TF 1700 and TF 2700 BGA Rework Station
Operation and Maintenance Manual

Manual Number 5050-0554

PACE TF 1700

PACE TF 2700

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NOTE:

This manual uses much of the TF1700 to demonstrate the features of the PACE BGA workstations. While most of the features are the same, the preheater array is unique to the TF 2700.

Packing Contents, Standard Items

Description	Part Number
TF 1700	8007-0465 (120V) 8007-0466 (230V)
TF 2700	8007-0467 (120V) 8007-0469 (230V)
PC	-
Monitor	-
Keyboard	-
Mouse	-
Pick Vac	7027-0001-P1
Vacuum Pick Kit	6993-0276
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

1. Specifications:

TF 1700

Part Number	8007-0465 8007-0466 (EXPORT)
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, 3.5 Floppy Drive, CD
Top Heater	Adjustable convective air (air or N2), Maximum 20 SLPM, 1200 watts 100 to 400 °C, 212 to 750 deg °F
Bottom Heater	IR, 400 watts, 100 to 221 °C, 212 to 430 deg °F
Vacuum	5.9 inHg
Optics	High resolution, 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 Nest Size (Optional)	65 mm x 65mm, 255” x 2.55” max. See warning on page 24

TF 2700

Part Number	8007-0467 8007-0469 (EXPORT)
Dimensions	737 mm H x 686 mm W x 737 mm D (29” x 27” x 29”)
Weight (w/o computer)	90 kg (200 lbs)
Power Requirements	115 VAC, 60 hz or 230 VAC, 50 Hz 2600 watts
PC	Pentium 4, 256M Ram, Floppy Drive, CD
Top Heater	Adjustable convective air (air or N2), Maximum 20 SLPM, 1200 watts 100 to 400 deg C, 212 to 750 deg F
Bottom Heater	IR, One 400 Watts IR Six 150 Watts 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) 17” Integrated color Flat Panel Monitor
PC Board Size	610mm x 610 mm, 24” x 24”
Component Nest Size	65 mm x 65mm, 2.56” x 2.56” max.

TF 1700 BGA Rework Station Parts Identification

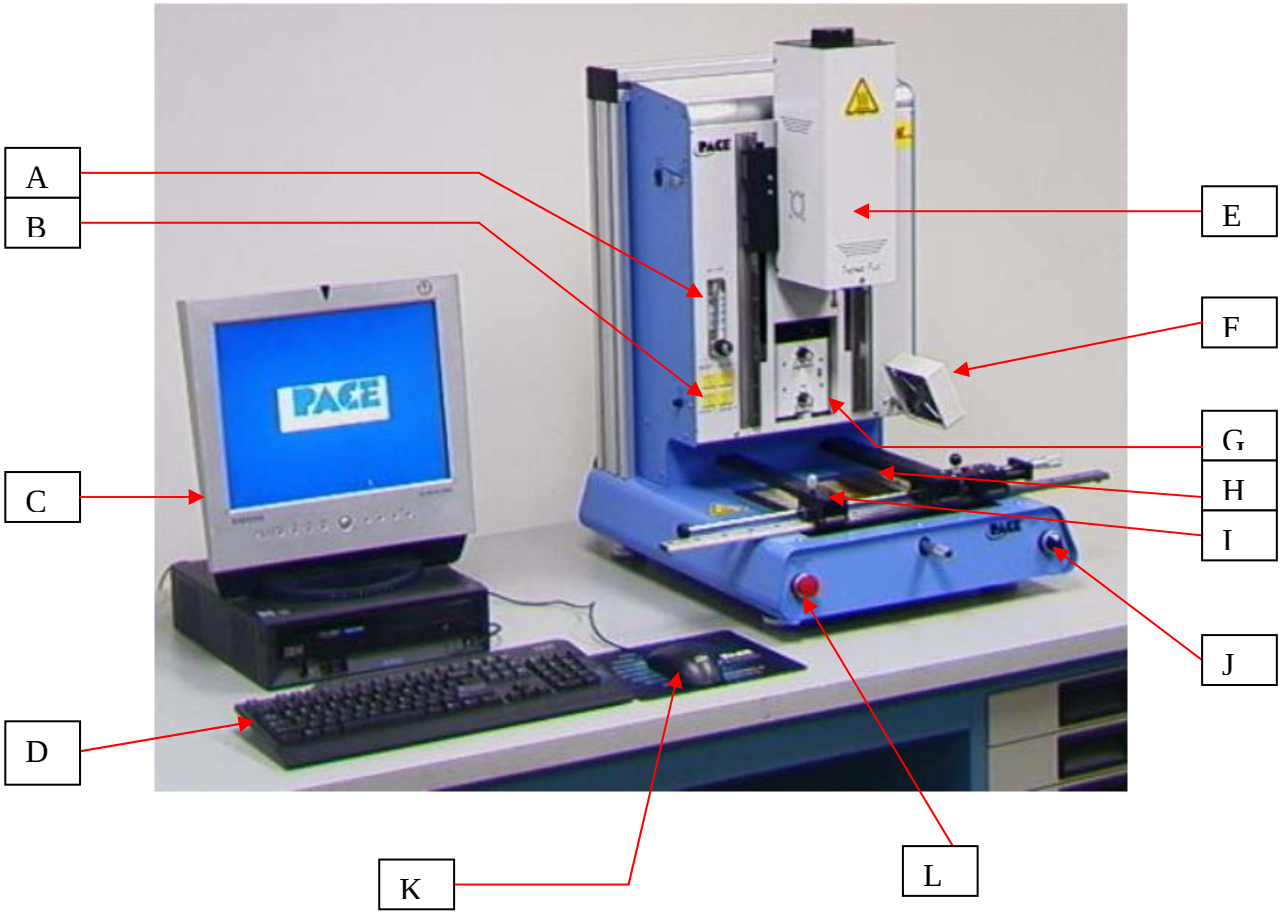
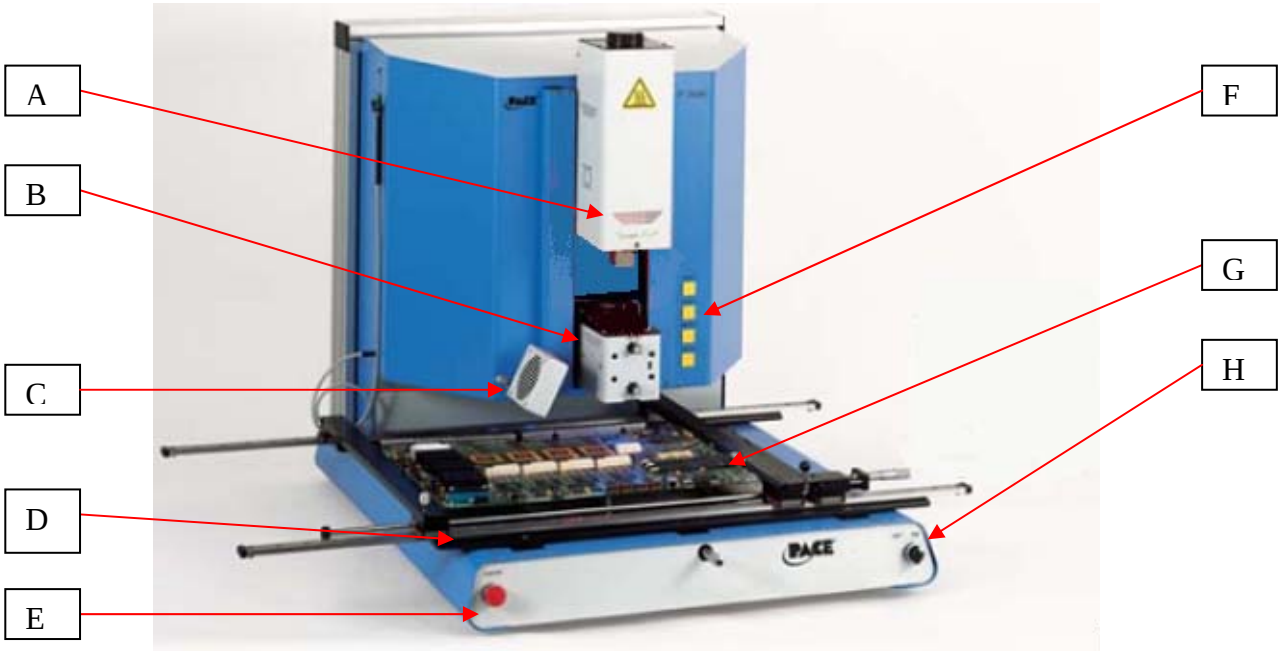


Figure 1a

A. Air Flow Meter	This device is used to control and monitor the airflow through the reflow head.
B. Sensor Inputs	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. LCD Display Monitor	Displays PC software.
D. Keyboard	Used to enter information into software.
E. 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 control downward force.
F. Cooling Fan	The component and PCB are cooled by the cooling fan, and can be activated automatically after the reflow cycle is complete or operated manually.

G. Optics Housing	Contains the camera and beam splitter (prism). The housing extends and retracts automatically during operation and 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	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. When starting the system, always turn on TF1700 before starting the PC software.
K. Mouse	Used to enter information into software.
L. Emergency Off Switch	In case an emergency shut down is necessary, press this button.

TF 2700 BGA Rework Station Parts Identification



**Not pictured: PC, Keyboard, and Mouse*

Figure 1b

A. 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 control downward force. through the reflow head.
B. Sensor Inputs	Contains the camera and beam splitter (prism). The housing extends and retracts automatically during operation and the lights for the optics will turn on/off automatically when the housing is extended/retracted.
C. Cooling Fan	The component and PCB are cooled by the cooling fan, and can be activated automatically after the reflow cycle is complete or operated manually.
D. Board Holder	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.
E. Emergency Off Switch	In case an emergency shut down is necessary, press this button.
F. Sensor Inputs	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.
G. Bottom Side Heater	Used to warm the PCB from the underside. It is an IR type heating source.
H. 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. When starting the system, always turn on TF1700 before starting the PC software.

2. 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. They are hot, you will get burned.
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 the main power cable.

3. Features

a. The TF 1700 and TF 2700 are ideal for post assembly rework, repair, and low volume/short run production operations. The TF 1700 and TF 2700 can remove and install PBGAs, CSPs, FCs, LGAs, LCC's and other SMDs.
b. Featuring unparalleled thermal performance, PACE BGA Rework Stations flexibility and state of the art process software means no other system is easier

to use. The TF 1700 and TF2700 are 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. PACE BGA Rework Stations advanced vision and placement system is highly accurate and can quickly magnify even the smallest components for easy alignment. TF 1700 and TF 2700 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, PACE BGA Rework Systems deliver 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 1200 Watt top heater, with closed loop temperature control, coupled with proven nozzle design ensures uniform temperature distribution when heating.
   iii. High power bottom heater 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.

