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TF 1500 BGA Rework Station
Operation and Maintenance Manual

Manual Number 5050-0525

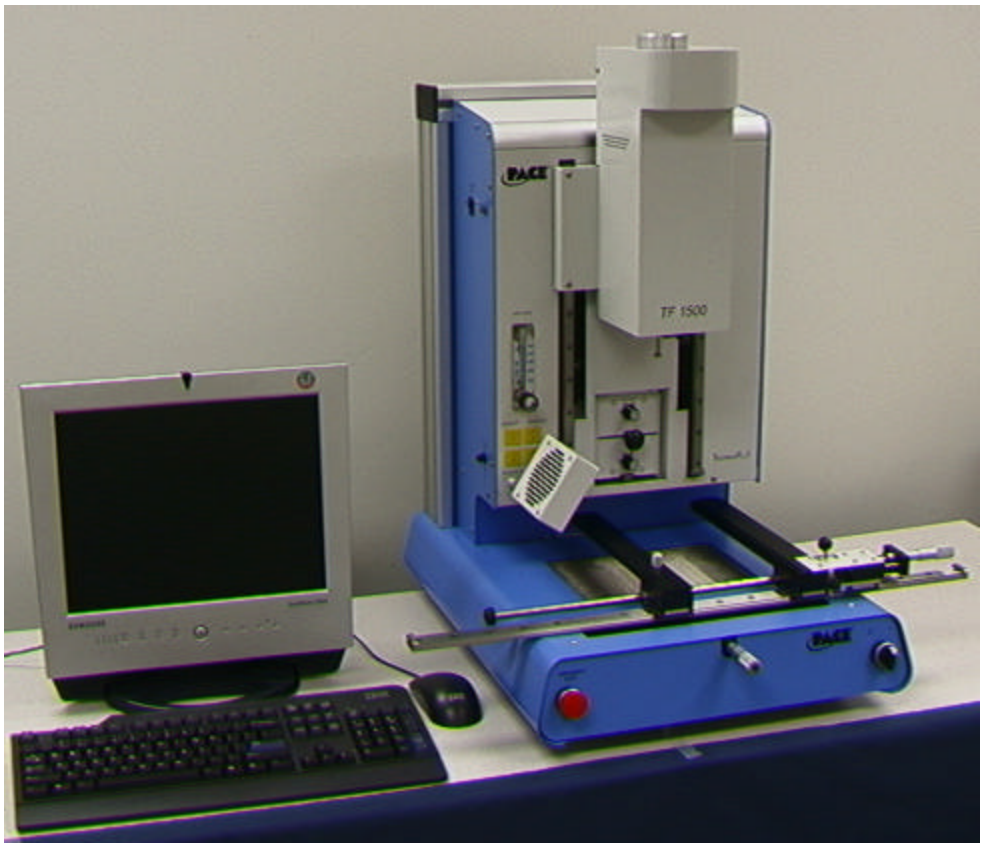


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1. **Packing Contents, Standard Items**

Description	Part Number
TF 1500	8007-0410 (120V) 8007-0411 (230V)
PC	-
Monitor	-
Keyboard	-
Mouse	-
Vacuum Pick	1272-0005-P1
Vacuum Pick Kit	6993-0060
Suction Cups	6993-0202-P1
Alignment Board	4018-0100-P1
Mounting Platform Stencil	1321-0725
Mounting Platform Flux Dip	1321-0735
Hot Grip Removal Pad	1100-0307
Thermocouples (4)	1340-0174-P1
Hex Wrench Kit	6016-0034
Power Cord	1332-0224
Video Cable	3008-0168

2. Specifications:

Part Number	8007-0410
Dimensions	737 mm H x 686 mm W x 737 mm D (29” x 27” x 29”)
Weight (w/o computer)	45 kgs (100 lbs)
Power Requirements	115 VAC, 60 hz or 230 VAC, 50 Hz 2000 watts
PC	Pentium 4, 256M Ram, Floppy, CD
Top Heater	Adjustable convective air (air or N2), Maximum 20 SLPM, 1600 watts 100 to 400 deg C, 212 to 750 deg F
Bottom Heater	IR, 400 watts, 2 @ 200w each 100 to 221 deg C, 212 to 430 deg F
Vacuum	450 mm Hg
Optics	High resolution, Dual Color Vision Overlay System
Positioning Accuracy (Z travel)	+/- 25 umeters (0.001”)
Video	2 Composite Video (external) 1 “S” Video (Internal) 15” Integrated color Flat Panel Monitor
PC Board Size	305 x 305 mm, 12” x 12”
Component Size	35 mm x 35mm, 1.38” x 1.38” max.

TF 1500 Parts Identification

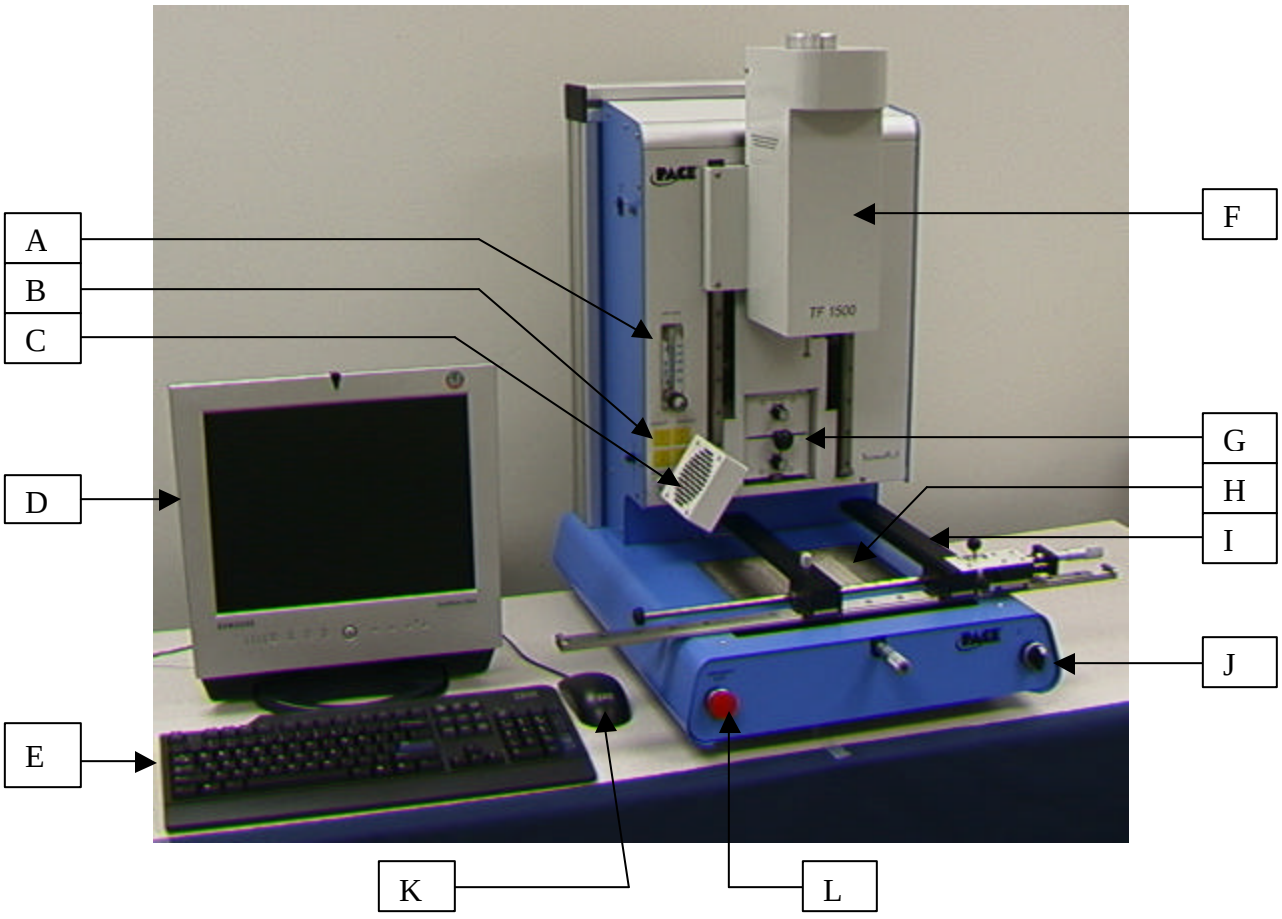


Figure 1

A.	Air Flow Meter	This device is used to control and monitor the airflow through the reflow head.
B.	Sensor Input	The sensor inputs are K-type thermo-couples. Measured temperatures are displayed through the PC software in real time for use in making profile graphs.
C.	Cooling Fan	The component and PCB are cooled by the cooling fan, which can be set to activate automatically after the reflow cycle is complete or operated manually.
D.	LCD Display Monitor	Displays PC software.
E.	Keyboard	Used to enter information into software.
F.	Reflow Head	Contains the top-side heater and moves up and down via an electric motor that is controlled through the software. The reflow head is clutched to prevent excessive downward force from being applied.

G.	Optics Housing	Contains the camera and beam splitter (prism). The housing is retractable and should be kept in the retracted position when not in use. The lights for the optics will turn on/off automatically when the housing is extended/retracted.
H.	Bottom Side Heater	Used to warm the PCB from the underside. It is an IR type heating source.
I.	Board Holder	The board holder is fully adjustable in the X direction only. Fine adjustment of both the X and Y direction is achieved by using the adjusting knobs on the end of the holder for X and on the front of the machine for Y. The right side of the holder is spring loaded to hold the PCB securely.
J.	On / Off Switch	Used to turn the system on or off. When turning off the system, always turn off the PC using the windows interface first.
K.	Mouse	Used to enter information into software.
L.	Emergency Off Switch	In case an emergency shut down is necessary, press this button.

3. Safety Information

a. Do not contact the Heater or its peripheral parts during operation.
b. Once turned off, let the unit cool completely before contacting.
c. When using fluxes, use fume extraction equipment or use in a well-ventilated area to minimize operator exposure to fumes.
d. Do not use near combustible vapors.
e. Do not leave the equipment unattended when in use.
f. Do not open rear panel without disconnecting power cable.

4. Features

a. The TF 1500 is ideal for post assembly rework, repair, and low volume/short run production operations. The TF 1500 can remove and install PBGAs, CSPs, FCs, LGAs, LCC's and other SMDs.
b. Featuring unparalleled thermal performance, The TF 1500's flexibility and state of the art process software means no other system is easier to use. The TF 1500 is a PC driven, semi-automated system that requires a Pentium ® 4 PC featuring Windows XP® Professional OS. The unique standard software package offers much more than just an operator interface. TF 1500's advanced vision and placement system is highly accurate and can quickly magnify even the smallest components for easy alignment. TF 1500 uses a combination of convective top heating coupled with powerful IR bottom heating for an effective, repeatable heating process.
c. Economical and easy to use, the TF1500 Rework System delivers high-end BGA/CSP functionality, moving far beyond expensive, bulky rework machines by offering unparalleled performance at an affordable price.

d. REFLOW FUNCTION
    i. Unequalled programmability and process control ensures successful, repeatable installation.
    ii. The powerful and responsive 1600 Watt top heater, with closed loop temperature control, coupled with proven TF 3000 nozzle design ensures uniform temperature distribution when heating.

iii. High power bottom heaters allow for successful and repeatable reflow at safe, low temperatures.
iv. Profiles are programmed through the PC software.
v. Creating the perfect profile is easy with real time adjustment of profile parameters through the PC.
vi. Store and recall an infinite number of profiles.
vii. Two pre-defined profiles for use as baselines when developing custom profiles are included.
viii. Self contained, no external air supply or vacuum connections required. Can also be used with N_2 from external source.
ix. Semi-automated, motorized reflow head.
x. Four thermo-couple sensor inputs ensure successful profile development and monitoring.
xi. External fan to cool PCB and component to below solder melt temperatures after reflow.

e. ALIGNMENT AND PLACEMENT FUNCTION
i. The component is held by a precision vacuum placement pick, which is located within the heater assembly.
ii. High resolution Dual Color Vision Overlay System (VOS) with color camera and dichroic prism. VOS does not require routine calibration, eliminating costly downtime and operator frustration.
iii. Color Camera with 72x zoom capability, featuring auto-focus zoom.
iv. Lighting system uses “Ultra Bright” Red and Blue LEDs for maximum contrast of lands and solder balls on component.
v. Independent lighting controls for component and PCB to maximize overlay contrast.
vi. Retractable optics housing protects VOS from dirt and contamination.
vii. Accurately places any array package up to 35mm (1.3") square and as small as 1 mm (.04”) square.
viii. Precise micrometer adjustment for X, and Y axis with Theta adjustment ensures placement accuracy.
ix. High-flow vacuum pick holds component securely.
x. Images are viewed through the PC in standard or full screen viewing options.

f. PRE-HEAT FUNCTION AND BOARD HOLDER
i. Fully adjustable, precision, spring loaded board holder with top or bottom PCB registration. Precise micrometer adjustment for X and Y adjustment ensures placement accuracy for repeatability.
ii. Rugged, stable board platform to hold and support the PCB.
iii. Unique board holding fixtures that are able to hold very small and odd shaped PCBs.
iv. Board supports are standard with the system.
v. Integrated, powerful, IR pre-heater with closed loop temperature control ensures process integrity by delivering heat evenly, time after time.

