit the water inlet is to the rear of the water outlet.
1 INTRODUCTION

1.1 Scope

This manual provides full instructions for installation, operation and maintenance of the Logitech WSB1 Wafer Substrate Bonding System. Numbers in brackets refer to parts shown on the front fold-out diagrams, Figures 1 and 2.

NOTE: Figures 1 and 2 show the two variants of this system (single-station and three-station), from different angles. Please refer to both Figures where necessary.

1.2 Operating Principles

The operation of the Logitech WSB1 Wafer Substrate Bonding System is illustrated in Figure 3 which shows a section of one of the bonding heads (7). A wax coated glass disc, to which the wafer or sample is to be bonded, is placed in the sample chamber (9). The sample is placed on top of this glass disc and covered by a circle of filter paper or lint free tissue. The chamber cover is then closed and secured by four thumb-screws (17). When the cover is closed, the sample chamber can be evacuated to beyond 1 x 10^-1 mbar, the vacuum sealing being provided by the two large O-rings on to which the head cover locates. The cover of the sample chamber contains a diaphragm (8) which can have atmospheric or positive pressure admitted to the space above it. This diaphragm applies pressure to the sample during the bonding cycle to create a uniform wax bond between the sample and the glass disc.

At the start of the bonding cycle, air is evacuated from space above the diaphragm, causing it to lift away from the sample, and then from the sample chamber (9). As the sample chamber is evacuated its temperature is raised to the preset point determined by the operator. This temperature should be just below the wax melting point: at this temperature the wax will soften but not liquify. Once the correct temperature and vacuum have been achieved, there is a ten minute delay ("soak") to allow temperatures throughout the head and sample to stabilise and the wax to outgas. After this soak time, atmospheric or positive pressure is admitted to the space above the diaphragm at a controlled rate, allowing the diaphragm to drop and press the sample into the softened wax. This pressure is maintained for the preset bond time. Once the bond time is complete, oil is circulated through the head and a heat exchanger to cool the chamber and sample to ambient temperature, whilst maintaining the pressure on the specimen. When the specimen chamber temperature has reduced to 40°C the vacuum is released at a controlled rate.

The single head and three head system will operate in the same manner.

1.3 Operator Console

The operator console comprises a display screen with four softkeys, three manual controls for air flow and two gauges. The sequence of control screens is described in section 3.

The three manual controls are as follows:-

a) **REGULATOR (4)** - The regulator limits the pressure that will be applied to the sample during the bonding phase if positive pressure is required for the bond.

b) **CHAMBER AIR/+VE PRESSURE INLET (5)** - This needle valve controls the rate at which the diaphragm drops, as pressure is applied to the sample during the bonding phase. The default is set during factory set up and should allow the diaphragm to fall to zero in approximately 30 seconds to 1 minute.

c) **SAMPLE Air INLET (6)** - This needle valve controls the rate at which air is admitted to the sample chamber at the completion of a bonding cycle. The default should be fully open unless the process is affected by a sudden rush of air into the specimen chamber.

The two gauges are as follows:-
(3) PRESSURE - This gauge shows the additional air pressure that may be applied by the diaphragm to the sample during the bonding phase.

(2) VACUUM/PRESSURE - This gauge always shows the current pressure applied by the diaphragm to the sample.

Figure 3: Bonding chamber cross-sections

16. Swing bolts
17. Thumb screws
18. Heating element
19. Thermocouple
20. O-ring seals
21. Chamber vacuum inlet
22. Diaphragm vacuum inlet
23. Vacuum diaphragm
24. Support pillars
1.4 Installation and Test

The WSB1 must be connected to a suitable AC mains supply. This must be 110V or 230V (+/- 6%), which makes the acceptable operating range from 218 to 243 volts) according to the rating plate at the rear of the machine. The supply lead colours are as follows:

LINE----------------------BROWN
NEUTRAL-------------------BLUE
EARTH----------------------GREEN/YELLOW

Connect a vacuum line to the aluminium connector on the left hand side of the unit (10). The vacuum quality can be checked using the test screen described in Section 3.3.

Connect cooling water inlet and outlet hoses to the large barbed tails on the left hand side of the unit ((12)and (13)).

N.B. The heat exchanger system cools the bonding head(s) from 188 degrees celsius to 40 degrees celsius in less than 9 minutes. In order to replicate this cooling time the following cooling water conditions should be applied:

Flow rate of 2 litres per minute.
Inlet temperature of 11 degrees celsius.

The above conditions will produce a cool down time of less than 9 minutes from a head temperature of 188 degrees cel- sius to 40 degrees celsius.