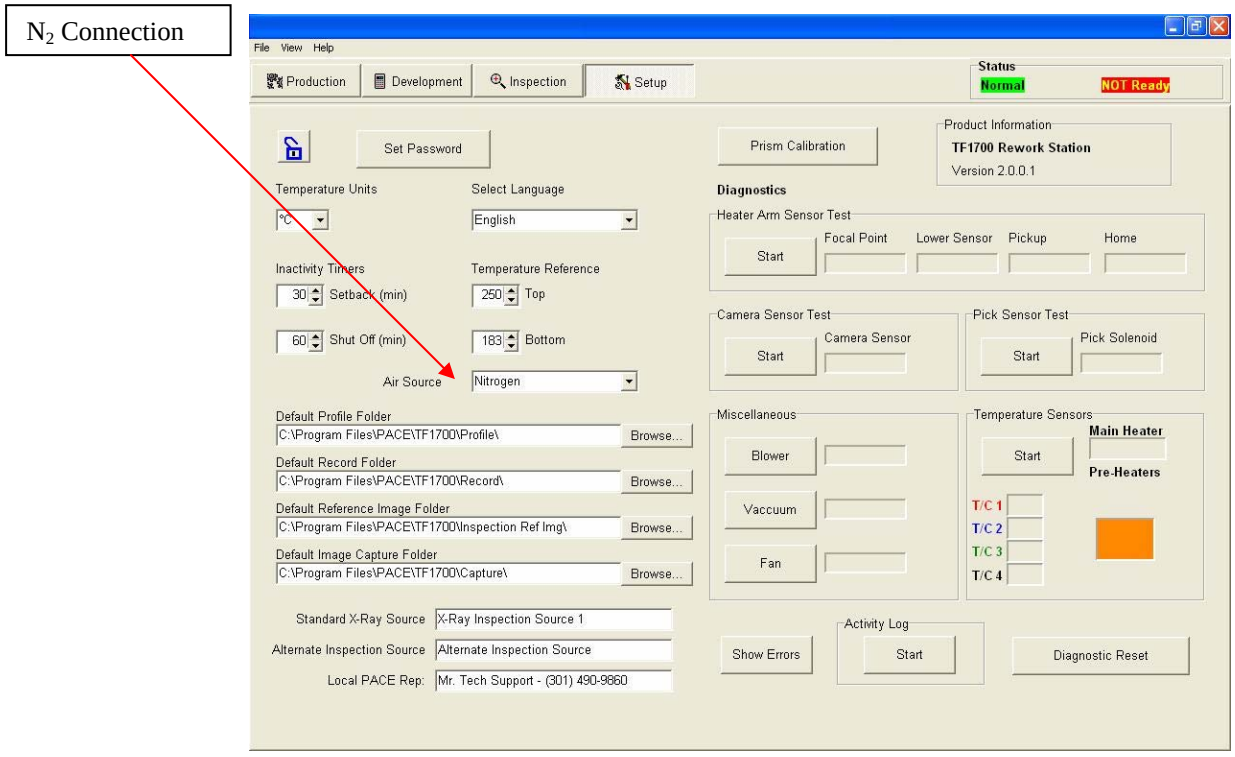
e. ALIGNMENT AND PLACEMENT FUNCTION
   i. The component is held by a precision vacuum placement pick, which is located within the heater assembly.
   ii. High resolution Color Vision Overlay System (VOS) with color camera and dichroic prism. VOS does not require routine calibration, eliminating costly downtime and operator frustration.
   iii. Color Camera with 72x zoom capability, featuring auto-focus.
   iv. Lighting system uses “Ultra Bright” White 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 65mm (2.5") 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

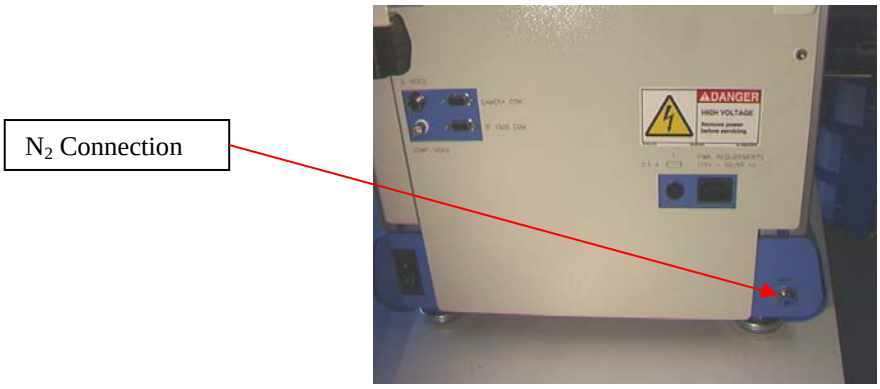
i. Fully adjustable, precision, spring loaded board holder with top or bottom PCB registration. Precise micrometer adjustment for X and Y adjustment ensures placement accuracy for repeatability.
ii. Rugged, stable board platform to hold and support the PCB.
iii. Unique board holding fixtures that are 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.

4. Set-Up

a. Connect
   i. The TF 1700 and TF 2700 come configured to use the internal air pump. Both BGA Rework Stations may also be operated with an external N_2 Supply. Select air or (nitrogen) source using the drop down box on the setup page. **Warning**: Do not operate the TF 1700 in N_2 mode unless N_2 supply is connected and on.



TF-1700 Software shown



ii. Insert PC into brackets on back of BGA Rework Station.
iii. Monitor
    1. Connect power cord.
    2. 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 BGA Rework Station according to labels.
vii. Connect power cords to BGA Rework Station 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 software 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)
    Warning: Use of tools to tighten vacuum pick may result in damage to system. Tighten vacuum pick by hand only.

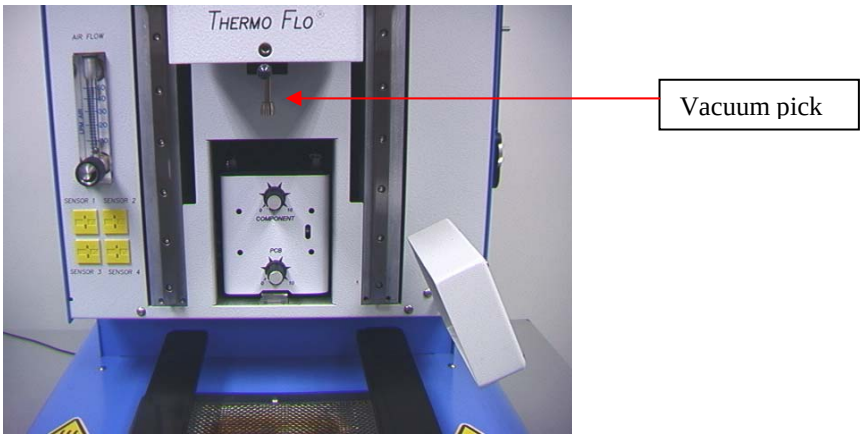


Figure 3a

d. Inserting/changing nozzle. (Figure 3b)

i. Insert proper size nozzle. The OD of 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 on the nozzle housing. To rotate the nozzle, first loosen the retention screw in front of the housing.

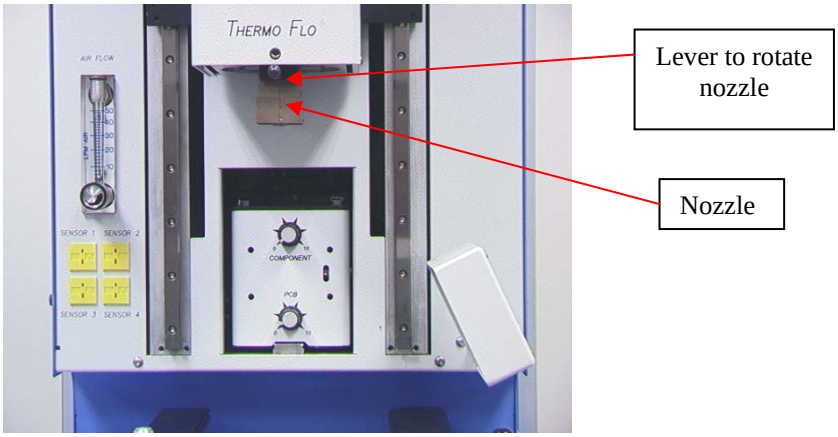


Figure 3b

a. Software set up screen features. (Figure 4a)

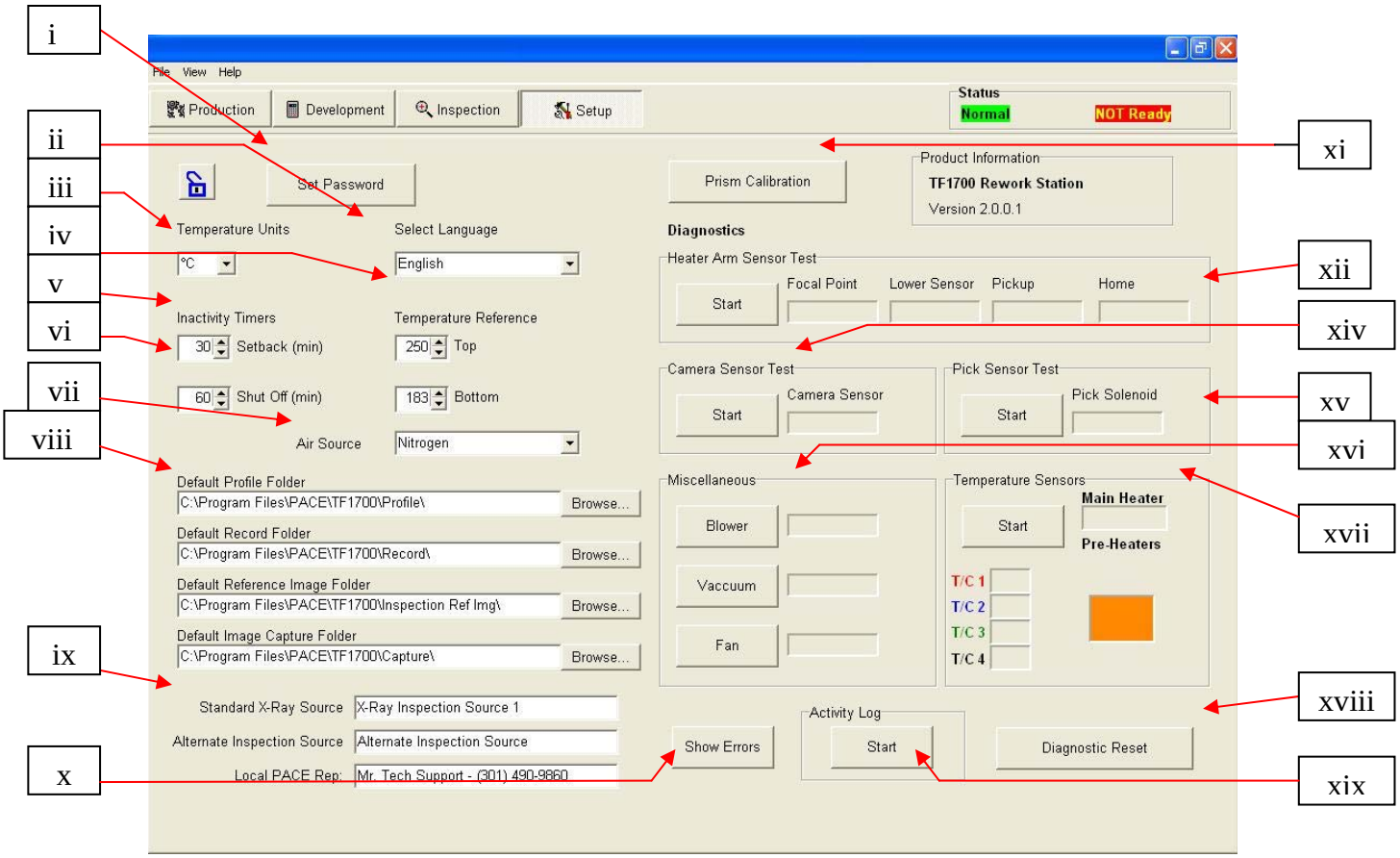


Figure 4a

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. Air Source selects internal pump or external N_2 source.
viii. Default location of saved profile files, records, image, and capture.
ix. Changes title of Video Sources on inspection screen.
x. Shows system communication error.
xi. Initiate prism calibration sequence.
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. Checks operation of heater blower, cooling fan, and vacuum pump.

xvi. Temperature sensors. Tests active thermocouple circuitry.
xvii. Reset diagnostics. Must be clicked after any diagnostic test is performed to reset the tests to default settings.
xviii. Run the activity log.

Figure 4b shows the pre-heater indicator of the TF 2700. This feature indicates which pre-heater is on and the current temperature. To turn on or off individual secondary pre-heaters click on the graphic. While individual secondary pre-heaters can be turned on and off, they must all be set at the same temperature. They can be adjusted by dragging the yellow lines on the graph or through the profile manager.