5. Set-Up

a. Connect

i. The TF 1500 comes configured for internal or external air. Select air source; internal pump or external N_2. (Figure 2a & 2b)
Warning: Do not run unit in N_2 mode unless N_2 supply is connected and on.

1. Open rear panel.
2. Turn key to desired air supply.
3. Close rear panel.

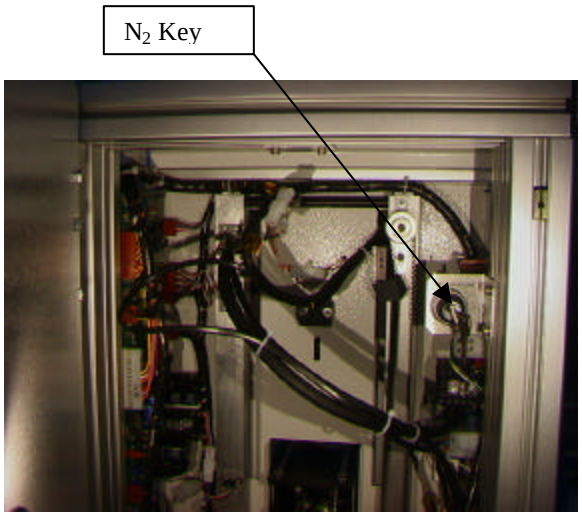


Figure 2a

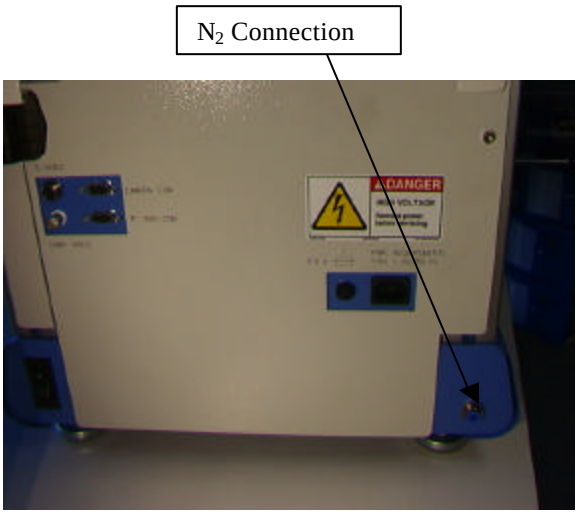


Figure 2b

ii. Insert PC into brackets on back of PC.
iii. Monitor

4. Connect power cord.
5. Connect video cable to the 9-pin connector of the PC.

iv. Keyboard – connect cable to computer.
v. Mouse – connect cable to computer.
vi. Connect cables between PC and back of TF 1500 according to labels.
vii. Connect power cords to TF 1500 and PC.

b. Start up

i. Turn on circuit breaker on back of unit.
ii. Turn on power switch on front of unit.
iii. Turn on computer.
iv. Turn on monitor.
v. Mouse click on TF 1500 icon.
vi. Read and accept license.

c. Inserting/changing vacuum pick.
    i. Insert proper size vacuum pick. The diameter needs to be smaller than the top of the component. The pick screws into place. (Figure 3a)

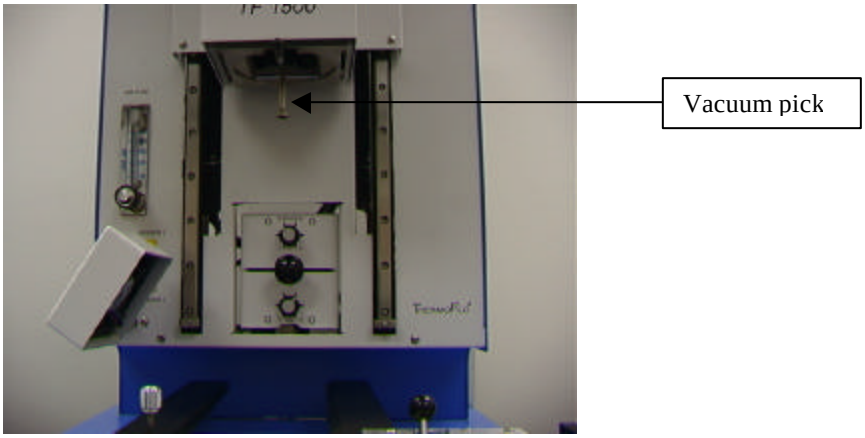


Figure 3a

d. Inserting/changing nozzle. (Figure 3b)
    i. Insert proper size nozzle. The nozzle should be 3 mm larger than the outside of the component. If the proper nozzle size cannot fit onto the PCB due to adjacent components being to close, use a smaller nozzle or keep the nozzle approximately 1mm above the part. Align the nozzle under the square hole in the reflow head. The nozzle snaps into place. The nozzle can be positioned with the front surface parallel to the PCB or at a diagonal by moving the lever by the nozzle housing.

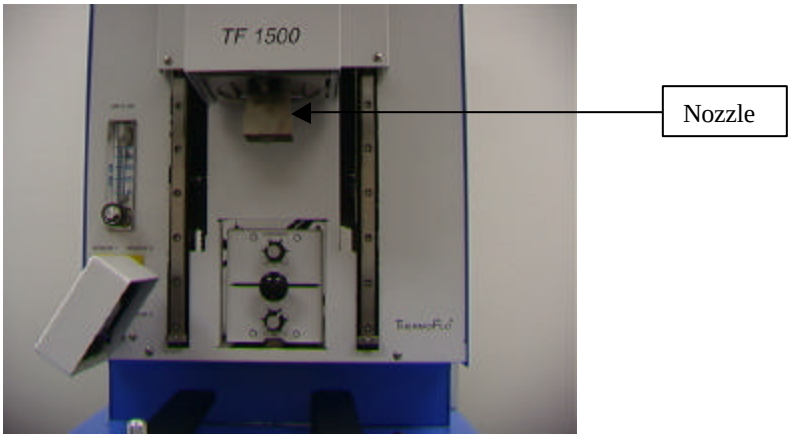


Figure 3b

e. Set up screen features. (Figure 4)

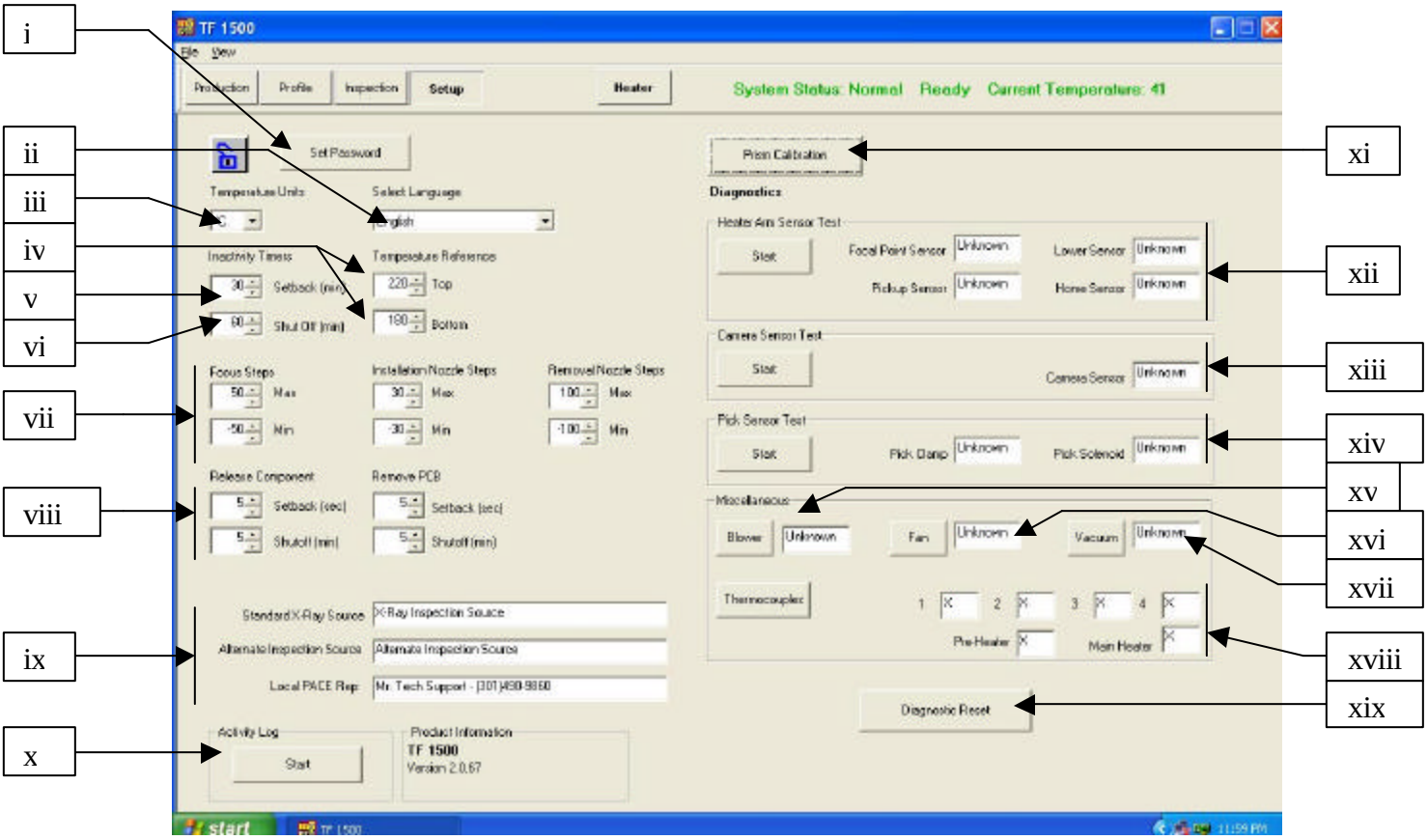


Figure 4

i. Set Password. Setup and profile settings can be password protected.
ii. Set Language. Software text language can be changed.
iii. Set temperature for Celsius or Fahrenheit.
iv. Set yellow temperature reference lines on the profile graph.
v. Set setback time. Machine will go into setback after selected idle time. Setback reduces heater temperatures during extended idle times to extend heater life.
vi. Set auto shutoff time. Machine will completely shut down after selected idle time.
vii. Set the limit on the focus range and nozzle movement.
viii. Set setback and auto shutoff times for component release and PCB removal.
ix. Type the text for these three displays.
x. Run the activity log.
xi. Initiate prism calibration sequence. Further explanation is in par. 5e.
xii. Initiate heater arm sensor test. Checks proper orientation and operation of heater arm position sensors.
xiii. Initiate camera sensor test. Checks proper orientation and operation of camera position sensor.
xiv. Initiate pick sensor test. Checks proper orientation and operation of pick position sensor.
xv. Blower test. Checks operation of heater blower.
xvi. Cooling fan test. Checks operation of cooling fan.

xvii. Vacuum pump test. Tests operation of vacuum pump.
xviii. Thermocouple test. Tests active thermocouple circuitry.
xix. Reset diagnostics. Must be clicked after any diagnostic test is performed to reset the tests to default settings.

f. Alignment Screen Features (Figure 5)