The outlet water temperature will rise to a maximum of 26 degrees celsius during cooling, i.e. immediately after the start of the cooling phase.

Connect a service duct extract to the oil vapour outlet (11) on the 6mm diameter barbed tail adjacent to the cooling water connections.

Connect an air line at a minimum pressure of 2 bar to the compressed air inlet "Hansen" connector (15) on the right hand side of the unit.

On connection to the mains supply the cooling fan on the WSB1 will be running. Switch on the main switch at the rear of the right hand side panel (14). The top level operating screen will be displayed. A description of the display screens is given in Section 3.

1.5 Bonding Process and Recommended Waxes

Samples may be bonded either to 83mm (3.27") diameter or 105mm(4.13") diameter glass mounting discs. The chamber is manufactured to suit a wafer thickness of 1mm or below, used with a 6mm thick glass disc. These discs should be pre-coated with an even layer of wax between 5 and 10 microns thick (when the Logitech WCS10 wax evaporation system is used). Where a manual application of wax is used, this is hand-applied by the operator. Three 83mm (3.27") diameter discs are provided with the machine, together with spacer rings which bring their effective diameter up to 105mm (4.13").

NOTE: DO NOT USE THE UNIT WITH ANY CHAMBER EMPTY. Equally importantly, the unit should not be operated using 83mm (3.27") diameter discs without the rings in place, as there is a possibility of damage to the diaphragms or displacement of the samples. The rings should be fitted with the grooved side face down to provide a uniform surface for the diaphragm to press. Optional spacer discs can be provided if thinner substrate materials are necessary, e.g. sapphire.

To bond a wafer to a glass substrate, both the wafer and glass must be prepared and cleaned before placing them in the bonding chamber (9).

First take appropriate wafer measurements, then clean and store the wafers ready for bonding. Clean and measure the flatness and taper on the glass. This should be 2um or less to provide an effective substrate for lapping and polishing the wafer. By measuring the wafer and the glass before and after bonding, the wax layer uniformity and thickness can be calculated. This will enable any process parameters to be adjusted to further improve the geometry of the final component or device.
A uniform layer of wax should be applied by hand to the glass after placing it on a hotplate at the wax melting point and manually coating the surface with a thin, even layer. The glass should then be cooled and placed in the bonding chamber.

Lay the wafers to be bonded on the waxed glasses; firmly press the wafer on to the glass to expel any trapped air, and cover each carefully with a disc of clean filter paper or tissue. Before closing the heads, ensure that the wafer has not floated off-centre. Close the heads, gently seat them on the seals and lightly tighten the locking screws by hand and start the bonding cycle. Once the vacuum evacuation and heating stage is reached, re-tighten the locking screws using only finger pressure.

Two types of bonding wax are recommended:

QUARTZ WAX (0CON-200) - A brittle, opaque amber, chippable wax that is particularly suited to bonding wafers. It is extremely fluid above its distinct melting point, hard and firm immediately below. It is soluble in trichloroethane. The recommended plate temperature for this wax is in the range 69°C - 75°C.

HIGH MELTING POINT WAX (0CON-196) - A tan coloured, medium hard synthetic wax with a melting point of 157-162°C. It is soluble in hot trichloroethane. The recommended plate temperature for this wax is 180°C - 183°C.

Both waxes have been chosen for two properties. First, they are extremely pure and can be evaporated on to the glass mounting discs using the Logitech WCS10 Wax Coating System. Secondly, finished wafers can readily be removed from the glasses by heating in a hot isopropanol vapour unit such as the Logitech 1ACCS-5100 solvent vapour cleaner, or by using a solvent such as ECOCLEAR.

It will be noted that both recommended bonding temperatures are below the wax melting points. This is fundamental to the process as it is intended that the sample be pressed into a softened layer of wax under vacuum to achieve the bond, so protecting any devices of the bonded face from contact with the glass disc. For any particular combination of sample and wax the optimum temperature may vary by a few degrees either side of the above recommended values.

The maximum bonding temperature recommended with the WSB1 is 180 degrees celsius.
2 OPERATION

Since all of the cycle parameters for the WSB1 are stored in non-volatile memory they may be recalled at any time. The following process parameters are stored in the machine’s battery backed-up memory. The default values are given in brackets

- Bonding temperature (75°C)
- End point temperature (40°C)
- Soak, bond and maximum outgas times (all 10 minutes)
- Vacuum thresholds (proceed if below 0.1 millibar, abort if above 0.3 millibar)

For more detailed process steps, refer back to section 1.5. To bond a wafer to a glass substrate both the wafer and glass must be placed in the bonding chamber. Lay the wafers to be bonded on the waxed substrates. Cover each carefully with a disc of clean filter paper or tissue.