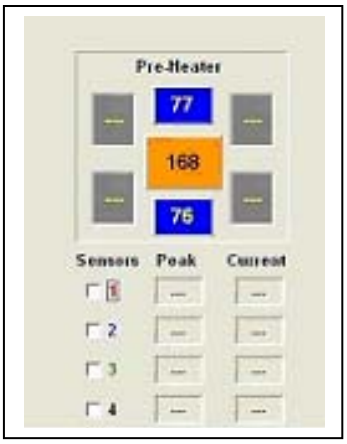


Figure 4b

b. Alignment Screen Features (Figure 5)

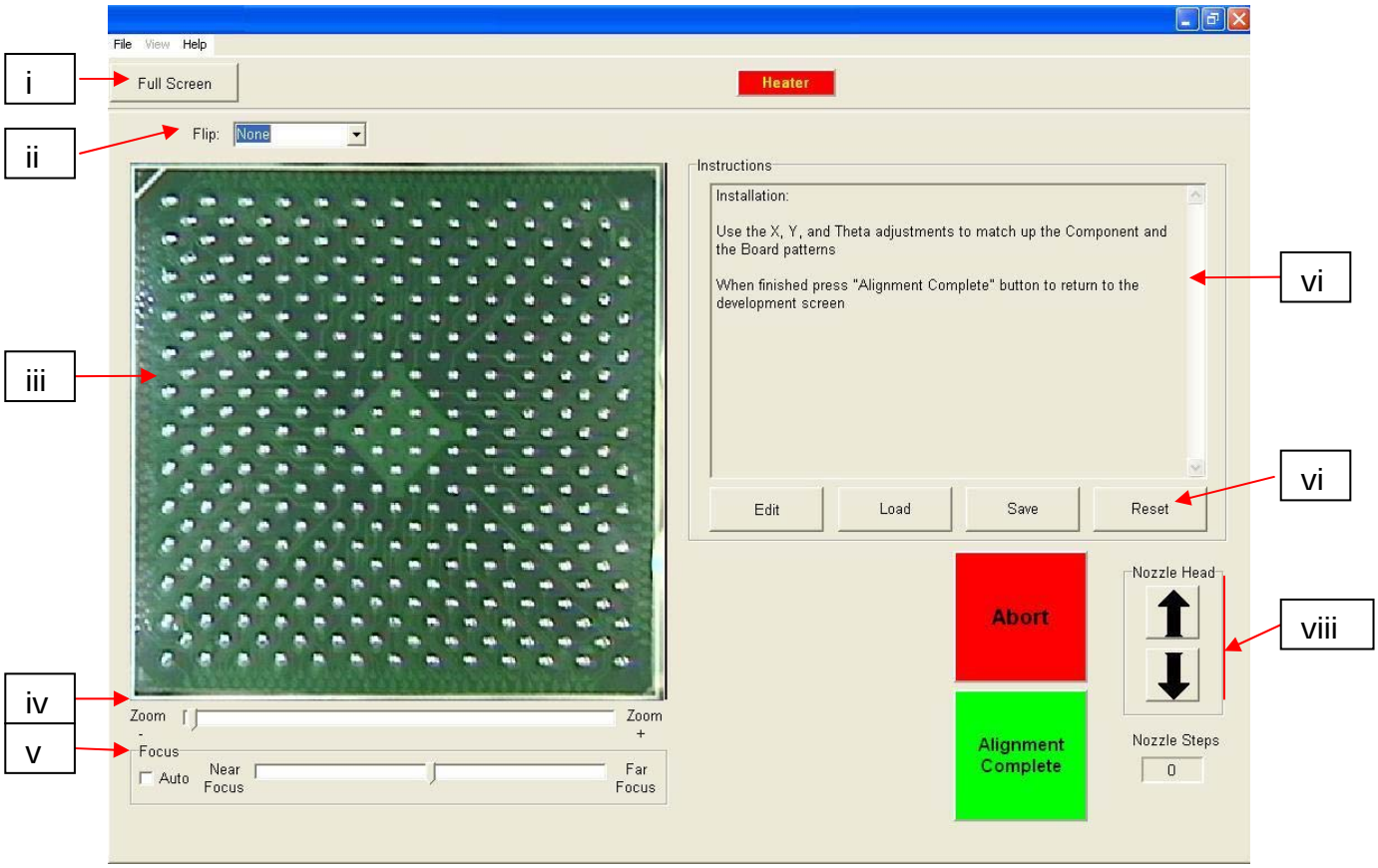


Figure 5

i. Full Screen. Click on here to view image full screen.
ii. Flip Image. Allows operator to flip the image horizontally or vertically.
iii. Component/PCB alignment image. Proper alignment is viewed here showing the PCB pads directly under the component pads.
iv. Zoom bar. The image can be zoomed in or out using this bar.
v. 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.”
vi. Instructions. Follow these instructions to proceed through the alignment sequence.
vii. Modify Instructions.
1. Edit – Change current profile instructions.
2. Load – Loads saved profile.
3. Save – Saves changes made to instructions.
4. Reset – Returns to factory set instructions.
viii. Nozzle step adjustment. If component cannot be aligned nozzle height up or down with this option until better alignment or focus is achieved.

c. Production Screen Features (Figure 6)

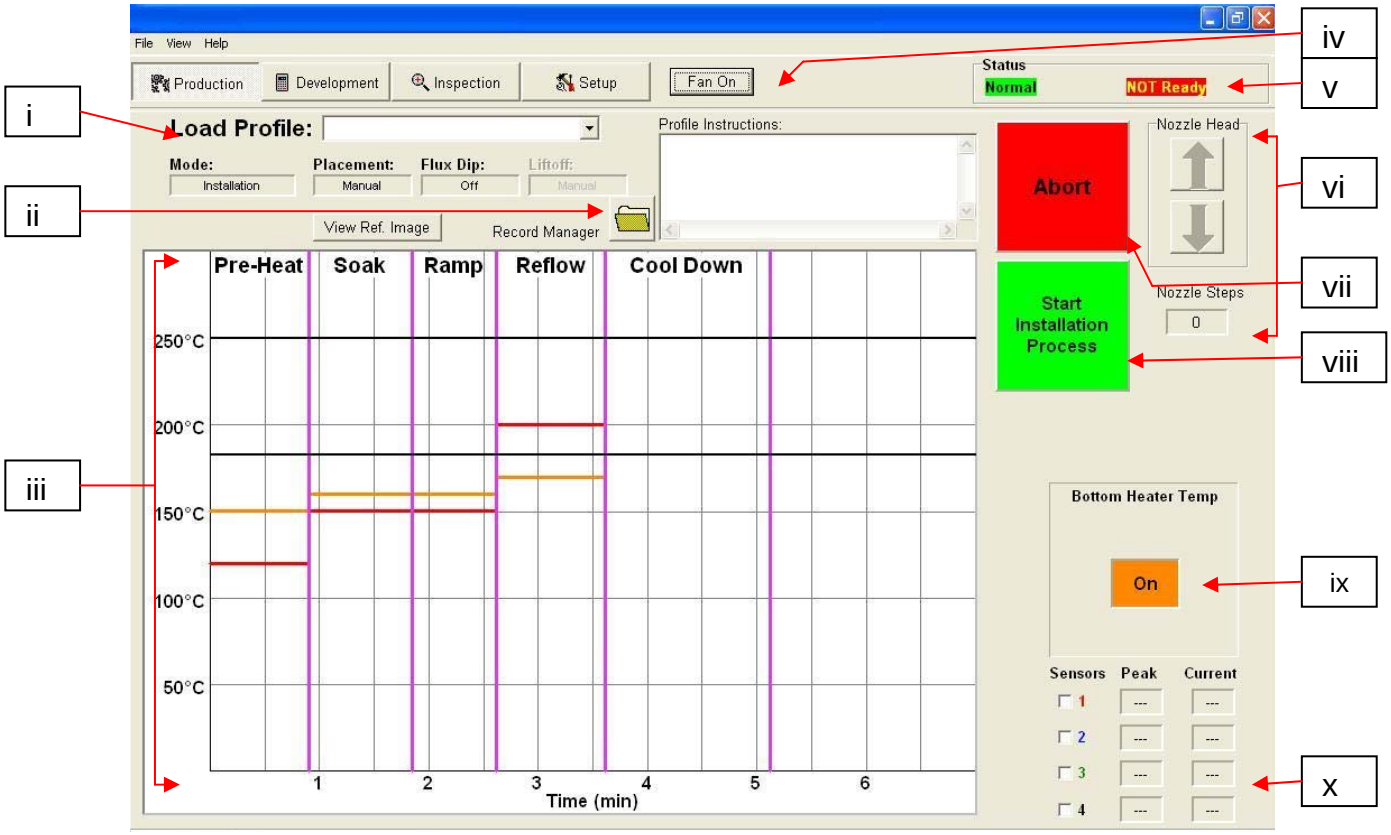


Figure 6a

i. Profile Name. Indicates currently selected profile. A new profile can be selected from a list of saved profiles by clicking on the arrow.
ii. Record Manager. Profile information may be stored and exported in PDF file format. See figure 6a
iii. Graph. A saved graph and, if thermocouples are used, an active trace graph are viewed here.
iv. Fan On/Off Selector. Manual on/off switch for the cooling fan.
v. 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.
vi. Nozzle Step Indicator. Indicates how many steps the nozzle will lower to properly position itself for operation.
vii. Abort Button. Click at any time to abort the process and return to the beginning.
viii. Sequencing Button. Click here to proceed to next step in the operation.
ix. Pre-Heater indicator. Indicates pre-heater is on or off .
x. Sensor indicators. Real-time sensor readings can be viewed here if thermocouples are used.
xi. Production Mode Record Manager Features (Figure 6c)

Figure 6b shows the pre-heater indicator of the TF 2700. This feature indicates which pre-heater is on and the current temperature. To turn on or off individual secondary pre-heaters click on the graphic. While individual secondary pre-heaters can be turned on and off, they must all be set at the same temperature. They can be adjusted by dragging the yellow lines on the graph or through the profile manager.

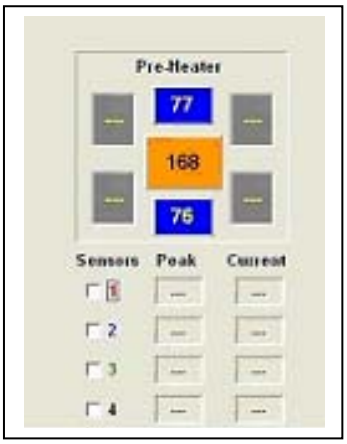


Figure 6b

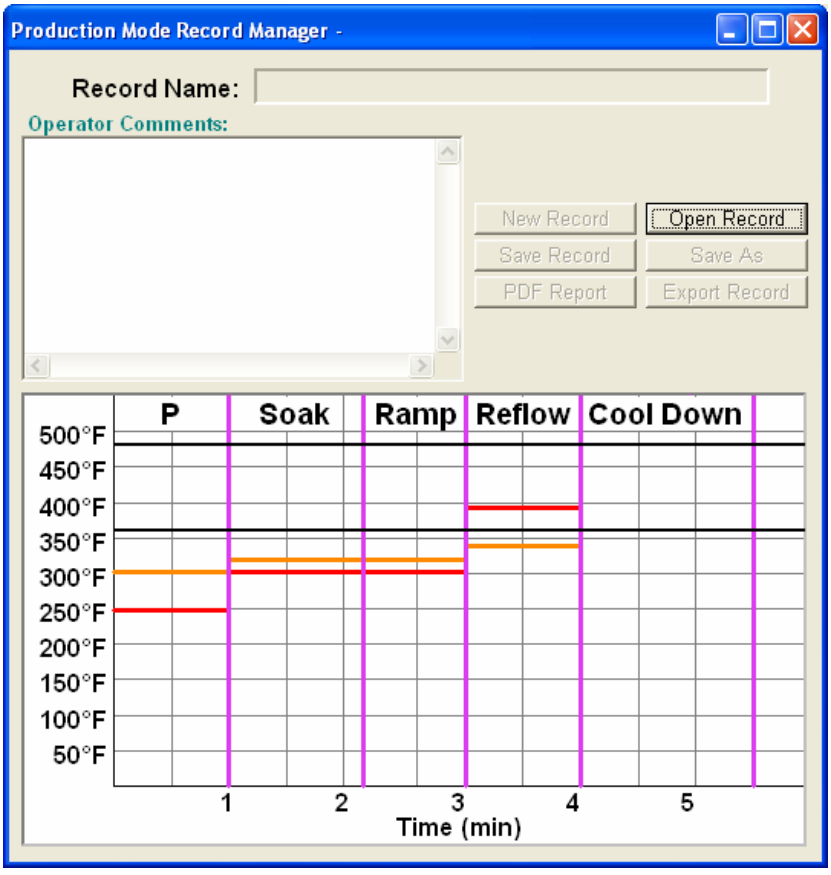


Figure 6c

d. Profile Development Screen (Figure 7)