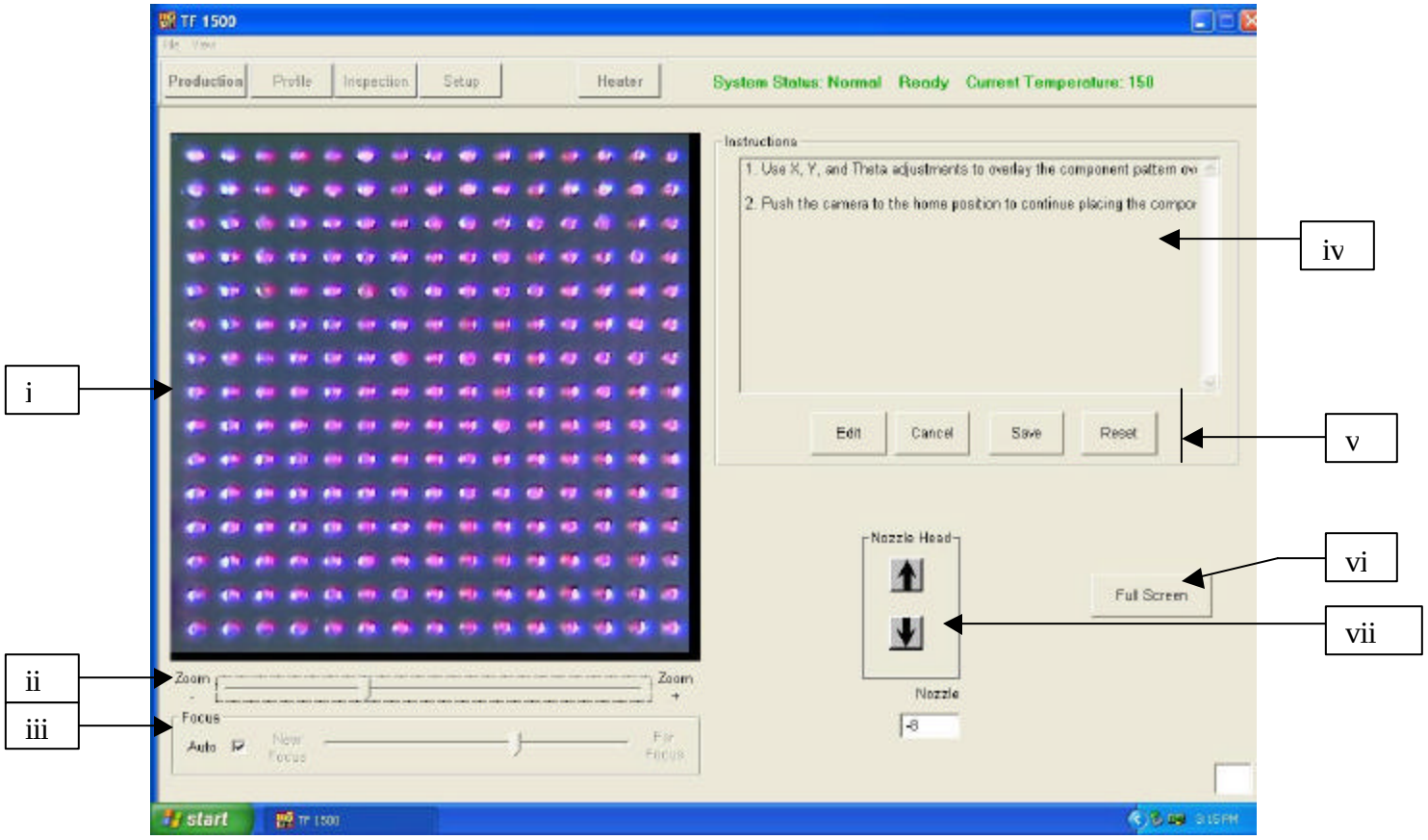


Figure 5

i. Component/PCB alignment image. Proper alignment is viewed here showing the PCB pads (blue) directly under the component pads (red).
ii. Zoom bar. The image can be zoomed in or out using this bar or the up and down arrows on the keyboard.
iii. Focus bar. The image can be manually focused using the slider on this bar or it can be automatically focused by checking the box by 'auto'.
iv. Instructions. Follow these instructions to proceed through the alignment sequence.
v. Screen options.
    1. Edit – Change Instructions.
    2. Cancel – Cancel changes made to instructions.
    3. Save – Save changes made to instructions.
    4. Reset – Returns to factory set instructions.
vi. Full Screen. Click on here to view image full screen.
vii. Nozzle step adjustment. If component (red) cannot be aligned to PCB (blue) or you cannot focus, adjust nozzle height up or down with this option until better alignment or focus is achieved.

g. Production Screen Features (Figure 6)

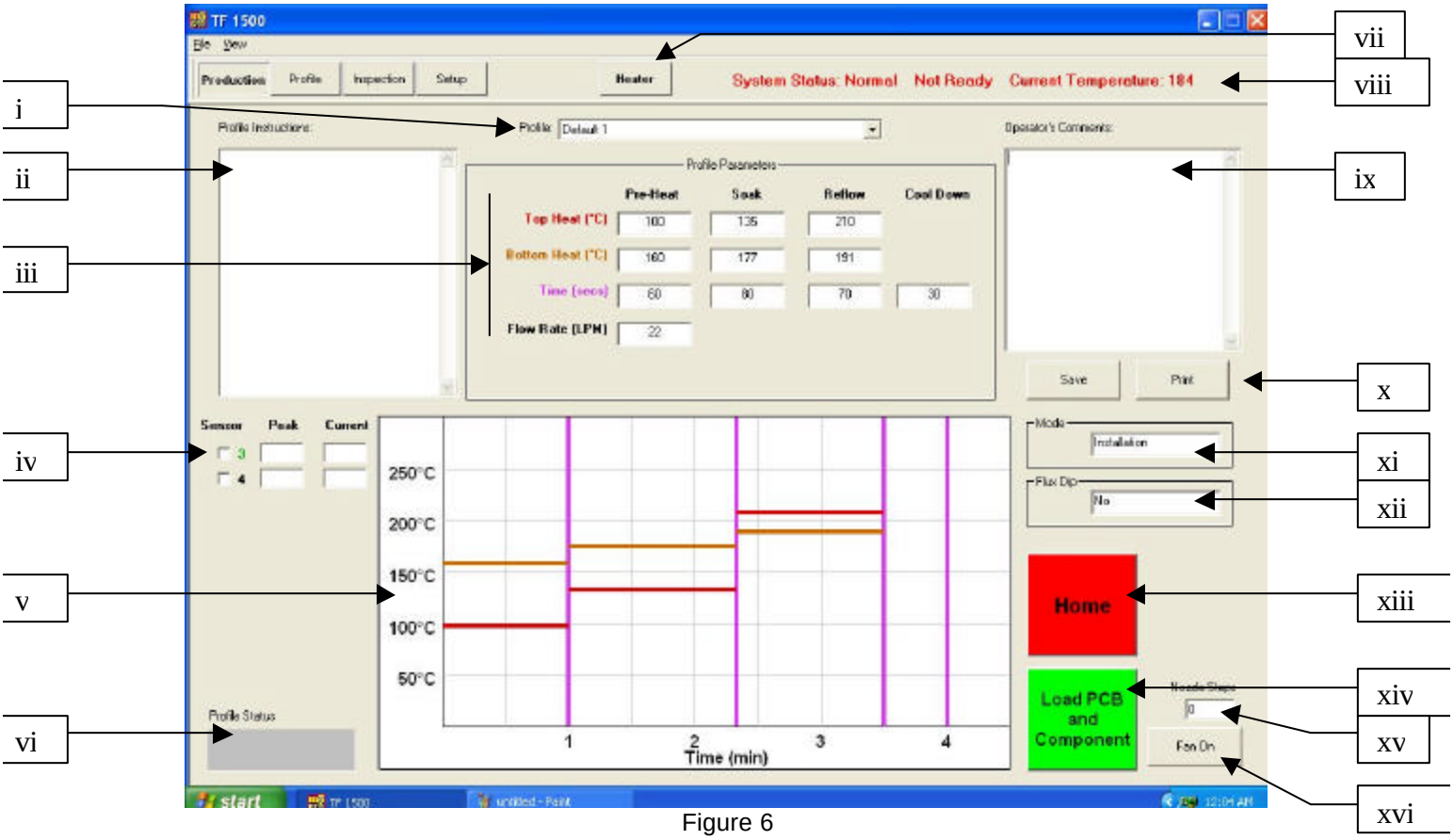


Figure 6

i. Profile Indicator. Indicates currently selected profile. A new profile can be selected from a list of saved profiles by clicking on the arrow.
ii. Profile Instructions. Instructions entered by the developer can be viewed here.
iii. Temperature and time settings. Settings for the profile are indicated here.
iv. Sensor indicators. Real-time sensor readings can be viewed here if thermocouples are used.
v. Graph. A saved graph and, if thermocouples are used, an active trace graph are viewed here.
vi. Profile Status Bar. Indicates the current status of a running profile.
vii. Heater Button. Used to turn the heater back on after the machine has been in setback. Blinks red if in setback and must be selected to continue sequence.
viii. Status Bar.
    1. System status – shows if system is 'normal', in 'setback' or 'shutdown'.
    2. Heater status – Shows 'ready' if bottom heater is in range. Shows 'not ready' if bottom heater is not in range. The software will not continue until it is in 'ready' status.
    3. Bottom heater temperature – Shows real time bottom heater temperature.

ix. Operator's Comments. Provides a space for the operator to write comments.
x. Options. Save to save operator's comments and reset to clear screen.
xi. Mode. Indicates whether this is an installation or removal profile.
xii. Flux Dip Option. Indicates if the Flux Dip option is selected.
xiii. Abort Button. Click at any time to abort the process and return to the beginning.
xiv. Sequencing Button. Click here to proceed to next step in the operation.
xv. Nozzle Step Indicator. Indicates how many steps the nozzle will lower to properly position itself for operation.
xvi. Fan On/Off Selector. Manual on/off switch for the cooling fan.

h. Profile Development Screen Features (Figure 7)

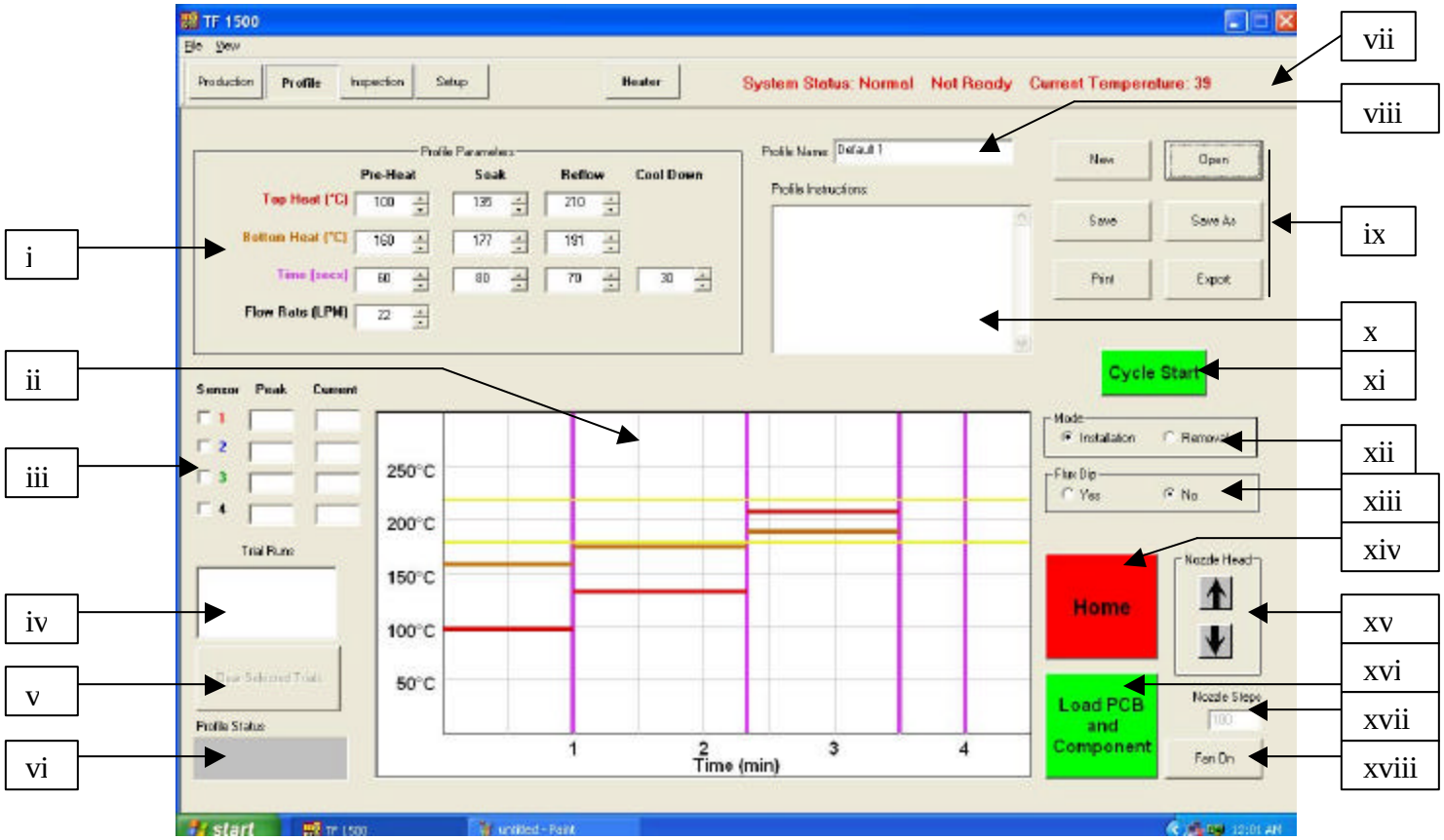
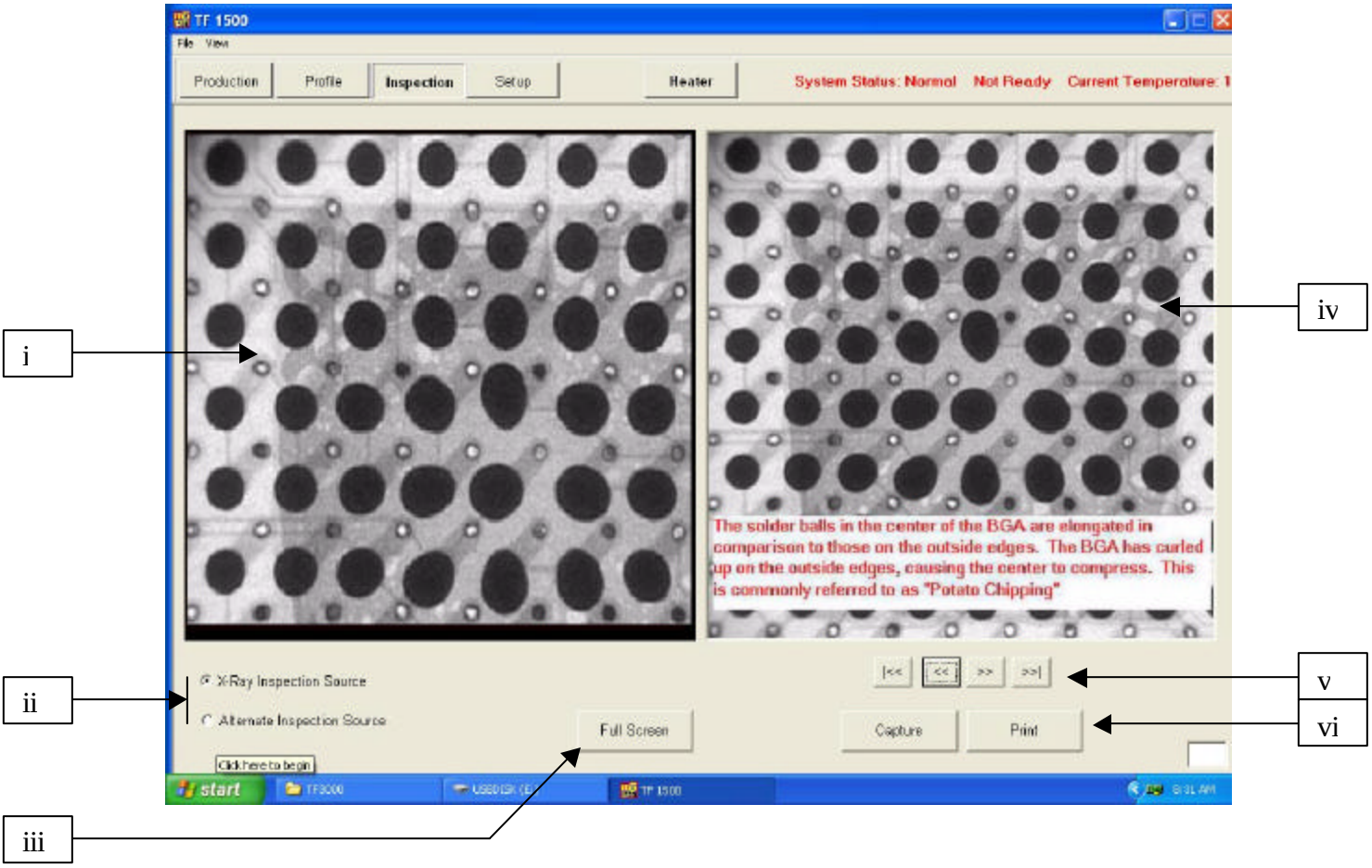