Once the vacuum evacuation and heating stage is reached, re-tighten the locking screws using only finger pressure.

ANY HEADS NOT IN USE MUST BE LOADED WITH CLEAN 105mm DIAMETER GLASSES (OR 83mm DIAMETER GLASSES INSIDE RINGS) TO AVOID OVER-STRETCHING THE DIAPHRAGM. ALL HEADS MUST BE CLOSED BEFORE THE BONDING CYCLE IS COMMENCED.

The bonding temperature should be set according to the melting point of the wax in use. The end point temperature is that at which the vacuum in the bonding chamber is released and the chamber lid may be opened. The cycle time may be shortened by reducing the soak time or the bond time, or by raising the end point temperature.

DO NOT HANDLE SAMPLES THAT ARE ABOVE 55°C WITHOUT GLOVES.

At the start of each cycle it is advisable to check that the vacuum reading on the main display is dropping rapidly towards the ideal value of 1 x 10⁻¹ mbar. Slow pumpdown can either be caused by a leak at the bonding heads or by outgassing from the samples or bonding medium. Outgassing can cause significant delays in the cycle depending on the materials used and in particular on residual solvents which may have been used in cleaning operations. If, however, a vacuum leak is suspected, as a first step, stop the cycle, open the heads and clean the top face of the head seal O-ring with a tissue moistened with a smear of vacuum grease. Check also that the O-rings are not damaged and that the grooves and rings are clean.

During the bonding cycle the vacuum in the specimen chamber is constantly monitored. Should the vacuum be lost then the process will be automatically aborted. A loss of vacuum is most likely to be caused by allowing the air pressure in the upper chamber to go above 2 bar; reducing this pressure with the pressure regulator should allow the vacuum to be re-established. Once the correct vacuum level has been reached again the bonding cycle will restart.

When the machine is not in use the bonding chambers should be left closed. The locking screws should not be left tightened as this will distort the O-rings and damage the unit.

NOTE: The machine must ALWAYS remain switched on while the water supply is connected to it. Should it be switched off with the water supply still connected, there will be a pressure build up within the unit, which may result in the supply pipe rupturing. This is due to the solenoid valve being positioned within the unit itself, allowing water to enter the machine before being stopped at the valve. If the supply pipe were to rupture within the machine itself this would have adverse effects on the unit. The supply pipe rupturing outside the machine would be equally undesirable.

The operation of the Wafer Substrate Bonding System is controlled through a sequence of display screens as described in section 3.
3 DISPLAY SCREENS

3.1 The Title Screen

When switching on the Wafer Substrate Bonding System, the software version and its revisal date will be displayed and the operator will be offered the choice between [PROCESS], [TEST] or [SETUP] as shown below.

![Figure 4: Title Screen](image)

The [SETUP] softkey takes the user to the Setup Screen described in section 3.2, the [TEST] softkey takes the user to the Manual Menu Screen described in section 3.3 and the [PROCESS] softkey takes the user to the Process Screen described in section 3.4.

3.2 The Setup Screen

After selection of the Setup Screen Menu the operator will be offered the choice between [TEMPERATURE], [VACUUM THRESHOLDS], [PROCESS CONTROL], [HEADS] or [SOLENOIDS] as shown below. The [EXIT] softkey will return the operator to the Title Screen.

![Figure 5: Setup Menu Screen](image)

The Temperature Setup Screen is described in section 3.2.1, the Vacuum Setup Screen in section 3.2.2, the Process Control Setup Screen in section 3.2.3, the Head Setup Screen in section 3.2.4 and the Solenoid Setup Screen in section 3.2.5.
3.2.1 Temperature Setup Screen

This screen allows the operator to adjust the set point temperature using the [+ and [-] softkeys (see figure 6). Selecting the [NEXT] softkey until the [UNITS] option is highlighted will enable the user to switch between the Celsius and Fahrenheit temperature scales (see figure 7). Having reached this point, the screen can be changed from measuring temperature in Celsius to Fahrenheit by pressing the degree [F] softkey. Once the user has selected the appropriate temperature scale, they can move between the Wax Temperature, Offset and End Point Temperature by selecting [NEXT]. The maximum value for both the Wax Temperature and the End Point Temperature is 200°C, while the lower limit is 20°C.

Offset is used to set the temperature differential across the glass substrate. This is required due to the wax temperature equalling what is required on top of the substrate, however, the platinum plate must be higher in temperature in order to sustain the required conditions for bonding to take place.

The following temperature settings should be used when bonding a 6mm float glass substrate using Logitech wax:

(a) Wax Temperature 75°C Offset 8°C
(b) Wax Temperature 162°C Offset 26°C

In the above cases the actual platen temperature will be 83°C and 188°C respectively.