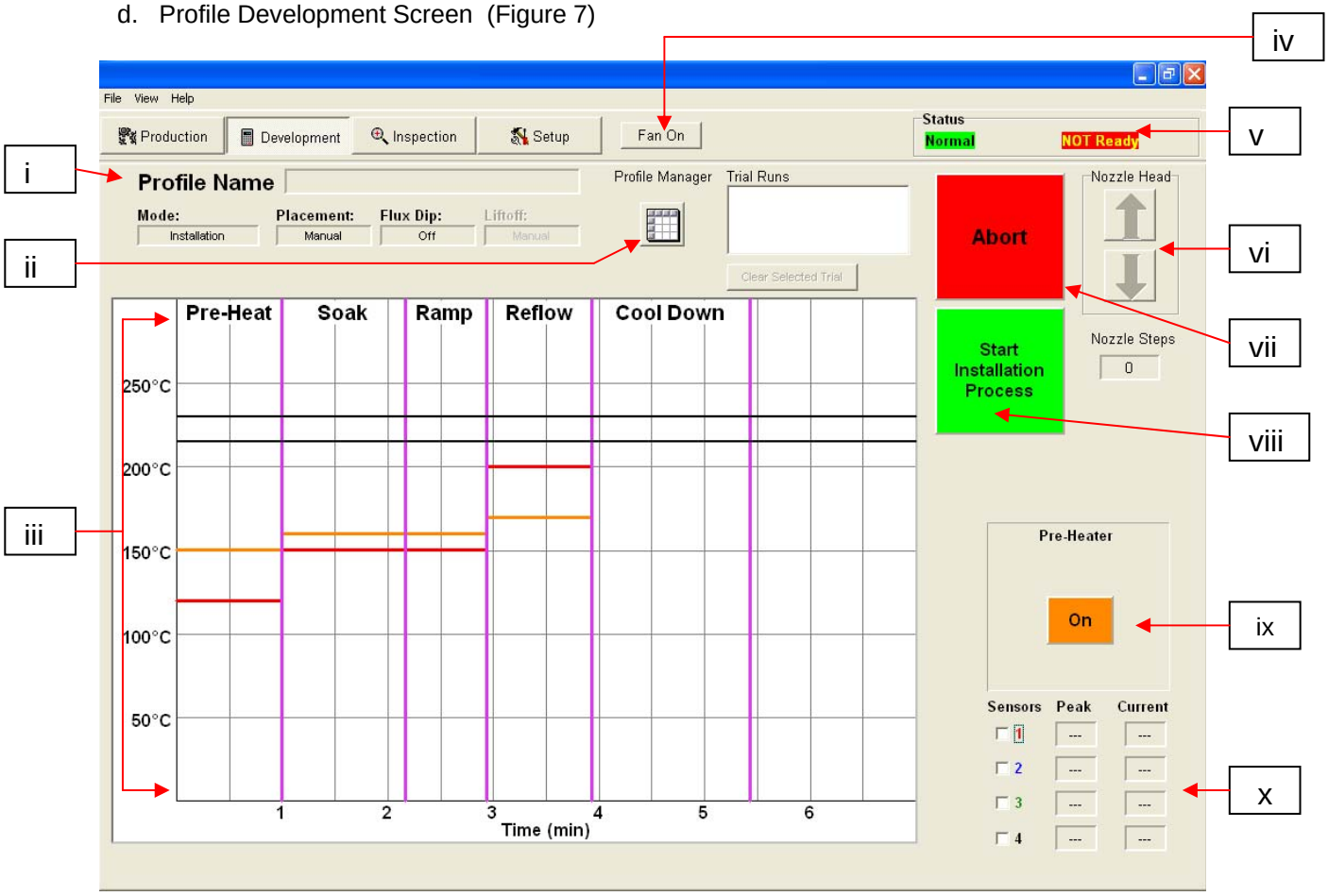


Figure 7a

i. Profile Name. Indicates currently selected profile.
ii. Profile Manager. Temperature and time setting entered by the developer can be viewed managed here (Figure 7a).
iii. Graph. A saved graph and, if thermocouples are used, an active trace graph are viewed here.
iv. Fan On/Off Selector. Manual on/off switch for the cooling fan.
v. 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.
vi. Nozzle Step Indicator. Indicates how many steps the nozzle will lower to properly position itself for operation.
vii. Abort Button. Click at any time to abort the process and return to the beginning.
viii. Sequencing Button. Click here to proceed to next step in the operation.
ix. Pre-Heater indicator. Indicates if pre-heater is on or off.
x. Sensor indicators. Real-time sensor readings can be viewed here if thermocouples are used.

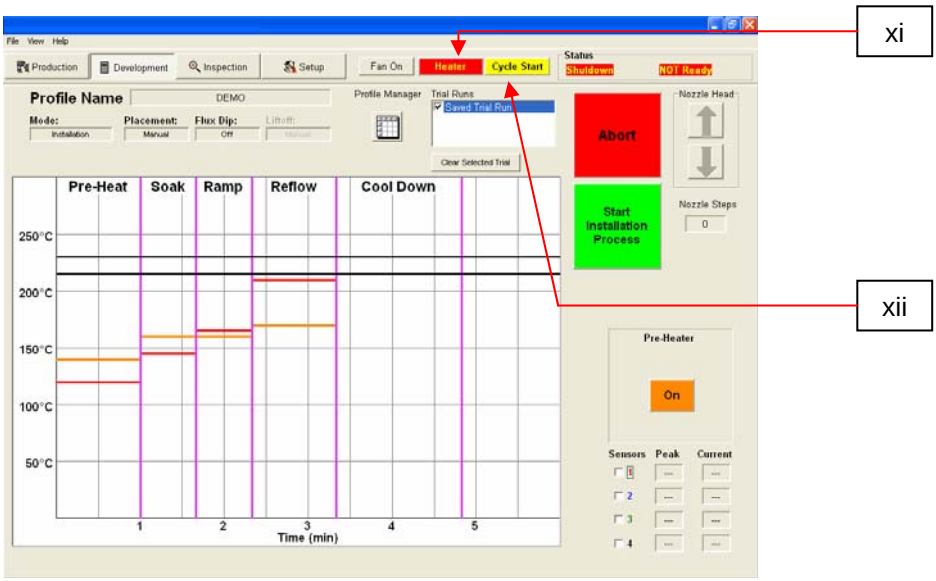


Figure 7b

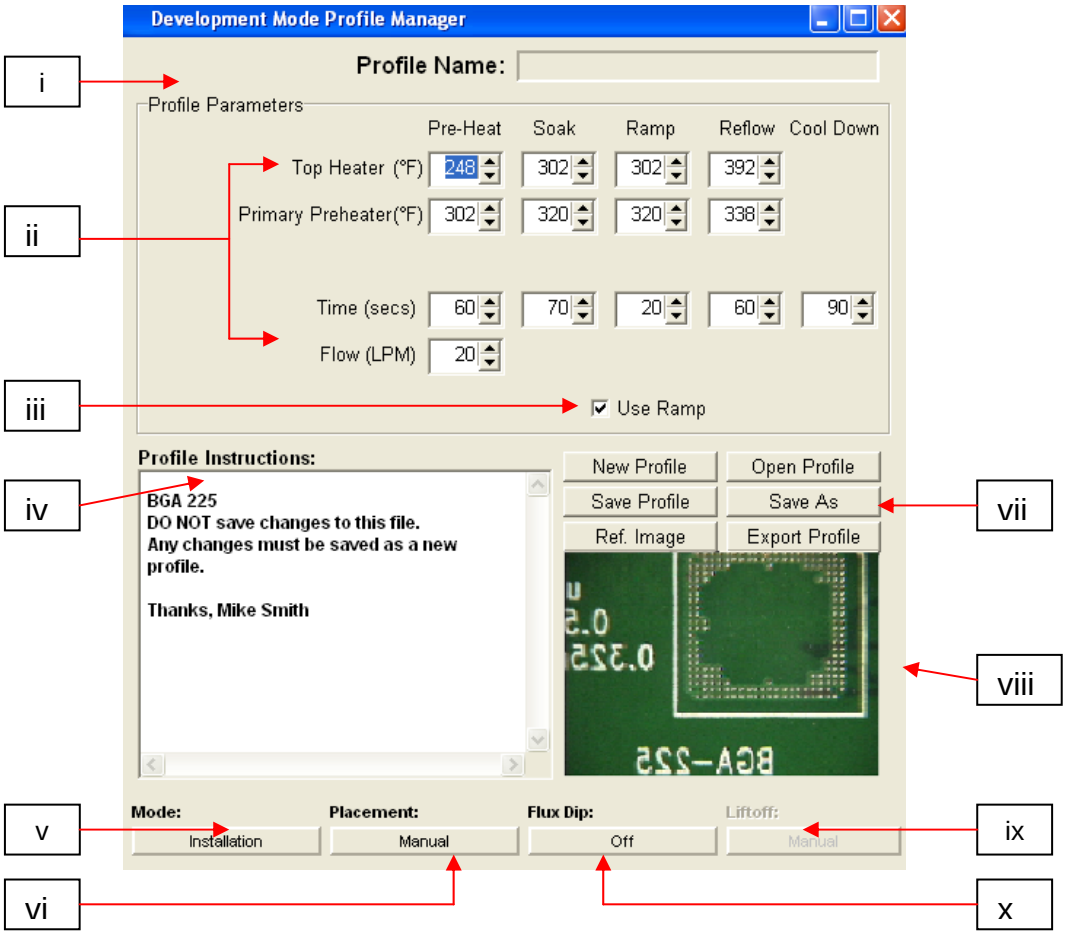
xi. Heater. Click on Heater button during profile development to deactivate heater.
xii. Cycle Start. Click on button to run profile during development.

TF 2700 Pre-heater Indicator

TF 2700 Pre-Heater Indicator. Indicates which pre-heater is on and the current temperature. To turn on or off individual secondary pre-heaters click on the graphic. While individual secondary pre-heaters can be turned on and off, they must all be set at the same temperature. They can be adjusted by dragging the yellow lines on the graph or through the profile manager.

Figure 7c

Profile Development Screen Features TF 1700 (Figure 7d)

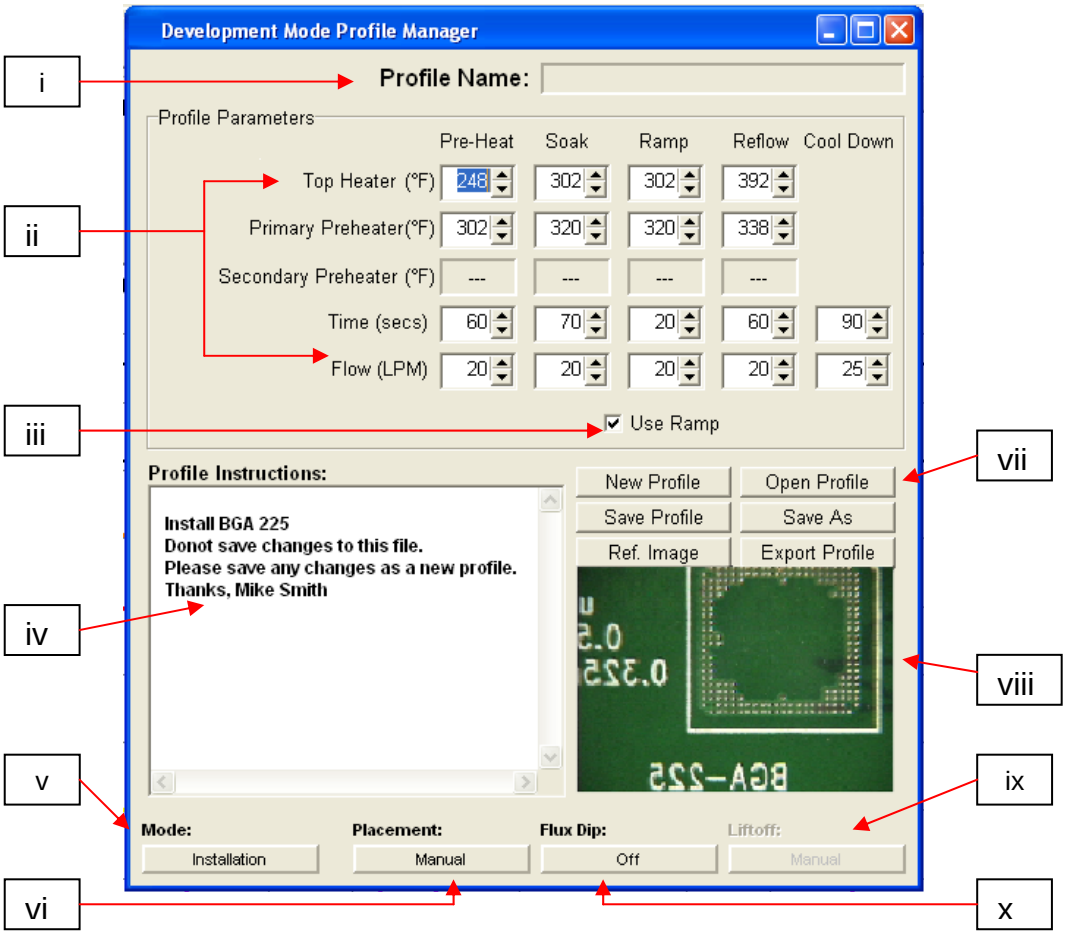


i. Profile Name. Indicates currently selected profile.
ii. Profile Parameters. Change each zone temperature and time settings
iii. Use Ramp. Enables or disables ramp phase.
iv. Profile Instructions. Allows operator to make notations and instructions.
v. Mode. Choose Installation or removal mode by clicking.
vi. Placement. Choose manual or automatic while in installation mode by clicking.
vii. Profile Management. Create, save, or recall profiles.
viii. View selected reference images.
ix. Liftoff. Select from Auto or Manual in removal mode by clicking.
x. Flux Dip. Enable or disable flux dip operation by clicking.