Figure 7

i. Temperature and Time Settings. Used to indicate and set the temperatures and times for the profile.
ii. Graph. Draws a trace graph of temperatures measured by thermocouples. Colored bars indicate the times and temperatures selected in the settings. Times and temperatures can be changed before and during a profile by dragging these lines to a different setting.
    1. red – top heater
    2. brown – bottom heater
    3. purple – time dividing lines between zones
    4. yellow – reference lines set in the setup screen

iii. Sensor Indicators. Indicates real-time temperature of thermocouples in use.
iv. Trial Run Window. Indicates which trial runs are showing on the graph. There can only be three trial runs saved in this window.
v. Clear Trial Run Selector. Clears the checked trial runs when clicked.
vi. Profile Status Bar. Indicates the current status of a running profile.
vii. Status Bar. Same as production screen.
viii. Profile Name. Indicates current selected profile.
ix. Options.
    1. New – clears all settings
    2. Open – opens a profile saved on the computer
    3. Save – saves profile to file name showing in the profile name window
    4. Save as – saves profile to new file name
    5. Print – prints current settings
    6. Export – saves profile as a spreadsheet file
x. Profile Instructions. Insert instructions for the operator.
xi. Cycle Start Button. Start the selected profile.
xii. Mode. Select whether this is to be an installation or removal profile.
xiii. Flux Dip Option Selector. Select whether this option will be used.
xiv. Home Button. Aborts the profile when clicked and returns to the beginning screen.
xv. Nozzle Head Position Selector. When the reflow head lowers automatically, it stops above the PCB. Use this to lower the PCB flush to the PCB. The number of steps it is lowered is indicated in the window below the buttons. This number is saved for operation.
xvi. Sequencing Button. Click here to proceed to next step in the operation.
xvii. Nozzle Steps Indicator. Indicates the number of steps the head is lowered by the nozzle head buttons.
xviii. Fan On/Off Button. Manual on/off switch for the cooling fan.

i. Inspection Screen Features



i. Inspection Image. The inspection image selected is viewed here.
ii. Select Inspection Source. Select whether the image is from an x-ray or alternate source.
iii. Select Full Screen Image.
iv. Library Image. The computer has a stored library of x-ray images with explanations of the viewed defects.
v. Select Library Image. Use these arrows to select a different library image.
vi. Capture or Print Inspection Image. Click on capture to freeze the current image in the window. Click print to send the image to a printer.

j. Prism Calibration – This step is required to ensure the prism is properly aligned so when the software shows the PCB and component visually aligned, they are actually physically aligned.

i. Select setup screen. (Figure 8)

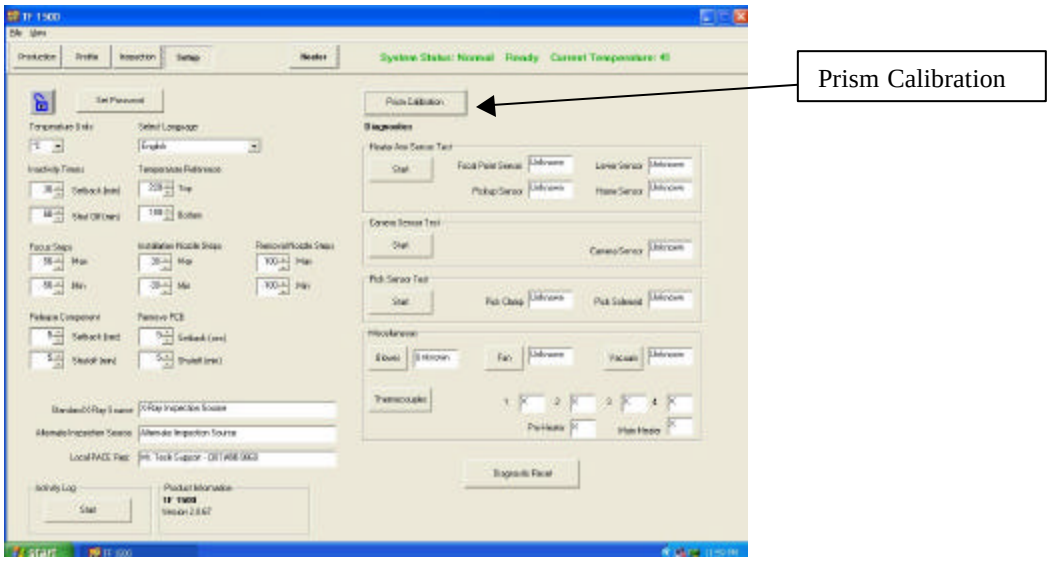


Figure 8

ii. Select prism calibration.
iii. Monitor now shows calibration screen. (Figure 9)

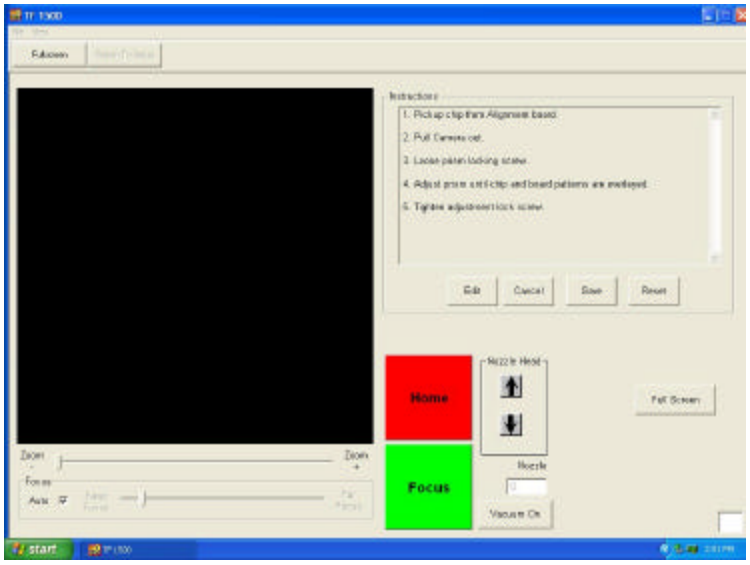


Figure 9

iv. Place alignment board with BGA in place in mounting brackets.

v. Align PCB so red laser sighting light is roughly centered on BGA. (Figure 10)

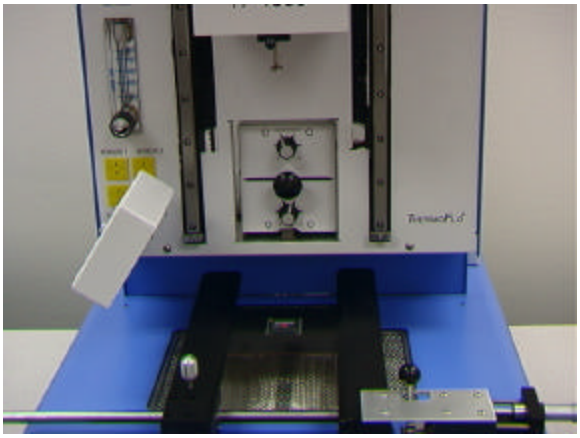


Figure 10

vi. Mouse click on green button, “Pickup.”
vii. Pull camera out. Make sure it is all the way out into the detent. (Figure 11)

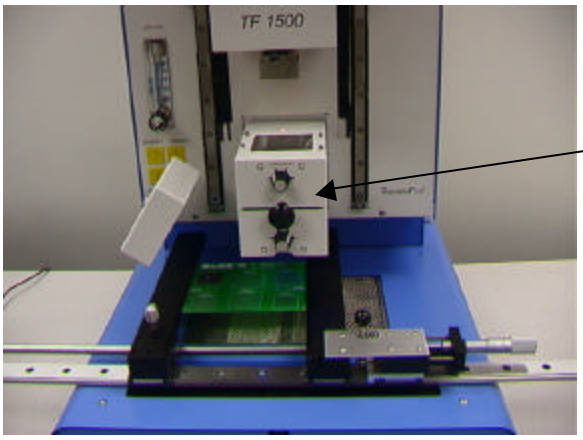


Figure 11

viii. Mouse click on green button, “Focus.”
ix. Adjust focus with up and down arrows on keyboard or by moving slide on screen. Refer to para. 5g.

x. Image in the window should be aligned like figure 12.

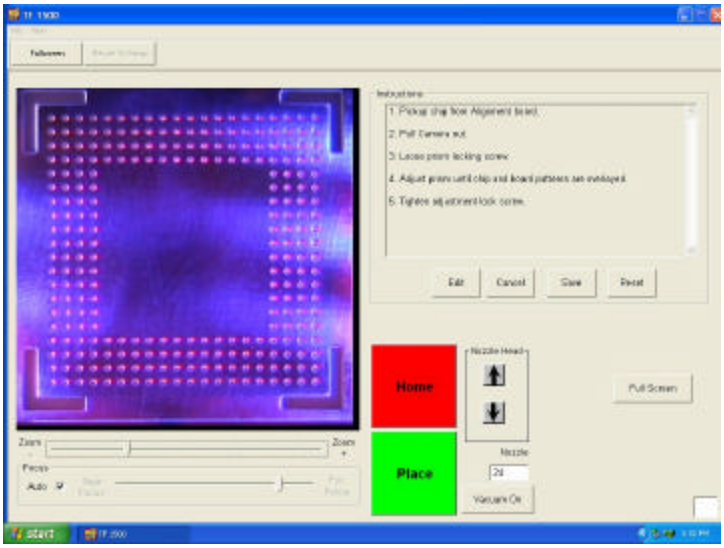


Figure 12

xi. If it is not, adjust prism until it is.
    1. Loosen the setscrews from the light adjustment knobs (Figure 13)
    2. Remove the knobs
    3. Remove the four screws (2 on each side) from the cameras' sheet metal cover (Figure 13)
    4. Remove the cover
    5. Loosening the top screws (A) and tightening the bottom screws (B) adjusts the prism down.
    6. Loosening the bottom screws (B) and tightening the top screws (A) adjusts the prism up.
    7. Loosening the right center screw © allows you to rotate the prism around the y-axis.
    8. Replace the cover
    9. Replace the four screws
    10. Replace the knobs
    11. Adjust the light adjustment knobs and tighten the setscrews

xii. Return to setup screen. Mouse click on button, "Return to Setup."