The [EXIT] softkey will return the operator to the Setup Menu Screen.

When the temperature scale is changed both the bonding and end point temperatures will change accordingly.
3.2.2 Vacuum Setup Screen

This screen allows the operator to adjust the vacuum levels at which the bonding process will proceed and the point at which the process will abort. The operator may highlight the values using the [NEXT] softkey, and alter them using the [+1] and [-1] softkeys. The [EXIT] softkey will return the operator to the Setup Menu Screen.

![Vacuum Setup Screen](image)

3.2.3 Process Control Setup Screen

This screen allows the operator to adjust the soak time, bond times, maximum outgas time and positive pressure auto delay time. These values must be between 2 and 99 minutes. The operator may highlight either the PROCESS TYPE, SOAK, BOND, OUTGAS LIMIT or POSITIVE PRESSURE DELAY values by pressing the [NEXT] softkey, this will allow the user to scroll through each of the options available to them on the screen. After selecting an option, the chosen option’s values may be altered by using the arrow softkeys. The four options available to the user whilst the PROCESS TYPE option is highlighted are WAX COAT AND BOND, HEAT AND OUTGAS, COLD PROCESS and RESIN BOND. Again, the user may scroll through these options by use of the arrow keys. The [EXIT] softkey will return the operator to the Setup Menu Screen. When setting the outgas time the user should ensure that they set a time longer in duration than the actual outgassing time. This is to ensure that the machine progresses through the process cycle, otherwise the machine will automatically abort.

![Process Control Setup](image)

(Please note that the Bond Time will always be 1 min. longer than the Positive Pressure Delay)
3.2.4 Head Setup Screen

The Head Setup screen allows the user to switch the heads on and off independently of one another by simply pressing the softkey below the required head on the display. Each key press toggles the associated head status from on to off or vice versa (in single head machines this screen displays only one option, telling the user that the head is on). The [EXIT] softkey will return the operator to the Setup Menu Screen.

![Figure 10: Head Setup Screen](image)

3.2.5 Solenoid Setup Screen

The water source for the machine can be altered by the user at this point by simply pressing the [MAINS] or [PUMPED] softkeys. Once the water source has been established, the user can then alter the application of positive pressure to the head in the bonding phase by selecting the [NEXT] softkey. This will then enable them to select either [AUTO] / [MANUAL]. Should the user select the [MANUAL] option it should be noted that the [+ve] key which appears in the bond stage screen (figure 16) will only remain visible until pressed, whereupon it will disappear.

![Figure 11: Solenoid Setup Screen](image)

The [EXIT] softkey will return the operator to the Setup Menu Screen.

3.2.6 Service Hours Screen

This screen enables the operator to monitor the service time of the whole machine, the heaters and the oil pump. These can be viewed by selecting "Service Hours" in the Setup screen, which will lead to the screen shown in Figure 12. The [EXIT] softkey will return the operator to the Setup Menu Screen.
3.3 The Solenoid Test Screen Menu

This screen allows the user to manually test the four Solenoid Valves and will display the following parameters:

From this screen the user will select which supply they wish to enter the machine's chambers. Figure 13 depicts this process. By setting the Lower Chamber option to either Vacuum or Atmosphere the user will decide whether the lower chamber is evacuated or filled with air at atmospheric pressure. Similarly, the user decides whether the upper chamber is to be evacuated or filled with air by choosing either Atmos or Vacuum from the Upper Chamber Air Inlet Select option. The air that is supplied to the upper chamber can be selected from either air at atmospheric pressure or compressed air supply, as shown below at the Upper Chamber Source.
3.4 The Process Screen Menu

On entering the process screen, by pressing the [PROCESS] softkey in the title screen (see Figure 4) the following information will be displayed:

i) Current system temperature (i.e. the lowest temperature detected from all the enabled heads).
   This option is shown in all processes apart from the Cold Process, where it is not required.
ii) Set point temperature, which can be user defined through the temperature setup screen. In the Wax Coat and Bond Process this will appear as Bond Temperature, while this option is not required in the Cold Process and does not appear for this reason.
iii) Elapsed time into the process
iv) Current vacuum level.

The process cycle is started by pressing the [START] softkey, which will activate either the Wax Coat and Bond Process, the Heat and Outgas Process, the Cold Process or the Resin Bond Process, depending upon which process the user selected at the Process Control Setup Screen (see Figure 9). The "Set point" prompt shown below will change depending upon which process has been selected (the Process Screen shown below is for the Heat and Outgas Process). Should the Wax Coat and Bond Process have been chosen, the "Set point" prompt will be replaced with a "Coat temp" prompt, while in the Cold Process the prompt space is left empty. In the Resin Bond Process the "Set point" prompt remains the same. The [EXIT] softkey will return the operator to the Title Screen.