NOTE

The TF 1700 airflow control is manual using the flow meter mounted on the front housing. The TF 2700 airflow control feature is operated using the PC software.

Profile Development Screen Features TF 2700 (Figure 7e)

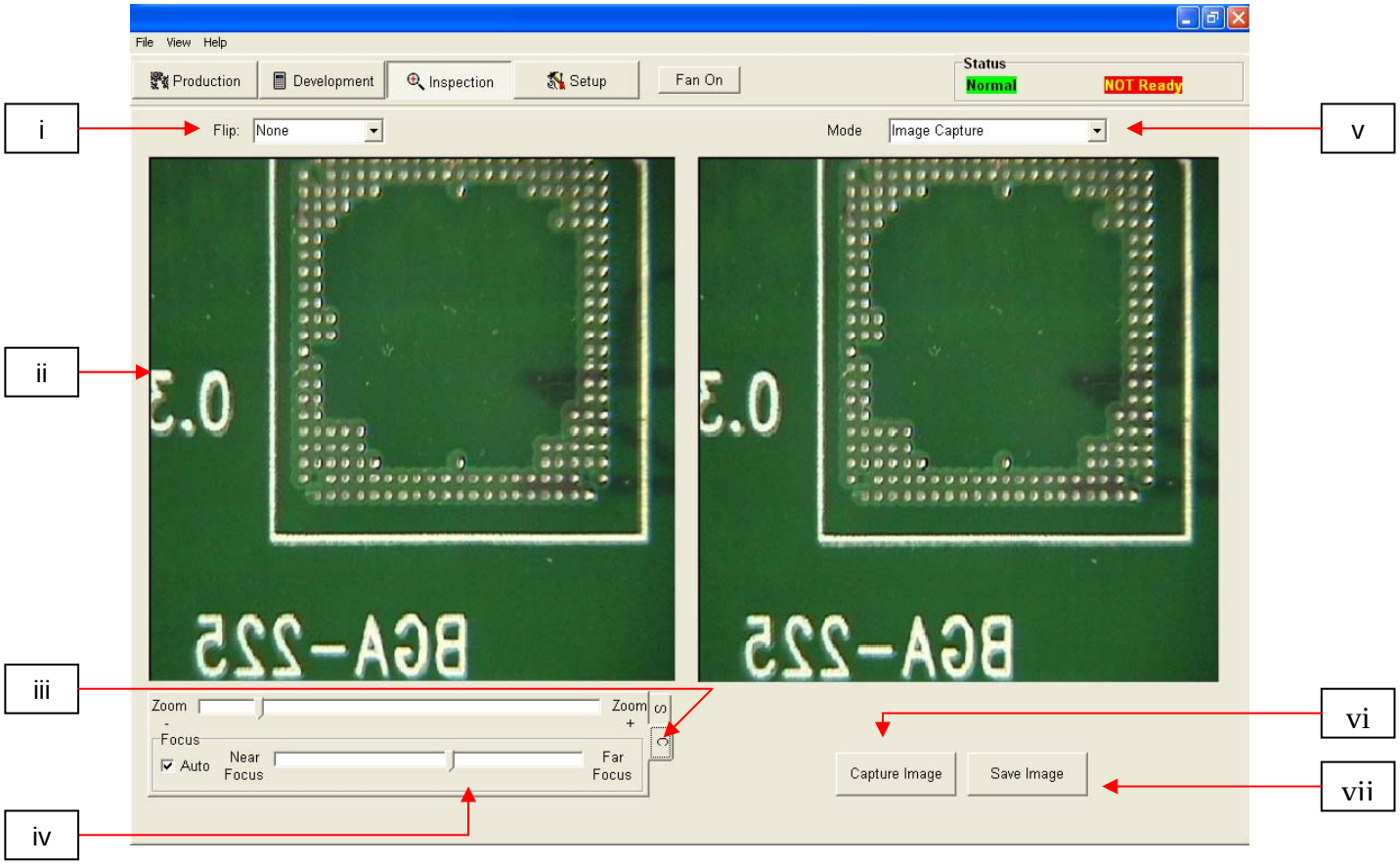


i. Profile Name. Indicates currently selected profile.
ii. Profile Parameters. Change each zone temperature and time settings
iii. Use Ramp. Enables or disables ramp phase.
iv. Profile Instructions. Allows operator to make notations and instructions.
v. Mode. Choose Installation or removal mode by clicking.
vi. Placement. Choose manual or automatic while in installation mode by clicking.
vii. Profile Management. Create, save, or recall profiles.
viii. View selected reference images.
ix. Liftoff. Select from Auto or Manual in removal mode by clicking.
x. Flux Dip. Enable or disable flux dip operation by clicking.

NOTE

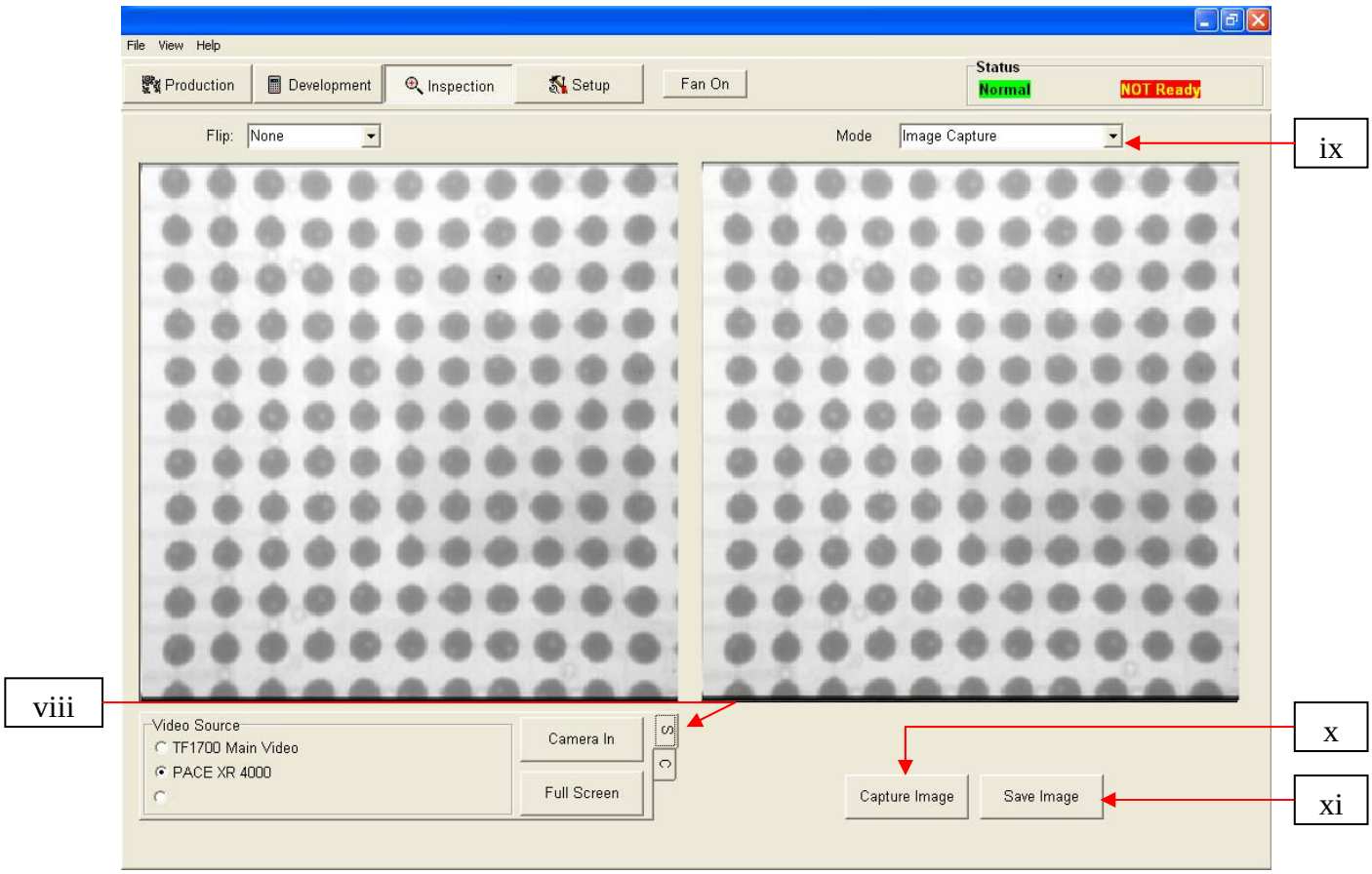
The TF 2700 airflow control feature is operated using the PC software. The TF 1700 airflow control is manual using the flow meter mounted on the front housing.

e. Inspection Screen Features



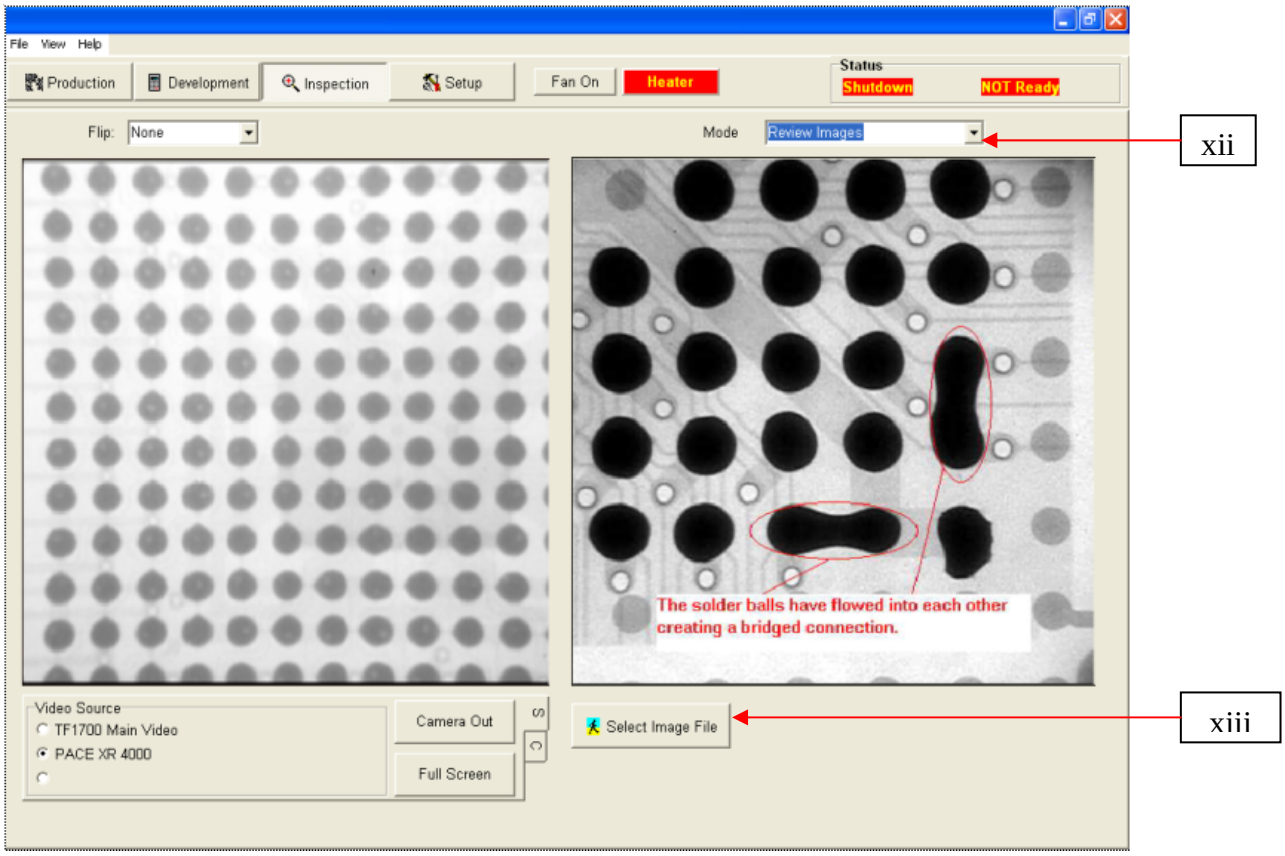
Inspection Screen (Figure 8a)

i. Flip feature. Rotate or flip inspection image.
ii. Inspection Image. The inspection image selected is viewed here.
iii. (S) tab allows you to select video input source. (C) tab gives you access to TF1700 camera control when selected input source.
iv. Focus. Select Auto or Manual Focus.
v. Mode. Allows operator to review library images (Fig 8a), capture images (Fig 8b), review saved images (Fig 8c), and create report (Fig 8d).
vi. Takes a snapshot of the current camera image.
vii. Save Image. Saves captured image to TIFF file format.