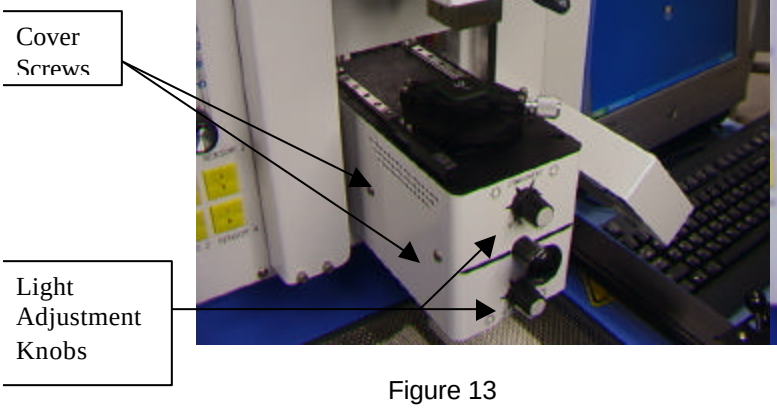


Figure 13

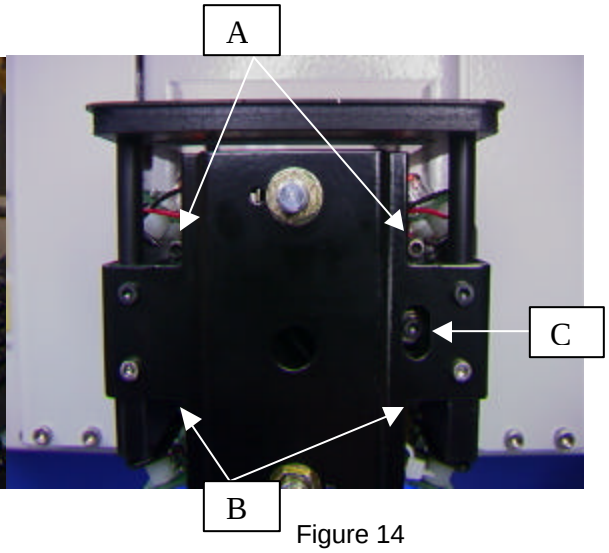


Figure 14

6. Operation

Note: It is recommended that the TF 1500 be turned on for at least 15 minutes before use to ensure the bottom side heater has reached its set temperature and stabilized. Once the bottom side heater is at operating temperature it will deliver consistent heating, ensuring highly repeatable heating from operation to operation.

It is advisable to conduct a trial operation each day to ensure all systems are operating properly. Also, it is important to verify the airflow of the unit with each profile to be run.

Verify that the devices/parts being soldered to the PCB do not exceed the height limitations. Exceeding the limitations may interfere with the operation of the machine.

The maximum height of any component or device on the top of the PCB is limited to 30mm (1.2”).

The maximum height of any component or device on the bottom of the PCB is limited to 15 mm (0.6”).

a. Production. Component alignment and installation – Note: If at any time you need to abort the process mouse click on the Red “Home” button.

i. Mouse click on Production to switch to the production screen. (Figure 6)
ii. Select a profile.
iii. Insert the proper vacuum pick. (Para. 5d)
iv. Insert the proper nozzle. (Para. 5e)
v. Place the PCB between the arms on the TF 1500 and tighten the retention screw. (Figure 15)

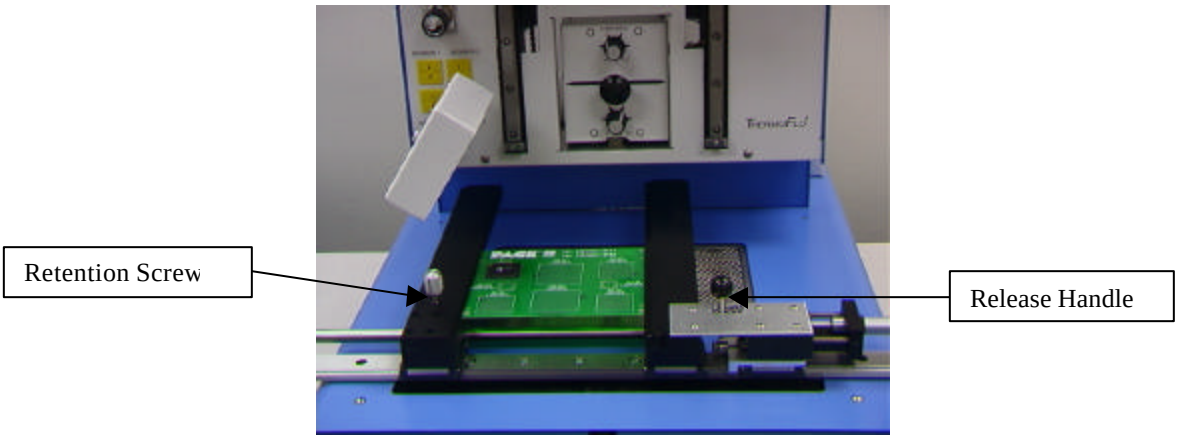


Figure 15

vi. Position the board so the red laser sighting light is roughly in the center of the placement site. To move the board forward and back simply move the PCB in the arms. To move the assembly left and right push the release handle away from you and move the assembly. Pull the release handle towards you to secure the assembly.

vii. Pull the camera out. (Figure 16)

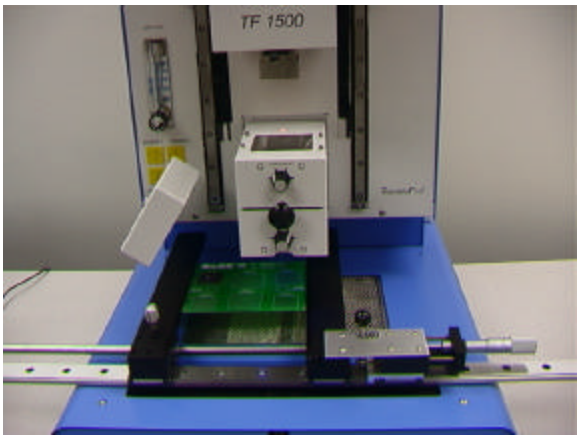


Figure 16

viii. Mouse click on the green button.

ix. Place the component in the mounting plate on top of the camera housing. (Figure 17a)

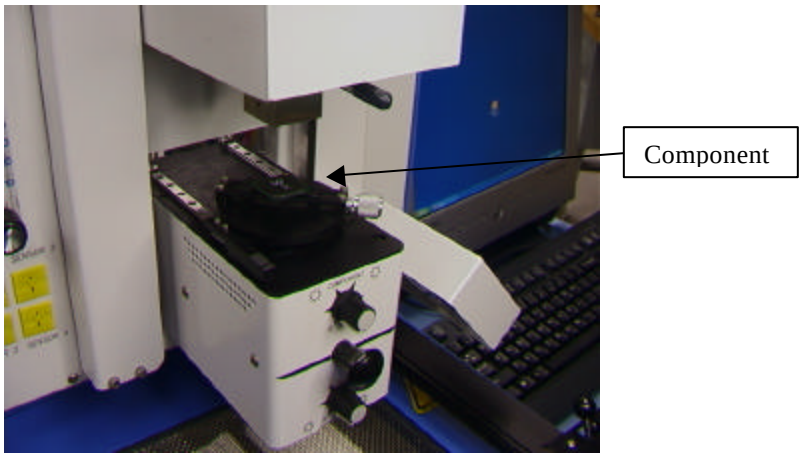


Figure 17a

x. Mouse click on the green button. TF 1500 will pick up component.
xi. Remove component mount from the top of the camera housing.
xii. If Flux Dip option was selected, place the flux dip assembly on top of the camera housing. (Figure 17b) Mouse click to dip, then remove flux dip assembly.
xiii. Mouse click on the green button again to switch to the alignment screen and lower component to focus point. (Figure 5)

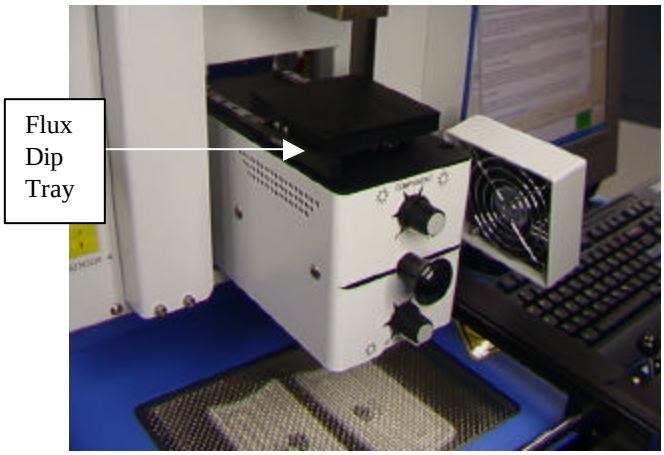


Figure 17b

xiv. Zoom in and align using the 3 axis adjustments until the component fills the screen and is aligned. (Figures 5 & 18)

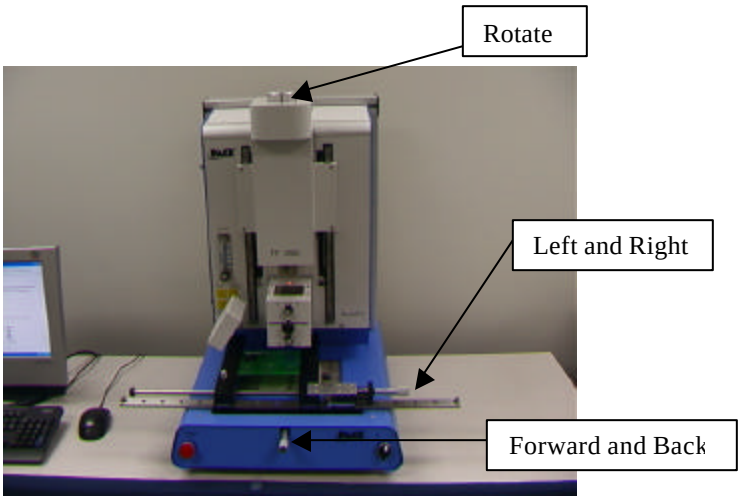


Figure 18

xv. Push camera in until the screen changes.
xvi. Mouse click on the green button, “Place” to lower the component. (Figure 19)

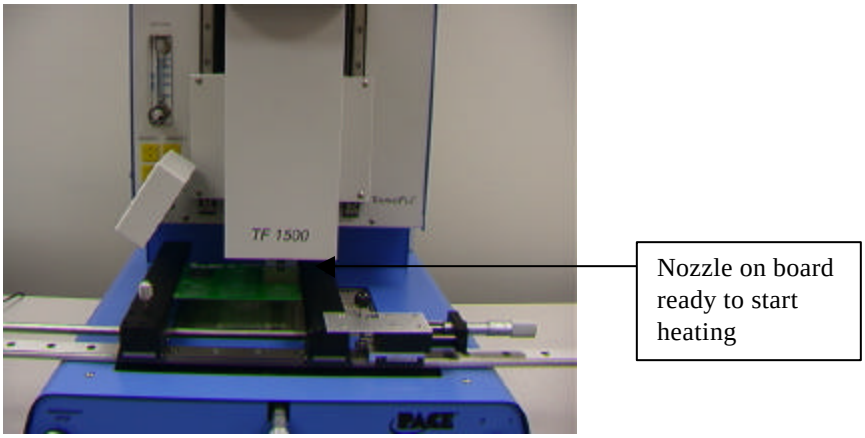


Figure 19

xvii. Mouse click on the green button again, “Start.”
xviii. Allow the PCB to cool and remove.

b. Component removal – Note: If at any time you need to abort the process mouse click on the Red Home button.

i. Conduct steps i – v in paragraph 6a.
ii. Position the board so the red laser sighting light is roughly in the center of the component. To move the board forward and back simply move the PCB in the arms. To move the assembly left and right push the release handle away from you and move the assembly. Pull the release handle towards you to secure the assembly. (Figure 20)

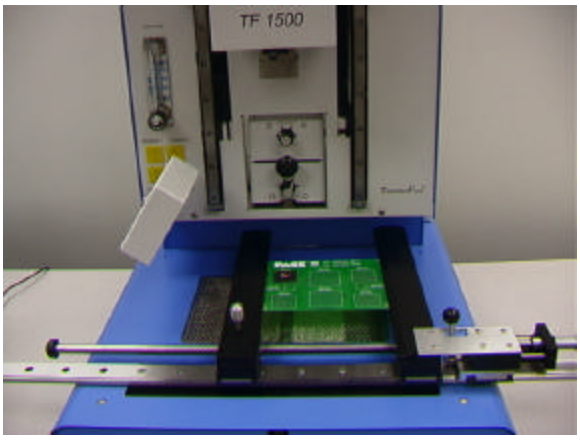


Figure 20

iii. Mouse click on Start button.
iv. Allow PCB and component to cool before removing.

c. Profile development

Note: General Information concerning the Profile Development Screen

The Reflow Graph area displays a representation of the Reflow cycle profile. Time in minutes is graphed along the X-axis and temperature in degrees Celsius or Fahrenheit is plotted along the Y-axis. The time and temperature axes incorporate a dynamic scaling feature to optimize the display for extremely short or long profiles. Profile graphs can be saved with profiles to be used for process validation by operators while using the Operation screen. Profile graphs can also be stored as individual records for each rework job for quality control purposes. Solid and dotted lines are used to indicate profile parameters.