The Wax Coat and Bond, Heat and Outgas, Cold and Resin Bond process screens all are detailed over the proceeding pages. Each stage of the process is shown allowing the user to visualise what should happen once the [START] softkey has been pressed.
The operator has the option of stopping each process by pressing the [ABORT] softkey. Should the user select the [ABORT] softkey, they will be prompted as to whether they still want to abort or not. Selecting the [No] key will return them to the previous screen, allowing the user to continue as before. On selecting the [Yes] key, the "Status" prompt will display the message "Cooling (user abort)".

Selecting the [STATUS] option will take the user to the Head Status Screen (this does not apply to single head machine users). This screen displays which heads have been turned on or off by the user, process type and timings.

Should any difficulties occur that lead to one of the bonding head’s temperature controller not working a COMMUNICATIONS ERROR message will appear on the screen.

When this message appears the user should switch off the unit and restart, as the bonding head affected by the message will no longer work. This bonding head will be shown as being switched off in the [STATUS] screen, with a message directly below it reading "Comms?". This message denotes that the temperature controller is not longer communicating with unit's host processor nad the user should either contact the service engineer or Logitech directly.

Once the unit has completed a full process, the display screen will show the word "Ready" next to the "Status" prompt (as shown in the first screen of each process). However, it should be noted that the final screen will also contain a "Last" prompt that informs the user of how the unit performed during the previous process. The different variables shown by the "Last" prompt are "OK", "User Abort", "Outgas Time Error", and "Threshold Error". This message will not appear if the unit is still to go through its first process.

**Figure 16: Head Status Screen**

**Figure 17: Process End Screen**

**NB** To avoid the machine automatically aborting, ensure that the outgas time, set in the Process Control Setup screen, is longer than the actual outgassing time.
3.4.1 Wax Coat and Bond Process

The above screen shows a unit before starting the Wax Coating process. Once the user presses the [Start] softkey the unit will automatically move onto the "Heat" stage of the process displaying the screen depicted below. When the coating temperature is reached, the above screen will be displayed and an audible warning will be issued. The user should open the sample chamber lids, apply wax to the support discs and press the [CONT.] softkey. After carrying out this procedure, the screen shown below will be displayed and the heads will start to cool until they reach the loading temperature. 

The above screen shows a unit before starting the Wax Coating process. Once the user presses the [Start] softkey the unit will automatically move onto the "Heat" stage of the process displaying the screen depicted below. When the coating temperature is reached, the above screen will be displayed and an audible warning will be issued. The user should open the sample chamber lids, apply wax to the support discs and press the [CONT.] softkey. After carrying out this procedure, the screen shown below will be displayed and the heads will start to cool until they reach the loading temperature.
Once the loading temperature has been reached, the above screen will be displayed and a second audible warning will be issued. The user should load the samples on to the wax-coated support discs, cover with filter paper, close the lids securely and press the [CONT.] softkey. The screen shown below will then be displayed and the heads will cool to the hardening temperature.

Once the Wax Coating Process has been completed the unit will move onto the Bonding Process. In the screen depicted below the unit is emptying the chambers of air and will remain at this stage until the Vacuum proceed level is reached or, alternatively, the maximum outgas time is exceeded, whereupon the screen will read "Cooling (Outgas Timer Overrun)" at the "Status" prompt.

Once the Outgas phase is complete the screen will move onto the "Heat" phase, as shown below. Whilst the "Heat" phase is highlighted, the machine will monitor the temperature of the heads until the procedure setpoint is reached before moving onto the "Soak" phase.
Providing the set point temperature is reached the screen will highlight the "Soak" phase.

During the "Soak" phase the vacuum level is monitored and compared to the proceed vacuum level. Should the vacuum rise above this preset level it will automatically switch to the abort sequence displaying the message "Cooling (Threshold Error)" at the "Status" prompt.

Once the bonding phase is reached the operator has the option of applying positive pressure to the upper chamber by pressing the [+ve P] softkey as shown above. After the user has applied positive pressure the [+ve P] option will no longer be shown. If "auto" was selected from the Solenoid Setup Screen, this option will not appear on the process initiated screen. Instead the machine will automatically set the positive pressure delay to the time interval entered at the positive pressure delay prompt in the Process Control Setup Screen.
After completing the bonding cycle, the machine will enter into the cooling cycle, which lasts until the end point temperature is reached. During this process the machine heads cannot be opened. The process is complete once the "Status" prompt returns to showing the word "Ready" and the "Last" prompt appears, as shown below.