Capture Mode Figure 8b

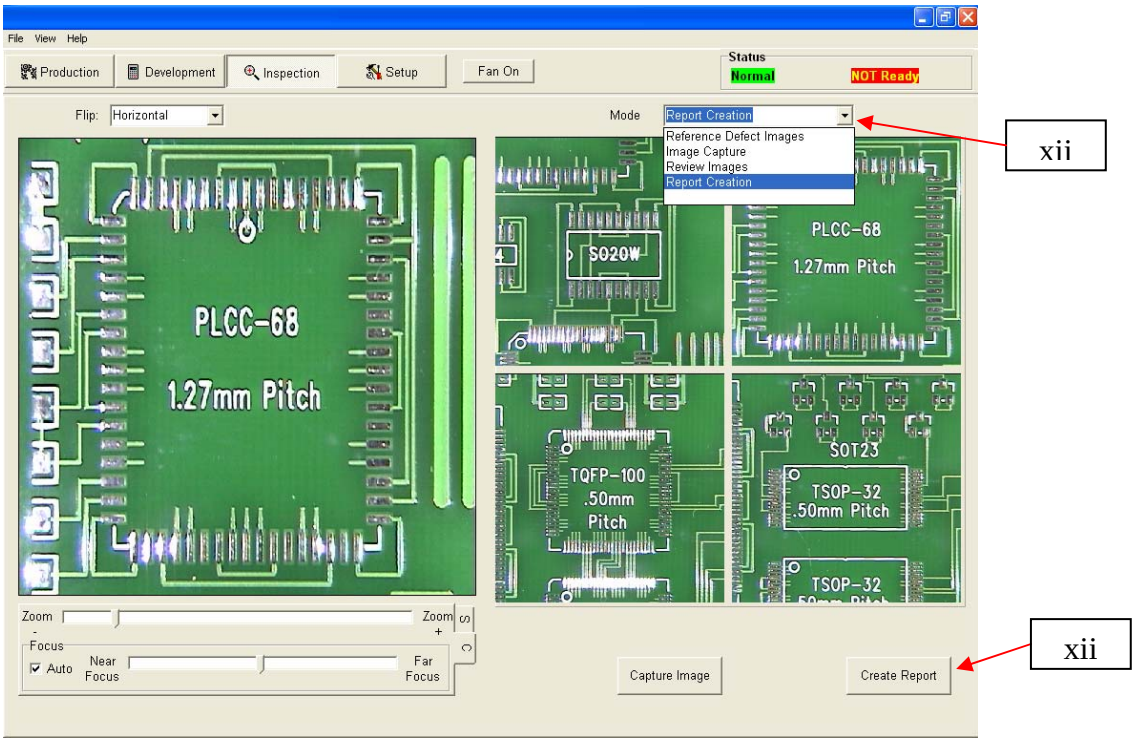
viii. Video Source. Select whether the image is from the BGA workstation (C) camera or (S) alternate source.
ix. Mode. Allows operator to review library images (Fig 8a), capture images (Fig 8b), review saved images (Fig 8c), and create report (Fig 8d).
x. Save Image. Save image in TIFF format Capture Image.
xi. Takes a snapshot of the current camera image.



Review Saved Images Mode Figure 8c

xii. Mode. Allows operator to review library images (Fig 8a), capture images (Fig 8b), review saved images (Fig 8c), and create report (Fig 8d).

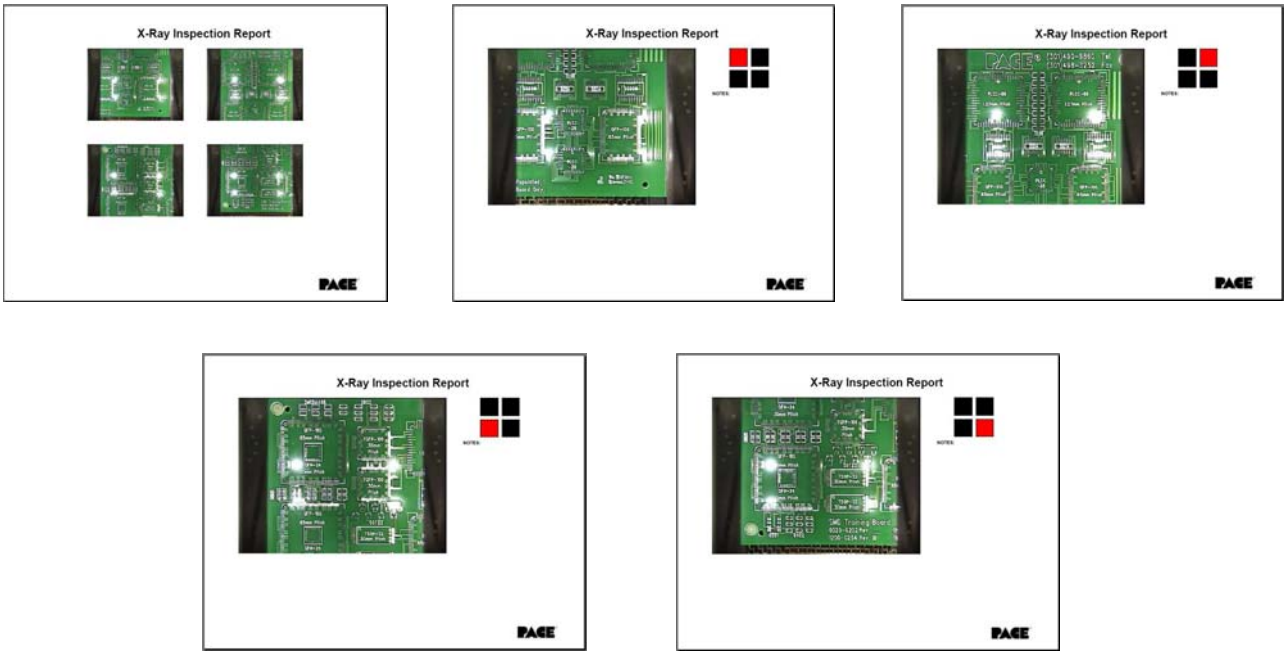
xiii. Select Image File. Opens folder containing image library.



Create Report Mode Figure 8d

xiv. Mode Menu. Drop down menu revealing capture and image viewing options.

xv. Create Report. Captured images are imbedded in a five-page Adobe PDF document. Page 1 shows four captured images. Remaining pages show individual images indicated by the red box on the right-hand side of the page. (See Fig. 8e)



Create Report Mode Figure 8e

g. 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 9)

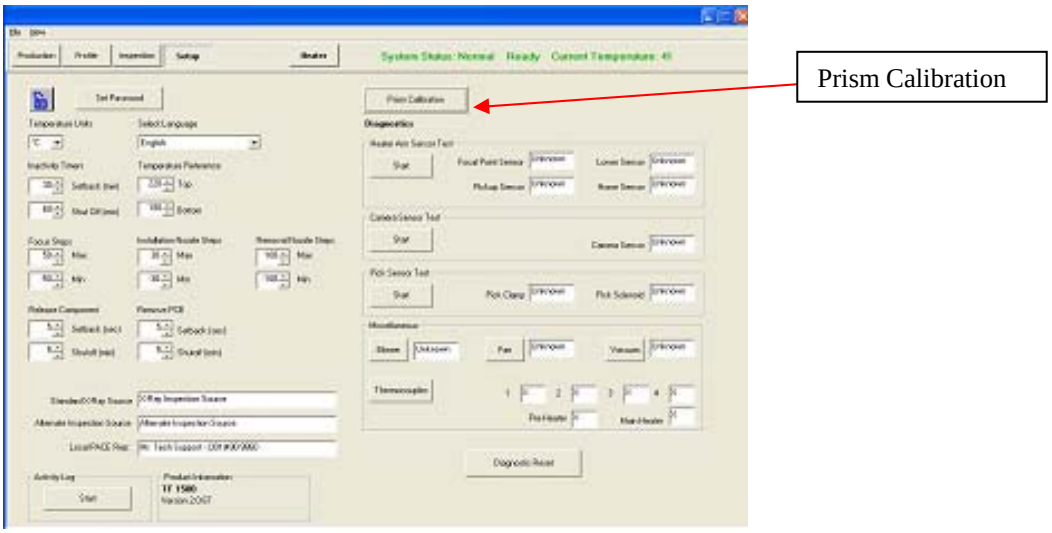


Figure 9

ii. Select prism calibration.
iii. Monitor now shows calibration screen. (Figure 10)

Figure 10

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)

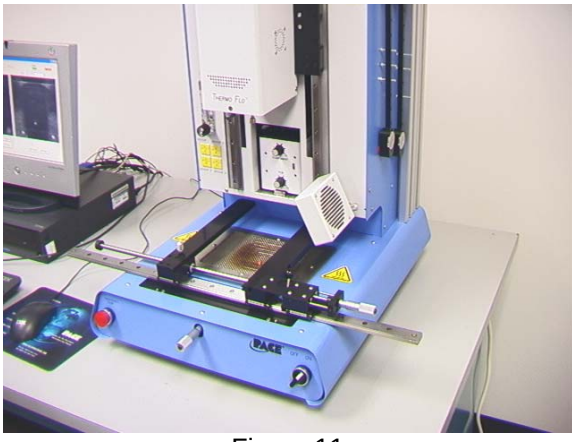


Figure 11

vi. Mouse click on green button, “Pickup.”
vii. Mouse click “OK” when message prompt (Please load PCB into board holder) appears.

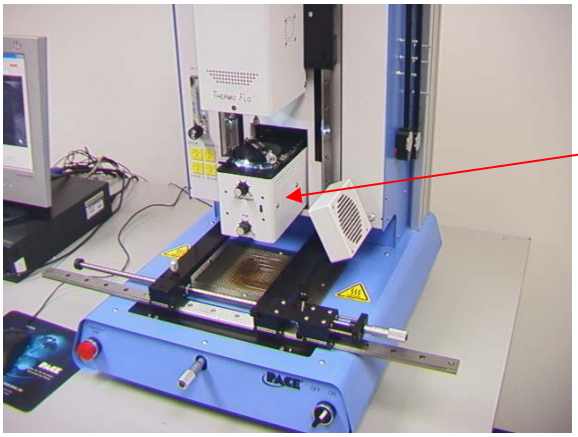


Figure 11

viii. Mouse click on green button, “Focus button.”
ix. Align image of board with image of component and click the “place” button.
x. Adjust focus and zoom with up and down arrows on keyboard or by moving slide on screen.
xi. Image in the window should be aligned like figure 12.

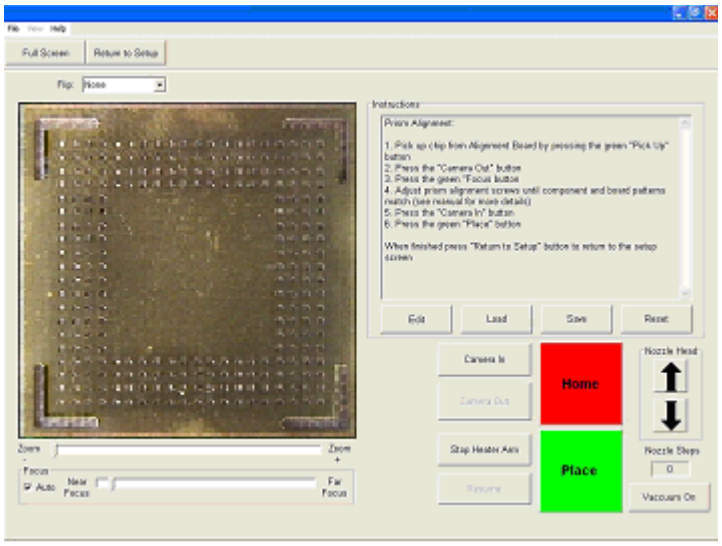


Figure 12

xii. If solder ball on part do not line up with holes on test PCB, adjust prism until it is.