Profile Creation

There are 2 recommended methods for developing a profile. The first, involves an actual component installation, while the second uses a previously installed package. Either method can be used to develop a reliable profile. However, there are some issues and considerations to be aware of with each.

When developing profiles through actual component installation, it is critical to make sure the thermocouples remain in contact with the solder throughout the entire process. Unreliable data will be collected should a thermocouple lose contact with the solder. If measuring the temperature on the top of the package, it is best to use a preinstalled component, as the thermocouple wire will typically cause the component to not lay flat on the PCB.

When using a previously installed package, the placement of the thermocouples is important. They must be in contact with the existing solder joints. This task can be accomplished by either (1) drilling through the bottom of the PCB into a solder joint and attaching the thermocouple or by (2) sliding the thermocouple under the package in the case of a BGA or along side in the case of other SMD's. When sliding a thermo couple under a component, it is critical that the thermocouple be in contact with the solder. Method 2 is the most commonly used. Information from the thermocouples will assist in determining the proper time and temperature parameters. In general, the following guidelines should be adhered to when developing profiles.

Ramp and Maximum Temperatures

Acceptable ramp rates and maximum temperatures should be obtained from the component manufacturer. Typical ramp rates are 2-5 ºC/s (4-9 ºF/s) for plastic parts and 1 ºC/s (2 ºF/s) for ceramic parts. It is recommended to select a maximum

temperature below the manufacturer's specification to provide for a margin of safety. Typically, 20 ºC below maximum specified temperature is selected.

Pre-Heat Phase

1. In a "step profile", the top of the PCB and package should reach a stable temperature of 95-105 ºC. If plotting the temperature curve, the trace will usually level off within this temperature range.
2. If a "linear slope" is desired, pre-heat and soak phases are combined. Both the package and the PCB are warmed at a constant ramp rate (usually 2-4 ºC/second) until the desired soak temperature is reached.

Soak Phase

The soak phase is a crucial part of the reflow process. During this period, the flux activates and drives off volatiles and excess flux. A temperature of 145-165 ºC (determined by the activation temperature of the flux used) should be maintained for approximately 20-40 seconds. This allows for uniform ramping across the entire package and PCB during reflow.

Reflow Phase

During this phase, the solder reaches solder melt and forms joints between the package and the lands. It is critical for all areas of the component to reach solder melt together and all solder joints remain in a liquid state for at least 10-20 seconds. Generally, plastic packages should not be exposed to temperatures higher than 220 ºC. Always consult the device specifications for maximum temperature recommendations. As a rule of thumb, a safe "maximum temperature" is the maximum temp specified by the manufacturer minus 20ºC. Lower temperatures and shorter times are common in CSPs and FCs. **The lowest temperatures possible should always be used to ensure safety of the device and PCB.**

Cool Down Phase

The cool down phase is necessary to bring the temperature of the package, solder joints and PCB under the package below solder melt temperatures. Cooling should be controlled. A good reference is to use the same cool down rate as for ramp up. The cooling fan on the TF 1500 will remain on for a minimum of 30 seconds from the start of the cool down cycle. Some types of components (like CBGAs) should be allowed to cool without external assistance from the cooling fan. When installing these packages, turn the fan away from the PCB so the air doesn't blow on it.

General

Using one of the two baseline (default) profiles will provide a good starting point for profile development. The reflow graph provides an excellent tool for monitoring profile parameters and fine tuning or perfecting the profile development process. When adjusting profile parameters "on-the-fly", all changes are reflected immediately on the profile development screen and graph.

Procedure

i. If the component needs to be placed first, conduct steps in paragraph 6a to step xv then do sections ii, vii thru x below.
ii. Mouse click on Profile for the Profile Development Screen. (Figure 7)
iii. Conduct steps ii thru v in paragraph 6a.
iv. Position the board so the red laser sighting light is roughly in the center of the component. To move the board forward and back simply move the PCB in the arms. To move the assembly left and right push the release handle away from you and move the assembly. Pull the release handle towards you to secure the assembly.
v. Mouse click the cycle start button. Make adjustments in accordance with paragraph 5i.
vi. To return to the beginning of the development stage mouse click on the cycle start button.
vii. If you're finished, allow the PCB to cool and remove.

7. Temperature Control

a. Heater temperatures are adjusted by changing the numbers on the profile screen by clicking on the arrows, moving the temperature bars or using the up and down arrows on the keyboard. (See paragraph 6.c.ii.)

8. Available Nozzles/Accessories/Optional Items

a. A complete list of nozzles and accessories is on our web site, paceworldwide.com

9. Maintenance

Caution: Disconnect the main power supply and computer cables before opening the TF 1500 door, replacing any component or before performing any routine maintenance.

a. Cleaning the Blower Filter. Clean the filter every three months.
   i. Open the cover on the back of the TF 1500. (Figure 21)
   ii. Identify the blower pump, mounted on the base of the machine.
   iii. Loosen the screw fitted to the end of the filter housing.
   iv. Remove the housing, then the filter.
   v. Clean the filter using warm water.
   vi. Make sure the filter is dry before reassembly.

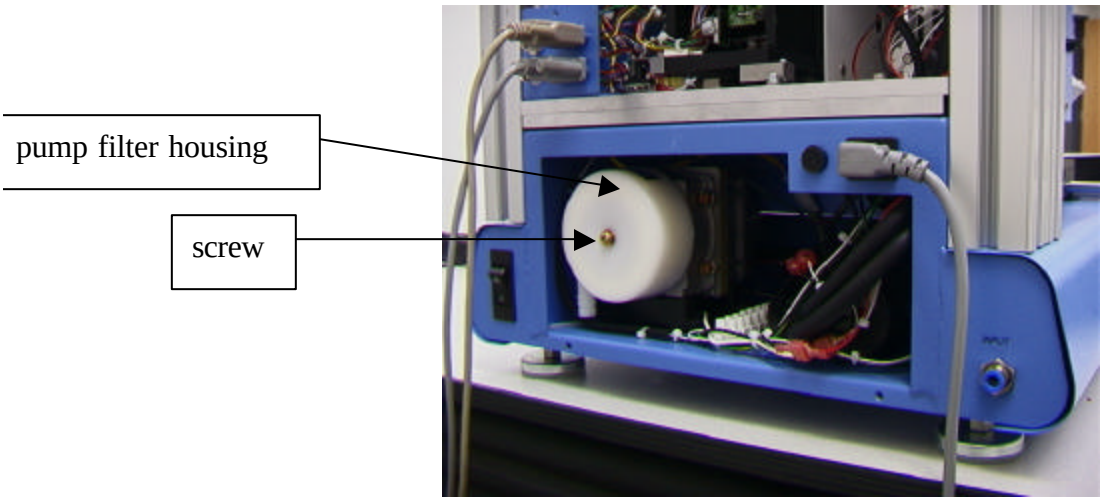


Figure 21

b. Periodically inspect the power cords and other cables for signs of wear or damage. If wear or damage is found, replace the cord or cable immediately.
c. The work surface and housing should be cleaned periodically with a soft damp cloth.
d. The camera glass window should be cleaned periodically with glass cleaner and a soft cloth.
e. Maintenance beyond this should only be completed by a qualified PACE service technician.

10. Regulation

a. This product is CE approved.
b. PACE products meet or exceed all applicable military and civilian EOS/ESD, temperature stability and other specifications, including ANSI-J-STD-001, IPC-7711, IPC-7721 and IPC-A-610.

12. Service and Warranty

Please contact PACE or your local distributor for service and repair.

LIMITED WARRANTY

Seller warrants to the first user that products manufactured by it and supplied hereunder are free of defects in materials and workmanship for a period of three (3) years from the date of receipt by such user. Blowers and motor pumps (which wear out during normal use) are warranted for a period of one (1) year.

This warranty does not cover wear and tear under normal use, repair or replacement required as a result of misuse, improper application, mishandling or improper storage. Consumable items such as tips, heaters, filters, etc. which wear out under normal use are excluded. Failure to perform recommended routine maintenance, alterations or repairs made other than in accordance with Seller's directions, or removal or alteration of identification plates in any way will void this warranty. This warranty is available only to the first user, but the exclusions and limitations herein apply to all persons and entities.

SELLER MAKES NO OTHER WARRANTY, EXPRESS OR IMPLIED, AND MAKES NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Seller will, at its option, repair or replace any defective products at its facility or other location approved by it at no charge to user, or provide parts without charge for installation by the user in the field at user's expense and risk. User will be responsible for all costs of shipping equipment to Seller or other location for warranty service.

EXCEPT FOR THE REMEDY ABOVE DESCRIBED, UNLESS OTHERWISE REQUIRED BY APPLICABLE LAW, SELLER WILL HAVE NO OTHER OBLIGATION WITH REGARD TO ANY BREACH OF WARRANTY OR OTHER CLAIM WITH RESPECT TO THE PRODUCTS, OR LIABILITY FOR ANY DIRECT, INDIRECT, CONSEQUENTIAL, OR INCIDENTAL LOSS OR DAMAGE CAUSED BY OR OCCURRING IN CONNECTION WITH ANY OF THE PRODUCTS.

Warranty service may be obtained by contacting the appropriate PACE Company or local Authorized PACE distributor as set forth below to determine if return any item is required or, if repairs can be made, by the user in the field.

Defective products may not be returned to PACE without a Service Authorization ("SA") Number.

Any warranty or other claim with respect to the products must be made in writing delivered to PACE (or local Authorized PACE distributor for Buyers outside the USA and the United Kingdom) within a reasonable time of the expiration date of this warranty with sufficient evidence of purchase and date of receipt, otherwise user's rights under this warranty shall be deemed waived.



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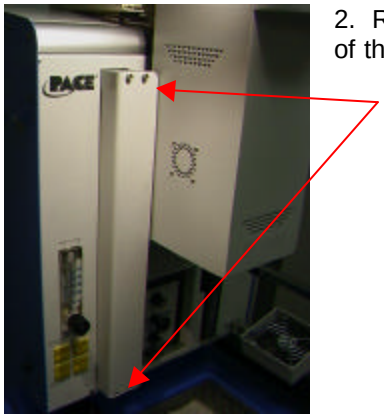
PACE products meet or exceed all applicable military and civilian EOS/ESD, temperature stability and other specifications including MIL STD 2000, ANSI/JSTD 001, IPC7711, and IPC A-610.

FIRST ADDENDUM – TOP HEATER REPLACEMENT

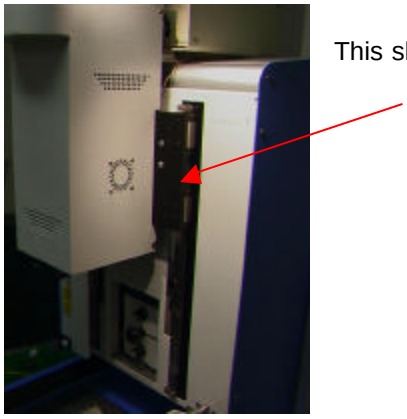
It is recommended you return the machine to PACE, Inc. or call a PACE representative to replace the heater element.

CAUTION: REMOVE POWER CORD FROM MACHINE.

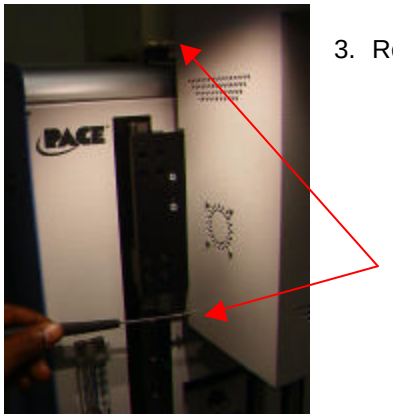
1. Remove the nozzle and vacuum pick.



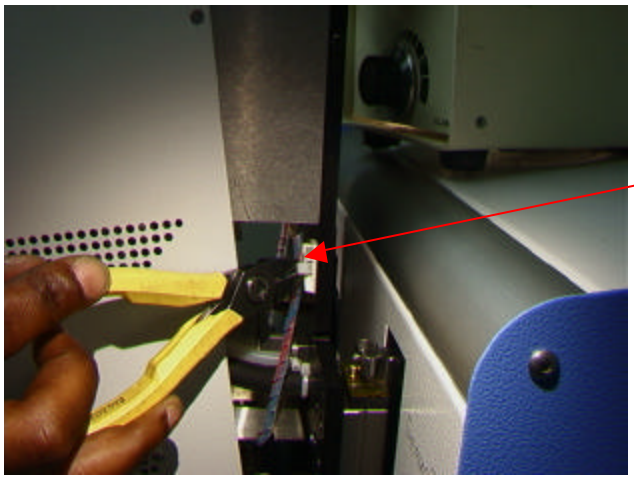
2. Remove the 4 screws on each rail cover on the left and right sides of the heater.