3.4.2 Heat and Outgas Process

As in the second part of the Wax Coat and Bond process, detailed in the previous section, the Heat and Outgas Process consists of the same phases shown below at the "Status" prompt. Once the user has pressed the [START] softkey depicted above, the unit will automatically move through each phase.

In this process the "Outgas" and "Heat" phases are both highlighted, as the unit will monitor the evacuation of the system until the proceed threshold is reached, but will also monitor the system temperature on all heads until the procedure setpoint is reached.
Once the unit has achieved the appropriate temperature on all heads, combined with the appropriate evacuation level, the
screen will move onto the "Soak" phase and follow exactly the same procedure as in the bonding sequence described in the
Wax Coat and Bond Process. The following two screens show this.

The "Bond" phase screen in the Heat and Outgas Process:

The "Cool" phase screen in the Heat and Outgas Process:
3.4.3 Cold Process

In this process the vacuum level is monitored and once the correct level has been reached, the system will start the process cycle whilst continuing to monitor the vacuum level, ensuring that it doesn’t rise above the abort threshold.

The user should note that the "Status" prompt only shows "Outgas" and "Bond" phases. This is due to there being no requirement for the system to reach a heat temperature prior to starting the bond process and there being no subsequent requirement for the system to cool down.

3.4.4 Resin Bond Process

In this process, the vacuum level is monitored and once the correct level has been reached, the system will start the process cycle whilst continuing to monitor the vacuum level, ensuring that it doesn’t rise above the abort threshold.

The user should note that the "Status" prompt only shows "Outgas" and "Bond" phases. This is due to there being no requirement for the system to reach a heat temperature prior to starting the bond process and there being no subsequent requirement for the system to cool down.
This process is used to bond two wafers together, rather than bonding a wafer to a support disc as in each of the other processes. The resin used should be a silicon resin that cures quickly at high temperatures.

In the "Outgas" phase the unit will evacuate the specimen chambers at room temperature prior to moving onto the "Bond" phase.

Once the wafers are sufficiently bonded, the unit moves into the "Heat" phase, where the resin will cure once the required temperature is reached. After achieving this the unit moves through the "Soak" and "Cool" phases before the bonded wafers can be removed from the sample chambers.
Status: Outgas Bond Heat Soak Cool
Actual: 60°C   End Point: 45°C
Vacuum: 9.4E-02 mBar   Time: 0:03:44

[Status]  [Abort]
4.1 Replacing the Bonding Head Diaphragm

To replace the bonding head diaphragm, it is first necessary to remove the top cover of the bonding head.

Remove the centre screw on the metal bar (21), then remove the two screws at the hinge end of the bar (22). Release the retaining thumb screws (17) and swing them down onto the work deck. The head can now be lifted away from the machine to replace the diaphragm.

Release the eight M5 screws (23) which clamp the diaphragm between the lower ring and the lid, separate the two parts, and remove the old diaphragm.

Place the new diaphragm between lid and lower ring, and re-attach the eight screws. NOTE: Ensure that the holes in the diaphragm are clear of the screws, to avoid tearing the diaphragm and causing vacuum problems.

Refit the bonding head cover to the machine, and then test the system vacuum to ensure that there are no leaks.
4.2 Removing the Top Casing

The Logitech Wafer Substrate Bonding System is designed to require minimal regular maintenance. The Top Casing should only be removed after consultation with Logitech or their representative.

SWITCH OFF THE MACHINE, DISCONNECT FROM THE MAINS SUPPLY AND ENSURE THAT THE BONDING HEADS ARE AT OR NEAR AMBIENT TEMPERATURE.

(Refer to diagram on the previous page, and Figures 1 and 2 at the start of the manual)

The machine should first be raised about 6 inches (15cm) off the bench on blocks. Release the thumb screws (17) on each bonding head, remove the two screws (22) at the rear of each bonding head which retain the head on the hinge, and then lift off the head. Remove the two screws (24) from each Thumbscrew Retaining Plate on either side of each bonding head and remove these plates. Remove the casing retaining screws from around the base of the casing at the sides and rear. There are six of these screws on a single station machine and seven on a three station machine. Finally remove the casing retaining screws under the front edge of the casing. There are two of these screws on a single station machine and three on a three station machine. Lift the casing from the machine.

NOTE: NORMAL SAFETY PRECAUTIONS SHOULD BE TAKEN TO AVOID ELECTRIC SHOCK IF WORKING ON THE MACHINE WITHOUT THE CASING ON.