1. Loosen the setscrews from the light adjustment knobs (Figure 14)
2. Remove the knobs
3. Remove the four screws (2 on each side) from the cameras' sheet metal cover (Figure 14)
4. Remove the cover
5. Loosening the top screws (A) and tightening the bottom screws (B) adjusts the prism down. Figure 15
6. Loosening the bottom screws (B) and tightening the top screws (A) adjusts the prism up.
7. Loosening the right center screw (C) allows you to rotate the prism around the y-axis.
8. When aligned, replace the cover
9. Replace the four screws
10. Replace the knobs
11. Adjust the light adjustment knobs and tighten the setscrews

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

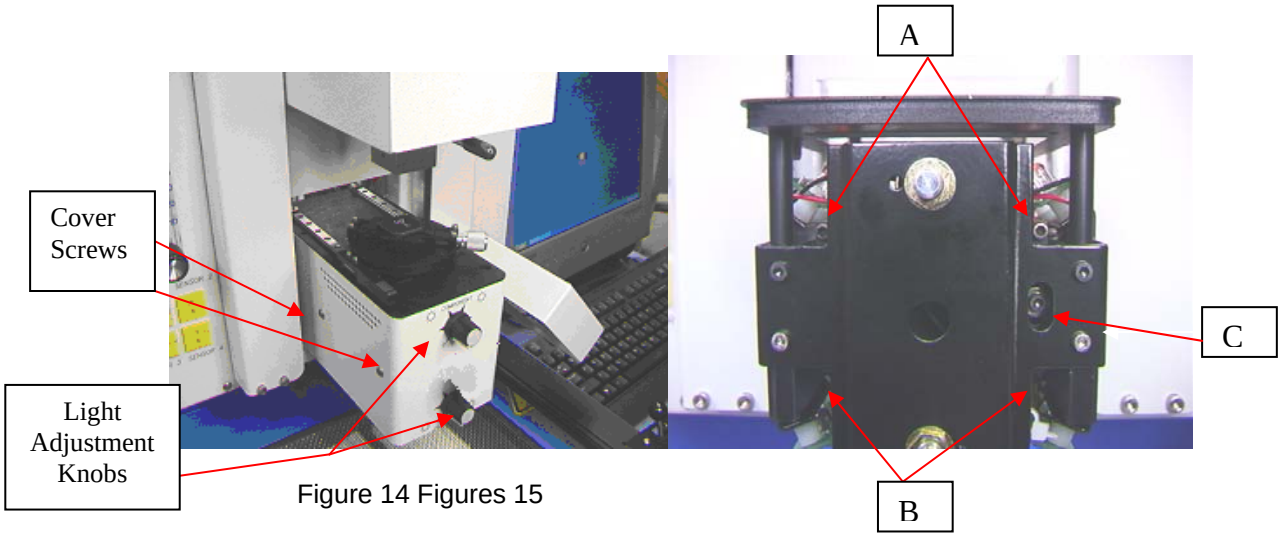


Figure 14 Figures 15

6. Operation

Note: It is recommended that the TF 1700 and TF 2700 be turned on for at least 10 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 also advisable to conduct a trial operation each day to warm the top heater and ensure all systems are operating properly. 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. Install the proper vacuum pick. (Para. 5d)
iv. Install the proper nozzle. (Para. 5e)
v. Place the PCB between the arms on the TF 1700 and tighten the retention screw. (Figure 16)

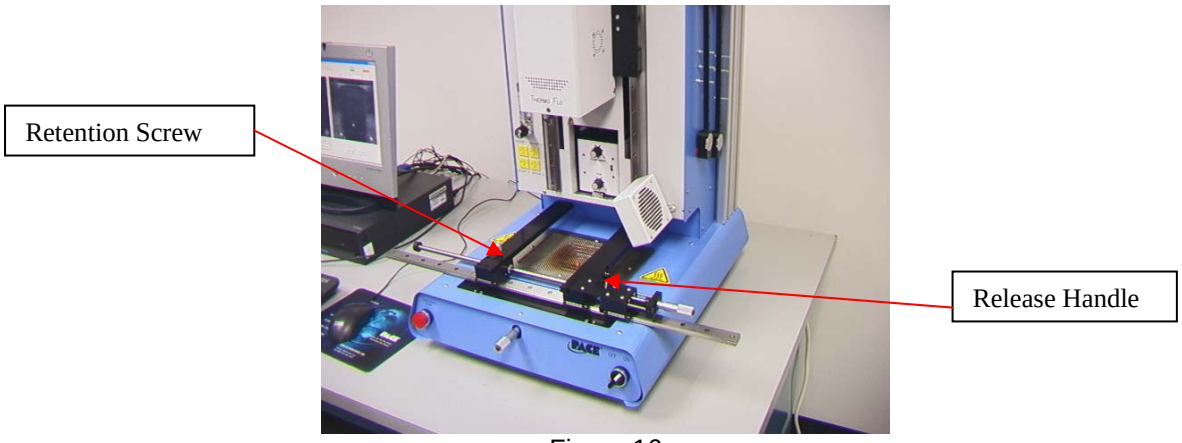


Figure 16

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. Mouse click on the green button to extend camera.

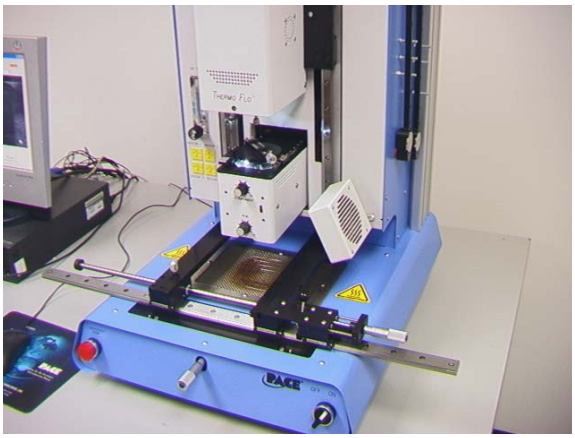


Figure 17

viii. Place the component in the mounting plate on top of the camera housing. (Figure 18) The component needs to be oriented the same as the nozzle.

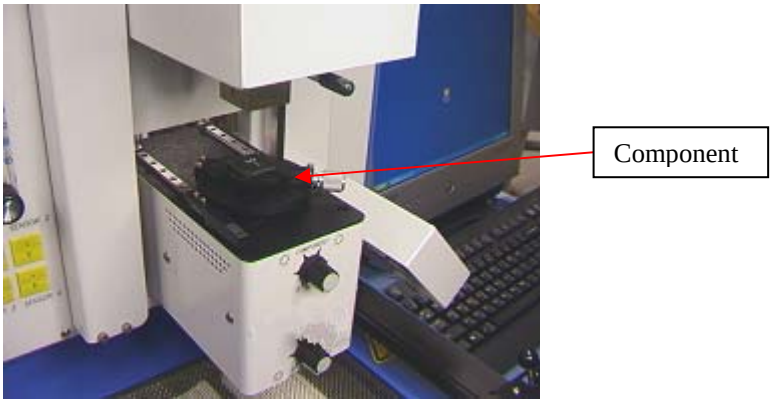


Figure 18

ix. Mouse click on the green button. The BGA workstation will pick up component.
x. Slide component mount away from the top of the camera housing.
xi. If Flux Dip option was selected, place the flux dip assembly on top of the camera housing. (Figure 19) Mouse click to dip, then remove flux dip assembly.
xii. Mouse click on the green button to pick component from holder.
xiii. Slide component nest / flux tray support back out of the way so optics are unobstructed.
xiv. Mouse click on the green button again to switch to the alignment screen and lower component to focus point. (Figure 5)

WARNING: TF 1700 USERS ONLY
When using the optional 65mm x 65mm component nest, (P/N 6000-0285) Nest must be removed from camera housing before camera is allowed to retract. **ALLOWING OPTIONAL NEST TO RETRACT WILL DAMAGE NEST AND POSSIBLY CAMERA HOUSING.**

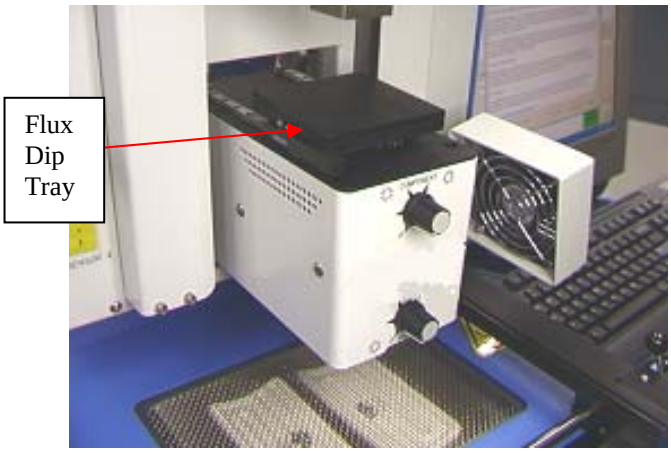


Figure 19

xv. Zoom in and align using the X, Y, and theta axis adjustments until the component is aligned. (Figures 5 & 20)

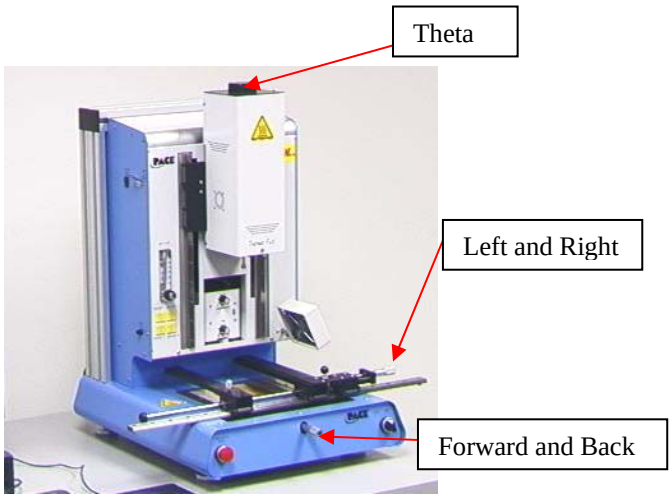


Figure 20

xvi. Mouse click on the green button, “Place” to lower the component. (Figure 21)

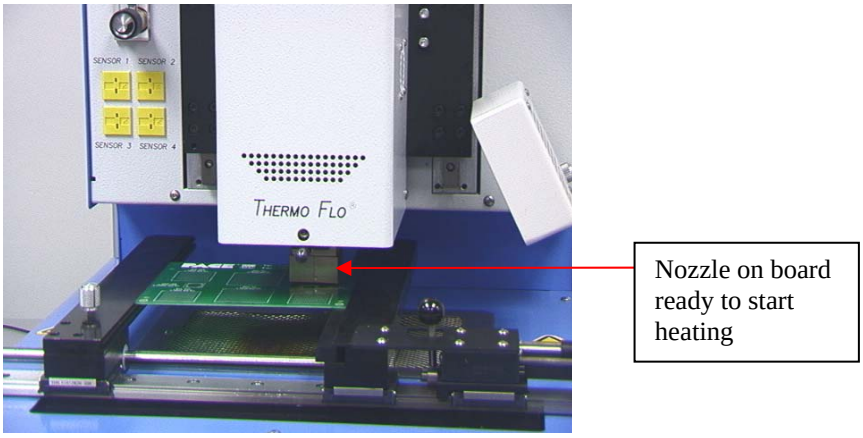


Figure 21

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. Mouse click on Production to switch to the production screen. (Figure 6)
ii. Select a removal profile from the “Load Profile” drop down box .
iii. Install the proper vacuum pick. (Para. 5d)
iv. Install the proper nozzle. (Para. 5e)
v. Place the PCB between the arms on the board holder and tighten the retention screw. (Figure 16) 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 22)

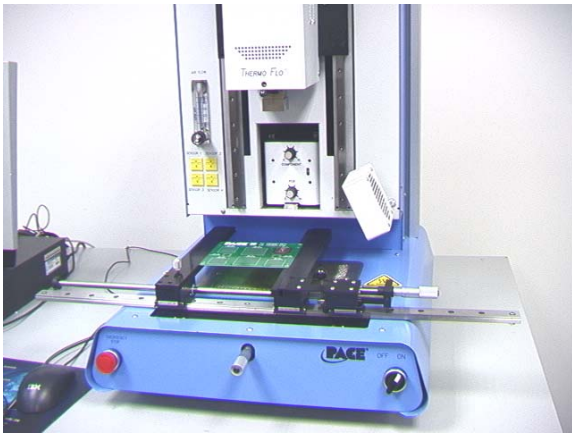


Figure 22

vi. Mouse click on Start button.
vii. Allow PCB and component to cool before removing.

c. Profile development installation procedure.

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 is plotted along the Y-axis. The time and temperature axes incorporate a dynamic scaling feature to optimize the display. 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. Colored lines are used to indicate profile parameters on the graph.

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 could 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. When sliding a thermocouple under a component, it is critical that the thermocouple be in contact with the solder. 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 Rates

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 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" profile 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.