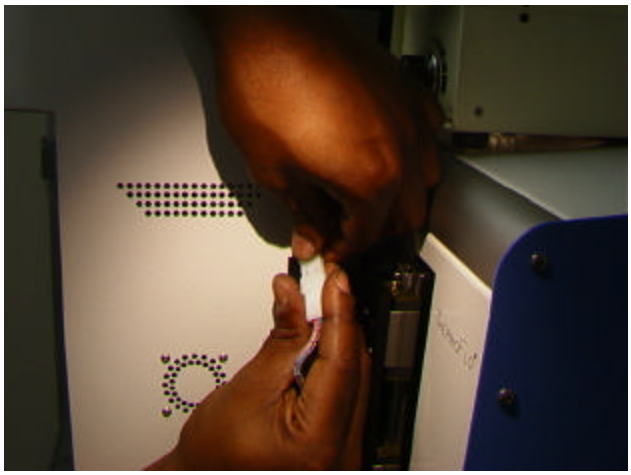
This shows the right rail cover removed.



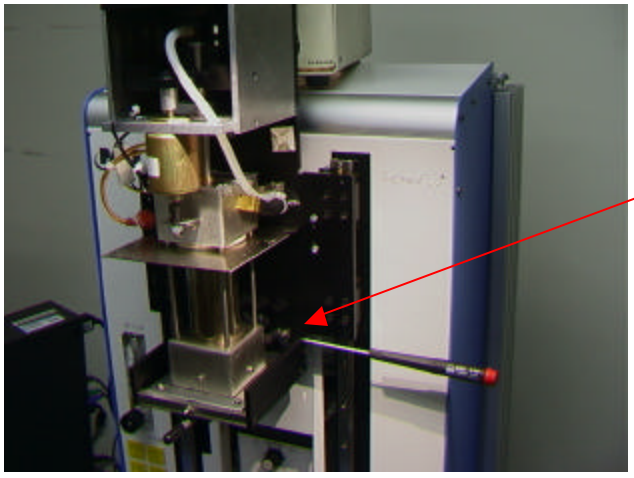
3. Remove the heater cover screws, 2 on each side.



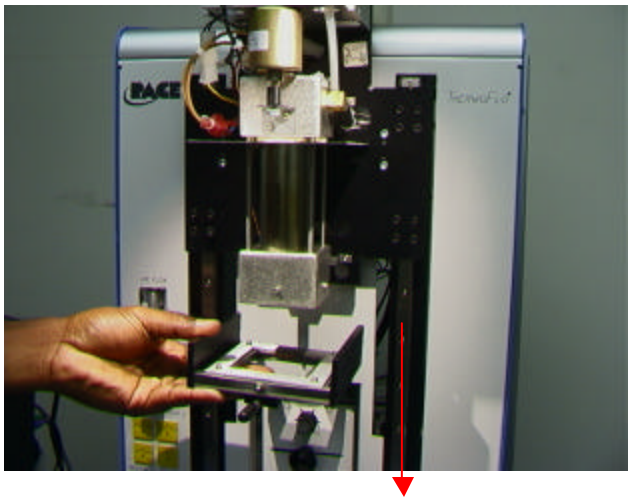
4. In order to remove the heater cover the wire will need to be disconnected. First cut the ties as shown here. There is one on each side.



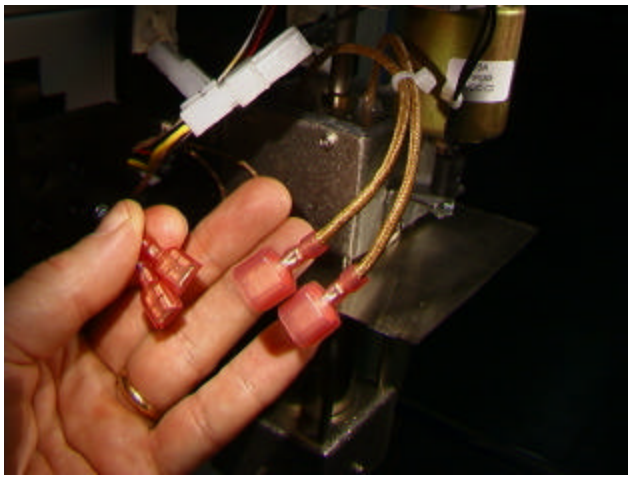
5. Now you can disconnect the heater cables, one on each side. Once these two cables have been disconnected you can remove the cover.



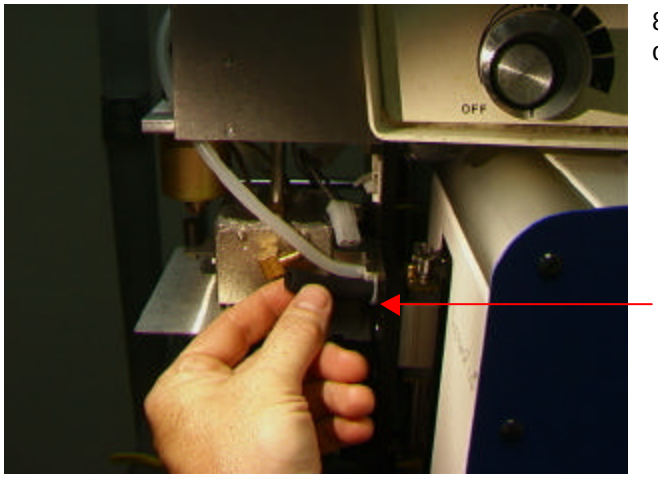
6. Remove the 4 screws attaching the heater base assembly to its mounting, 2 on each side. Be sure to hold the assembly or it will fall.



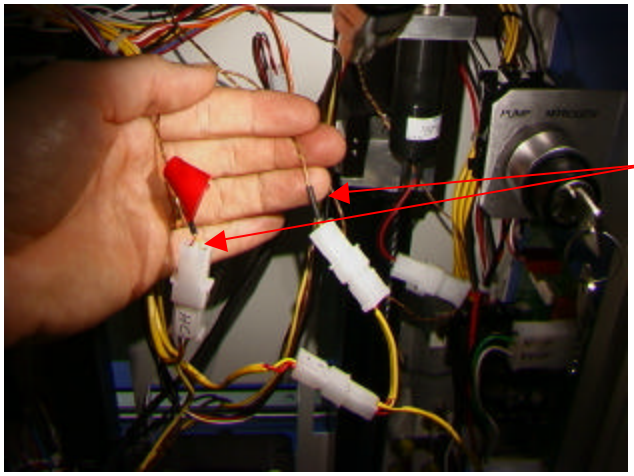
This shows the heater base loose and being lowered off the heater.



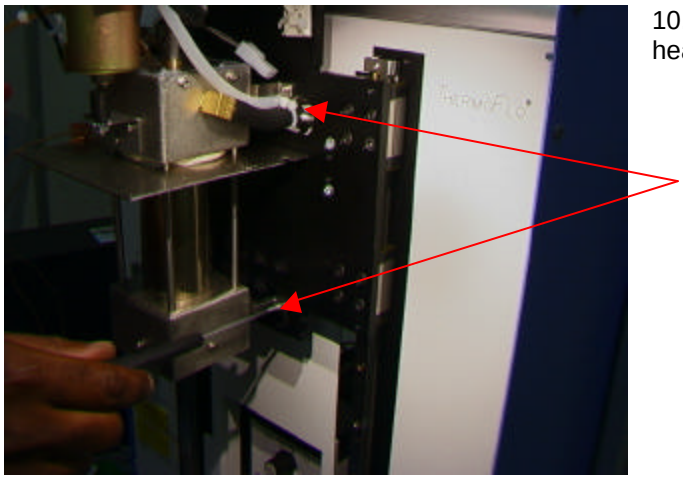
7. Disconnect the blower motor wiring on the side of the heater assembly.



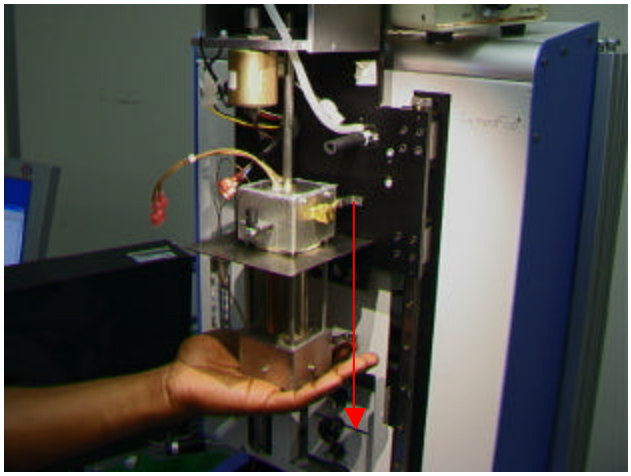
8. Disconnect the hose on the right side of the heater assembly.



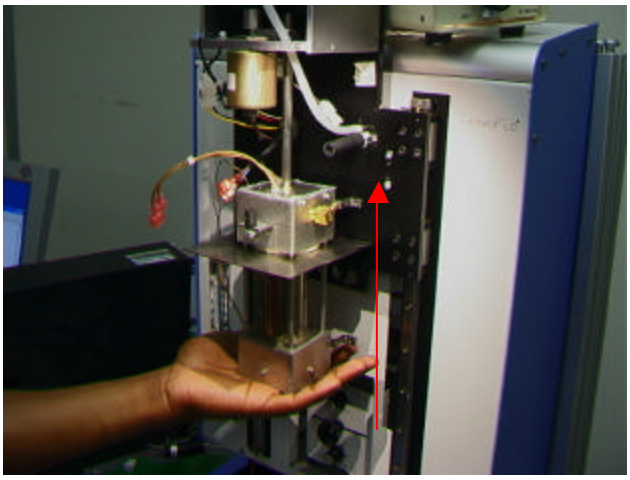
9. Inside the back of the TF 1500, locate the 2 sensor wires, cut the ties and disconnect them. DO NOT CUT THE WIRES. Pull these 2 wires thru to the front. Identify and mark the wires so they are not reversed.



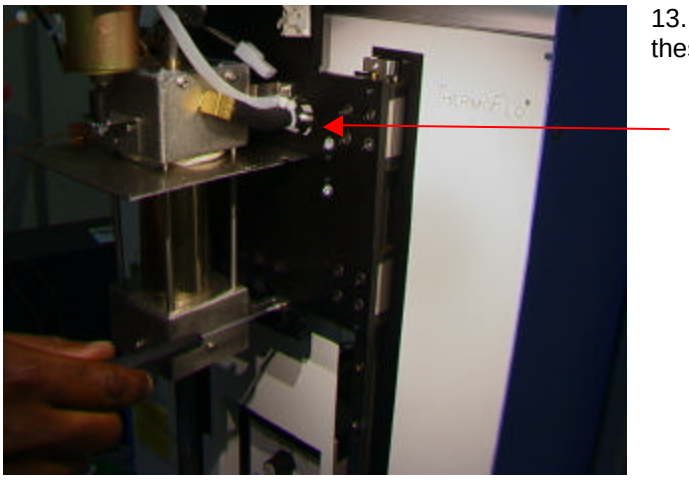
10. Remove the 4 screws holding the heater to its mount, one on each corner.



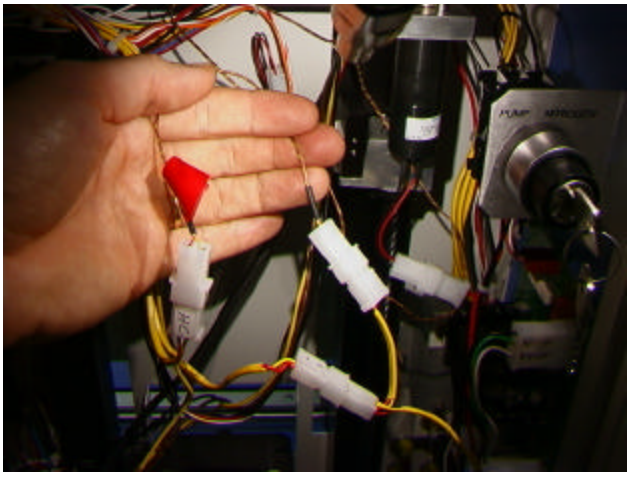
11. Carefully lower heater off the vacuum shaft. Make sure as it is lowered that it is free of hoses and wires.



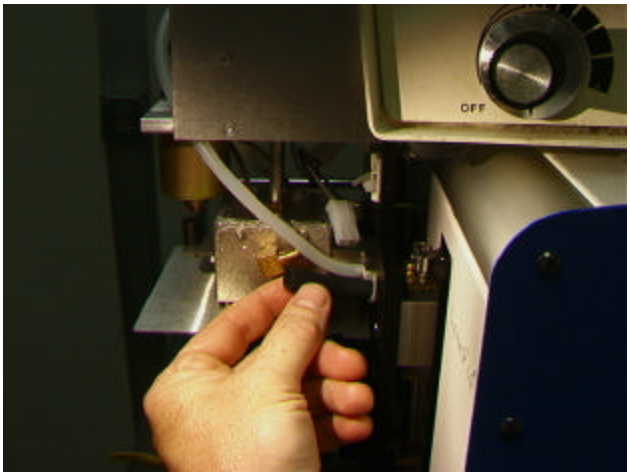
12. Install new heater. The two hoses must run under the bracket.