After working on the interior it is recommended that a low temperature bonding cycle is run (say up to 50°C) before refitting the casing to check the integrity of any pipe or electrical connections which may have been disturbed.

4.3 Fault Finding

The following are intended as diagnosis points only. Logitech will be pleased to assist with any fault diagnosis and repair or replacement of any part of the system during the warranty period and to provide prompt advice and service thereafter.

4.3.1 No Front Panel Display

Check the connections to the control board mounted on the rear of the front panel. If these are all secure check that there is 12 volts at the power supply.

4.3.2 Head Malfunction

Check that all of the connectors at the base of the relevant temperature controller are correctly inserted.
5. WSB1 SPARE PARTS

<table>
<thead>
<tr>
<th>Cat No</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2ELC-327</td>
<td>240V axial fan</td>
</tr>
<tr>
<td>2ELC-328</td>
<td>110V axial fan</td>
</tr>
<tr>
<td>2ELC-461</td>
<td>Mains filter</td>
</tr>
<tr>
<td>2ELC-486</td>
<td>12V power supply</td>
</tr>
<tr>
<td>2ELC-489</td>
<td>Power supply cover</td>
</tr>
<tr>
<td>2ELC-519</td>
<td>Pressure solenoid 240V</td>
</tr>
<tr>
<td>2ELC-520</td>
<td>Pressure solenoid 110V</td>
</tr>
<tr>
<td>2MSC-290</td>
<td>Heat exchanger</td>
</tr>
<tr>
<td>2MTR-080</td>
<td>Oil pump motor</td>
</tr>
<tr>
<td>2NUT-043</td>
<td>Thumb screw</td>
</tr>
<tr>
<td>2PNU-221</td>
<td>Oil pump</td>
</tr>
<tr>
<td>WBS1-0504</td>
<td>Modified solenoid 240V</td>
</tr>
<tr>
<td>WBS2-0504</td>
<td>Modified solenoid 110V</td>
</tr>
</tbody>
</table>

Figure 19: Three-station unit (rear view)
Figure 20: Three-station unit (top view)

Note: Colour-coding on this diagram is intended to help the user identify pipes. It does not represent colours used on the actual system.

<table>
<thead>
<tr>
<th>Cat No</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2CAS-101</td>
<td>Control housing</td>
</tr>
<tr>
<td>2GAG-036</td>
<td>Panel mount pressure gauge</td>
</tr>
<tr>
<td>2GAG-037</td>
<td>Vacuum / pressure gauge</td>
</tr>
<tr>
<td>2ELC-461</td>
<td>Mains filter</td>
</tr>
<tr>
<td>2ELC-522</td>
<td>Temperature controller</td>
</tr>
<tr>
<td>2ELC-540</td>
<td>Solid state relay</td>
</tr>
<tr>
<td>2MSC-290</td>
<td>Heat exchanger</td>
</tr>
<tr>
<td>2MTR-080</td>
<td>Oil pump motor</td>
</tr>
<tr>
<td>2PAN-061</td>
<td>Membrane panel</td>
</tr>
<tr>
<td>2PCB-054</td>
<td>Solid state relay snubber board</td>
</tr>
<tr>
<td>2PCB-062</td>
<td>4 channel relay board</td>
</tr>
<tr>
<td>2PNR-119</td>
<td>Viton O-ring</td>
</tr>
<tr>
<td>2PNR-120</td>
<td>Viton O-ring</td>
</tr>
<tr>
<td>Cat No</td>
<td>Description</td>
</tr>
<tr>
<td>---------</td>
<td>--------------------------------------</td>
</tr>
<tr>
<td>2PNU-002</td>
<td>Air supply regulator</td>
</tr>
<tr>
<td>2PNU-107</td>
<td>Needle valve</td>
</tr>
<tr>
<td>2PNU-221</td>
<td>Oil pump</td>
</tr>
</tbody>
</table>

![Diagram of single-station unit (top view)](image)

**Figure 21: Single-station unit (top view)**

<table>
<thead>
<tr>
<th>Cat No</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2ELC-327</td>
<td>240V axial fan</td>
</tr>
<tr>
<td>2ELC-328</td>
<td>110V axial fan</td>
</tr>
<tr>
<td>2ELC-522</td>
<td>Temperature controller</td>
</tr>
<tr>
<td>2ELC-540</td>
<td>Solid state relay (below 2ELC-522)</td>
</tr>
<tr>
<td>2MTR-080</td>
<td>Oil pump motor</td>
</tr>
<tr>
<td>2MSC-290</td>
<td>Heat exchanger</td>
</tr>
<tr>
<td>2NUT-043</td>
<td>Thumb screw</td>
</tr>
<tr>
<td>2PCB-054</td>
<td>SSR snubber board (below 2ELC-522)</td>
</tr>
<tr>
<td>2PCB-062</td>
<td>4 channel relay board</td>
</tr>
<tr>
<td>2PNU-221</td>
<td>Oil pump</td>
</tr>
</tbody>
</table>
### Table 1: List of Components