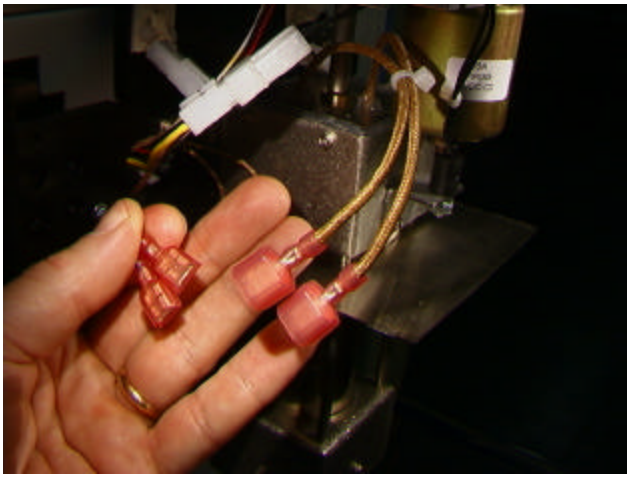
13. Install 4 heater screws. Make sure these hoses are not pinched.



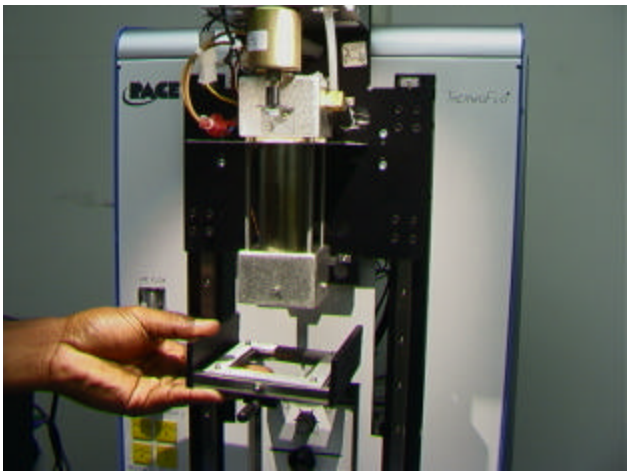
14. Run sensor wires thru front panel the way they came out, reconnect and tie. Make sure they are connected to the right one.



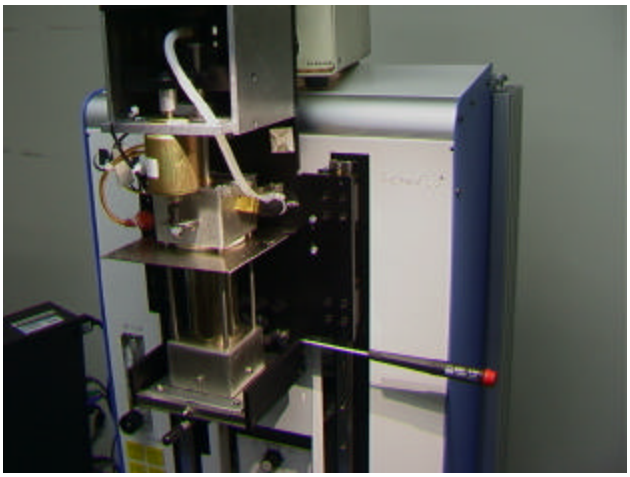
15. Reconnect hose.



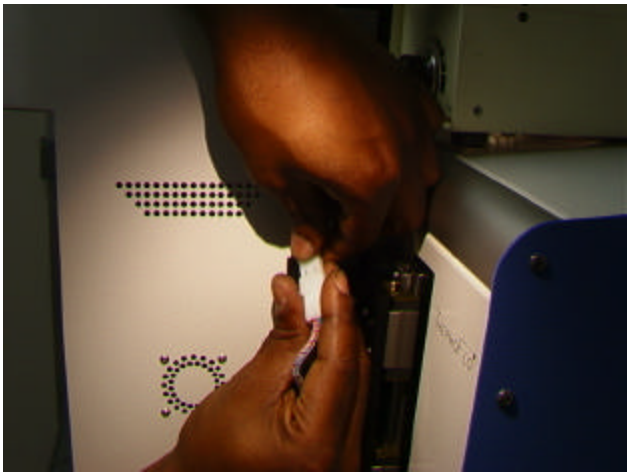
16. Reconnect motor wiring. It does not matter which one is attached to which.



17. Replace base assembly.



18. Reinstall the 4 base assembly screws.



19. Reconnect the wires on each side and tie them back to their mounts. Be sure to pull the wires up taught so they do not contact the heater.

20. Put the heater cover back on making sure not to pinch hoses or wires. Reinstall the 4 screws.

21. Replace the 2 rail covers.

22. Test the heater.

SECOND ADDENDUM – ALIGNMENTS AND ADJUSTMENTS

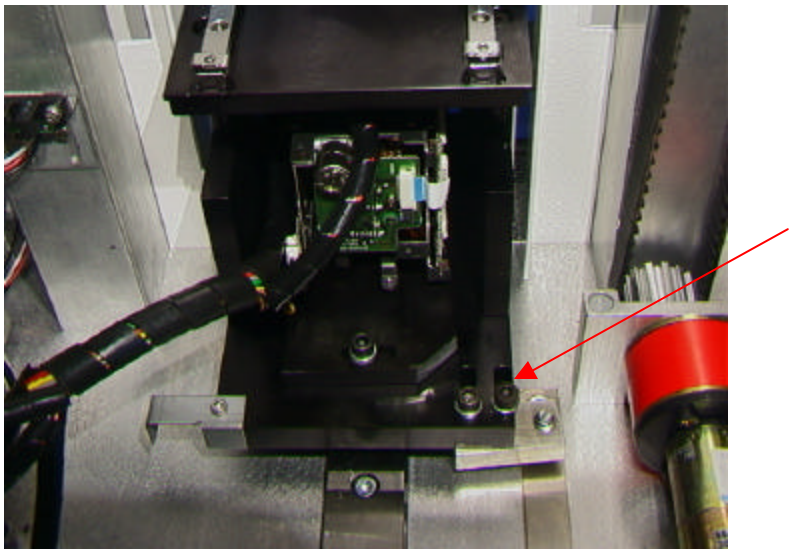
1. Platform planarity. This procedure is only necessary if the vacuum pick does not pick up the component.
   a. Insert the large vacuum pick.
   b. Insert a PCB into holder.
   c. Advance the production process to the 'place' step. Do not pick up a component.
   d. Lower the heater head to the PCB by clicking the green button during the place step. When the vacuum pick contacts the PCB click the heater stop button.
   e. Loosen the four large screws on the front of the platform.



   f. Adjust the smaller four screws to bring the platform and PCB level with the vacuum pick. Loosening a screw will raise that portion of the platform. Tightening a screw will lower that portion of the platform. To keep the screws tight for every bit you loosen a screw, tighten the opposite screw equally as much.
   g. Once the platform is level, tighten the four large screws.
   h. Raise the heater by clicking the red button.

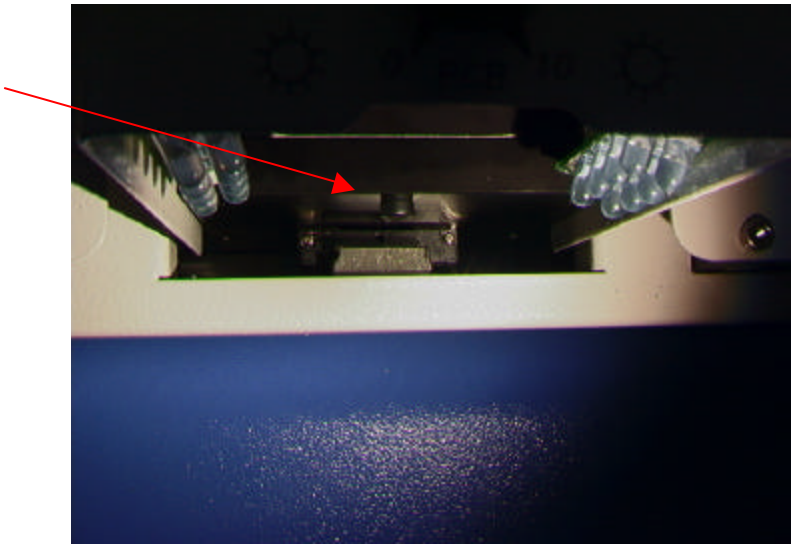
2. Camera alignment. The camera must be aligned to the nozzle on the heater head.
   a. Insert a nozzle in the heater head.
   b. On the Profile screen, adjust all the heaters to minimum temperatures then advance to the focus step and click on the green focus button.
   c. Loosen the nozzle retention screw and rotate the nozzle so its 4 sides are aligned with the edges of the viewing window.
   d. Zoom in on the image so it fills the viewing area.
   e. If the nozzle edges are too far back:
      i. Open the back of the TF 1500. **WARNING: DO NOT TOUCH LIVE CIRCUITS!**

ii. With the camera pulled out, loosen the two screws on the top right of the camera.

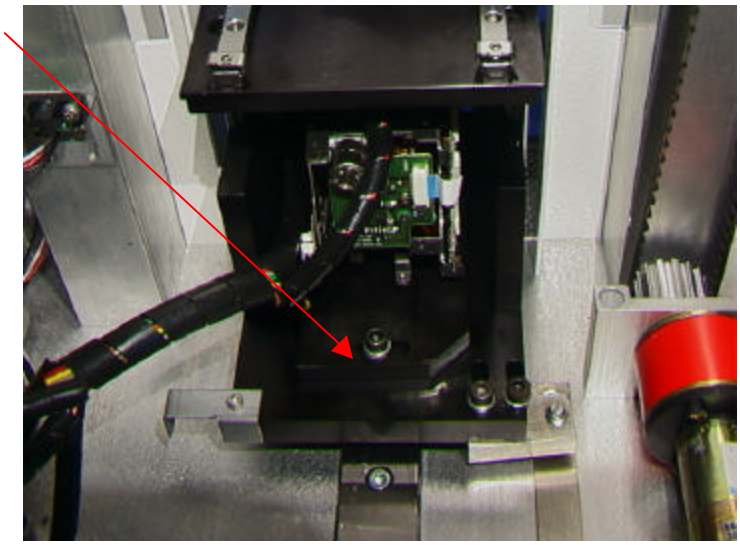


iii. Reposition the camera until the front and back edges are centered in the viewing window and tighten the screws.

f. If the nozzle edges are off right to left:
   i. Open the back of the TF 1500. **WARNING: DO NOT TOUCH LIVE CIRCUITS!**
   ii. In front, loosen the screw protruding under the camera housing.



iii. In the back, loosen the screw in the center on the back of the camera housing.



iv. Rotate the camera until the left and right sides of the nozzle are centered between the sides of the viewing area.
v. Tighten the screws.

3. Laser alignment. This adjustment is necessary if, after spotting the PCB with the laser, the PCB is grossly out of alignment with the nozzle and camera viewing area.
   a. Pull out the camera housing.
   b. Orient a component on the PCB so it is centered in the viewing area. (Figure) Make sure the camera is aligned with the nozzle first. (Step 2)
   c. Open the back of the TF 1500. **WARNING: DO NOT TOUCH LIVE CIRCUITS!**
   d. Loosen the two screws holding the laser mount. (Figure)
   e. Adjust the laser to a spot roughly in the center of the component and tighten screws.

4. Component Nest Platform alignment. This adjustment is necessary if the component is not aligned with the nozzle and vacuum pick.
   a. Place the component nest platform on the camera housing with the component.
   b. Advance the Production procedure to the 'pickup' step and click on the green button.
   c. Click on the stop button when the vacuum pick contacts the component.
   d. Loosen the screw on the mechanical stop on the right of the platform and the two screws on the left of the platform and move it until the component is aligned with the nozzle.
   e. Adjust the mechanical stop and tighten all three screws.

THIRD ADDENDUM - CORRECTIONS

Section 5d

Step i. To rotate the nozzle, first loosen the retention screw in front of the housing.

Section 5e

Step xi. Initiate prism calibration sequence. Further explanation is in par. 5j.

Section 6a Production Procedure.

Step ix. The component needs to be oriented the same as the nozzle. To rotate the platform, loosen the retention set screw, turn to align the component with the nozzle, then tighten the set screw.

Section 6c, Profile Development Install Procedure.

Step i. Mouse click on Profile for the Profile Development Screen. (Figure 7)

Step ii. If the component needs to be placed first, conduct steps ii to xv in paragraph 6a, then do sections iv thru x below.

After Section 6c. vii.

Section 6d. Profile Development Removal Procedure

Step i. Load PCB and align component with red laser light roughly in the center of the component.

Step ii. Click on Load PCB button.

Step iii. Click on Lower Heater Arm button.

Step iv. Align component so nozzle will fit down over without contacting the component. Click on Align component button.

Step v. Adjust nozzle flush with the PCB using the up and down arrows. Click on Lower Nozzle button.

Step vi. Click Start button to begin profile.

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