<table>
<thead>
<tr>
<th>Cat No</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>WBS1-0504</td>
<td>Modified solenoid 240V</td>
</tr>
<tr>
<td>WBS2-0504</td>
<td>Modified solenoid 110V</td>
</tr>
<tr>
<td>2CAS-101</td>
<td>Control housing</td>
</tr>
<tr>
<td>2GAG-036</td>
<td>Panel mount pressure gauge</td>
</tr>
<tr>
<td>2GAG-037</td>
<td>Vacuum / pressure gauge</td>
</tr>
<tr>
<td>2ELC-327</td>
<td>240V axial fan</td>
</tr>
<tr>
<td>2ELC-328</td>
<td>110V axial fan</td>
</tr>
<tr>
<td>2ELC-478</td>
<td>Mains filter</td>
</tr>
<tr>
<td>2ELC-486</td>
<td>12V power supply</td>
</tr>
<tr>
<td>2ELC-489</td>
<td>Power supply cover</td>
</tr>
<tr>
<td>2ELC-519</td>
<td>Pressure solenoid 240V</td>
</tr>
</tbody>
</table>

---

**Figure 22: Single-station unit (2)**

Note: Colour-coding on this diagram is intended to help the user identify pipes. It does not represent colours used on the actual system.
<table>
<thead>
<tr>
<th>Cat No</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2ELC-520</td>
<td>Pressure solenoid 110V</td>
</tr>
<tr>
<td>2PAN-061</td>
<td>Membrane panel</td>
</tr>
<tr>
<td>2PNR-119</td>
<td>Viton O-ring</td>
</tr>
<tr>
<td>2PNR-120</td>
<td>Viton O-ring</td>
</tr>
<tr>
<td>2PNU-002</td>
<td>Air supply regulator</td>
</tr>
<tr>
<td>2PNU-107</td>
<td>Needle valve</td>
</tr>
<tr>
<td>Cat No</td>
<td>Description</td>
</tr>
<tr>
<td>--------</td>
<td>-------------</td>
</tr>
<tr>
<td>2BRG-009</td>
<td>Bearing</td>
</tr>
<tr>
<td>2CAS-099</td>
<td>Bonder casing (single station unit)</td>
</tr>
<tr>
<td>2CAS-100</td>
<td>Bonder casing (three station unit)</td>
</tr>
<tr>
<td>2CAS-101</td>
<td>Control housing</td>
</tr>
<tr>
<td>2ELC-485</td>
<td>Power supply loom kit</td>
</tr>
<tr>
<td>2ELC-523</td>
<td>Heating element</td>
</tr>
<tr>
<td>2ELC-524</td>
<td>20-way connector (rear of display panel)</td>
</tr>
<tr>
<td>2ELC-527</td>
<td>Harness set (single-station unit)</td>
</tr>
<tr>
<td>2ELC-528</td>
<td>Harness set (three-station unit)</td>
</tr>
<tr>
<td>2ELC-530</td>
<td>Insulated thermocouple</td>
</tr>
<tr>
<td>2PCB-052</td>
<td>Display module</td>
</tr>
<tr>
<td>2PCB-055</td>
<td>WSB processor board</td>
</tr>
<tr>
<td>2PNR-140</td>
<td>Adjustable foot</td>
</tr>
<tr>
<td>2SCR-219</td>
<td>Swing bolt for thumb screw</td>
</tr>
<tr>
<td>2VAC-002</td>
<td>Balston filter for vacuum pump</td>
</tr>
<tr>
<td>2VAC-006</td>
<td>110V/60Hz E2M1.5 vacuum pump</td>
</tr>
<tr>
<td>2VAC-007</td>
<td>240V/50Hz E2M1.5 vacuum pump</td>
</tr>
<tr>
<td>2VAC-018</td>
<td>Active gauge head</td>
</tr>
<tr>
<td>2VAC-087</td>
<td>Stainless steel bellows</td>
</tr>
<tr>
<td>2VAC-106</td>
<td>8-way connector</td>
</tr>
<tr>
<td>WBS1-0402</td>
<td>Bonding diaphragm</td>
</tr>
<tr>
<td>WBS1-0408</td>
<td>Substrate holding ring</td>
</tr>
</tbody>
</table>
APPENDIX A

WIRING DIAGRAM