Ramp Phase

The ramp phase is variation to the soak phase. When using lead free solders, it is sometimes desirable to add a second "step" to the process as to not thermally shock the PCB or component while trying to reach the solder melt temps for lead free solders. If this is not desired, simply uncheck the "Use Ramp" check box on the profile manager on the profile development page of the PC software.

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 230 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 heater set 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 1700 and TF 2700 will remain on for a minimum of 50 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. Mouse click on Profile for the Profile Development Screen. (Figure 7)
ii. Conduct steps vi thru v in paragraph 6a.
iii. 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.
iv. Mouse click the cycle start button. Make adjustments as necessary.
v. If you're finished, allow the PCB to cool and remove.

d. Profile Development Removal Procedure
   i. Click on Development button.
   ii. Install Vacuum tip and nozzle.
   iii. Open file manager and set profile parameters.
   iv. Save profile and close profile manager.
   v. Click on start removal process button.
   vi. Load PCB and align component with red laser light roughly in the center of the component.
   vii. Click on "OK" to Load PCB into board holder message.
   viii. Use the X, Y, and Theta adjustments to center the target componet in the camera screen.
   ix. Click on the alignment complete button.
   x. Click on the Lower Reflow Arm button.
   xi. Adjust the nozzle height using the up and down Nozzle Head arrows.
   xii. Click Start Heating button to begin profile.
   xiii. Adjust as necessary.

Note – It is always good practice to run a new profile a second time without making any changes to verify your results

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.

8. Available Nozzles/Accessories/Optional Items

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

9. Maintenance

Caution: Disconnect the main power supply and computer cables before opening the BGA workstation 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 1700 or TF 2700. (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.

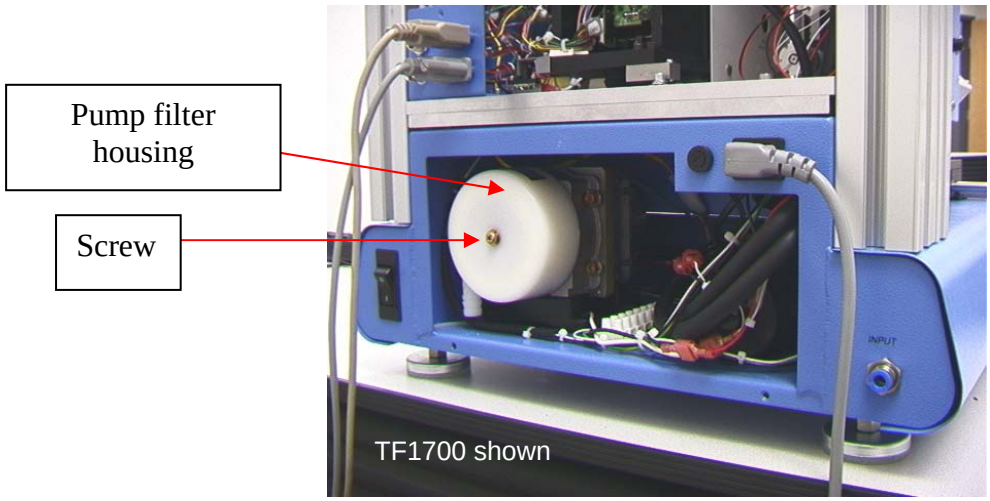


Figure 23a

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.

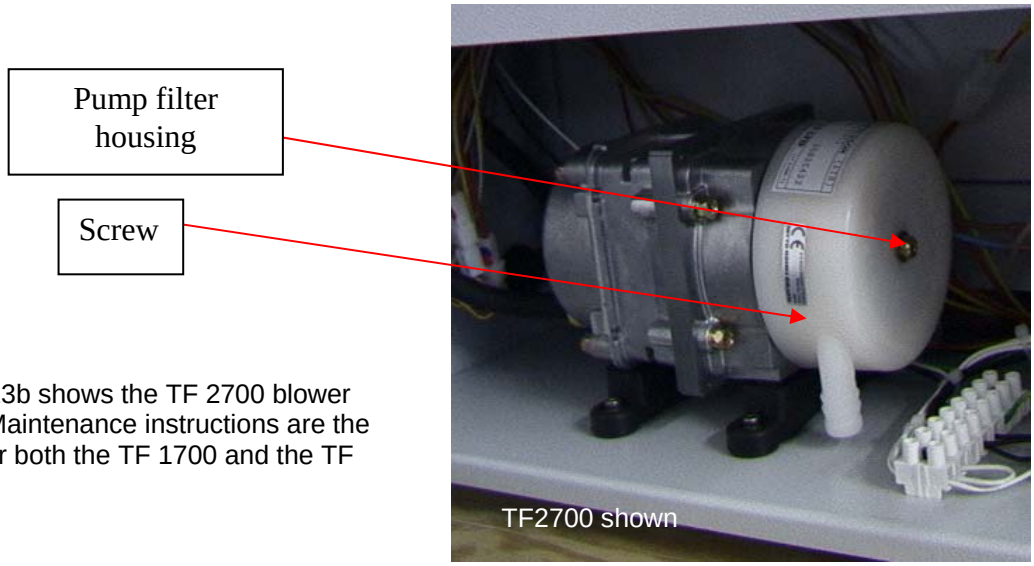


Figure 23b shows the TF 2700 blower pump. Maintenance instructions are the same for both the TF 1700 and the TF 2700.

Figure 23b

Maintenance beyond this should only be completed by a qualified PACE service technician.

10. 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.

Removal Procedure

1. Remove the nozzle and vacuum pick.
2. Remove the 4 hex socket head screws[illegible]es of heater.

Figure 22

3. Once the rail covers are removed, reinstall one of t[illegible] hex head screws in the rails to avoid the accidental removal of the reflow head assembly from the rails. This will avoid the loss of the ball bearings. This may also be achieved by installing the metal retainers on the tops of the rails.

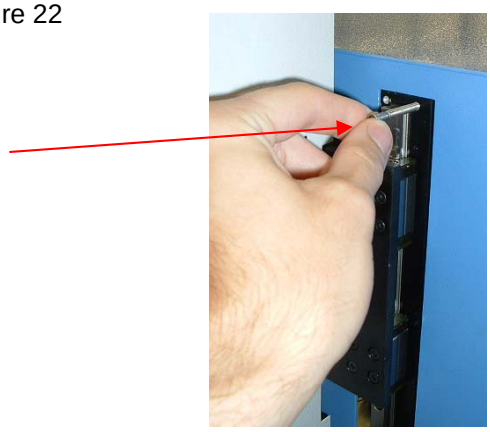
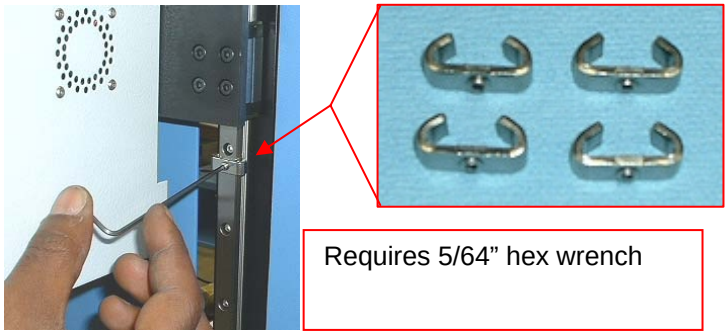


Figure 23

4. Slide the metal retainers up the lower rail assemblies after the removal of the rail covers on the reflow head assembly. Be sure that the metal retainers are installed on the rails.

Important Note:

Failure to perform this operation may result in loss of the ball bearings that are contained within the rails.



Requires 5/64" hex wrench

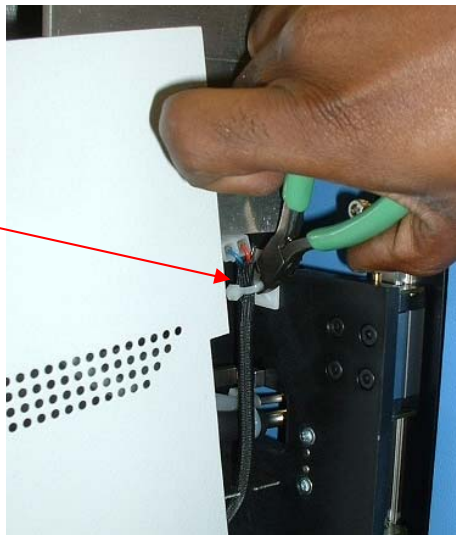
Figure 24

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

Requires 3/32" hex wrench

Figure 25

6. In order to remove the heater cover, the fan wire and ty-wrap will need to be disconnected. First, cut the ties as shown here. There is 1 on each side.



7. Now you can disconnect the cooling fan cables, 1 on each side. Once these two cables have been disconnected you can remove the cover.

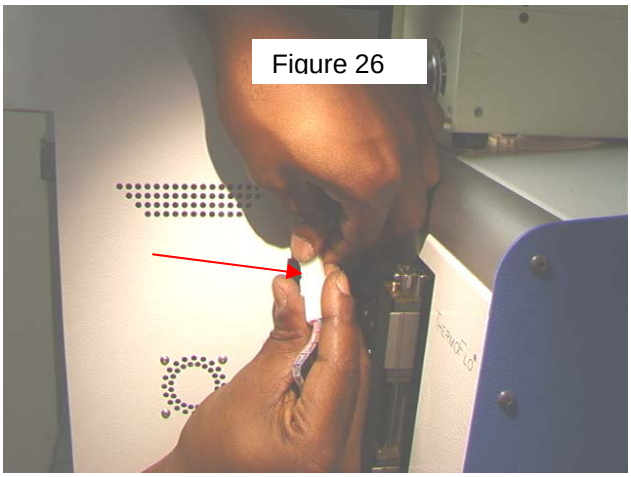


Figure 27

8. Disconnect the main heater wiring on the left side of the heater assembly.

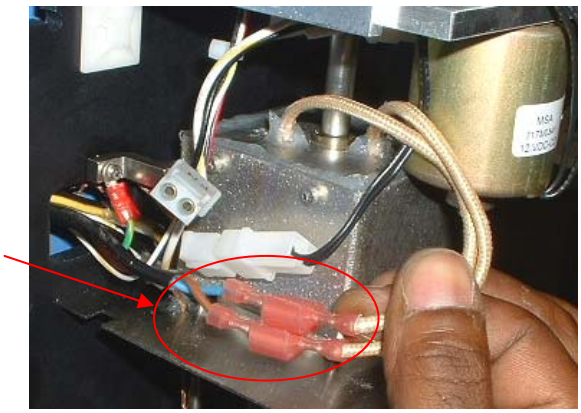


Figure 28

9. Disconnect the pick solenoid wiring on the left side of the heater assembly.

Celsius

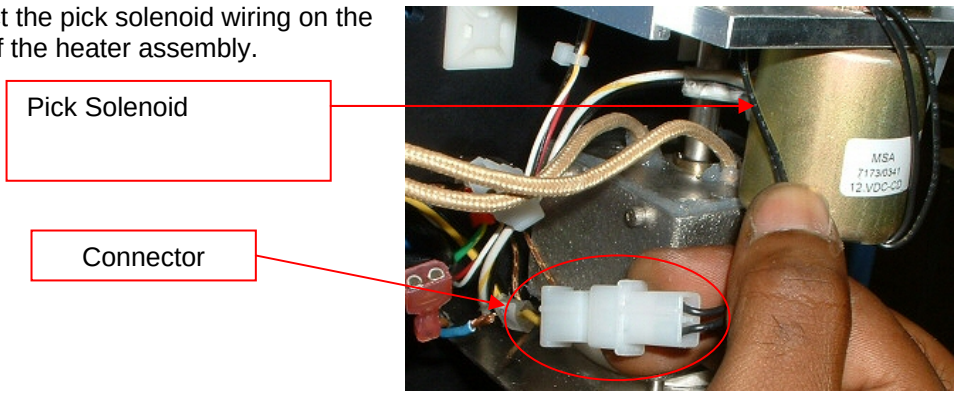
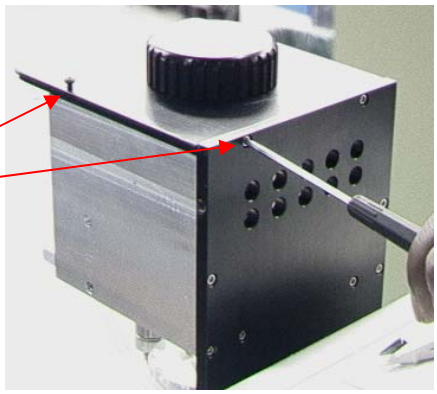


Figure 29

10. Remove the four pick solenoid sensor cover screws.

Requires 3/32” hex wrench



11. Remove the pick solenoid sensor.

Requires 3/32” hex wrench

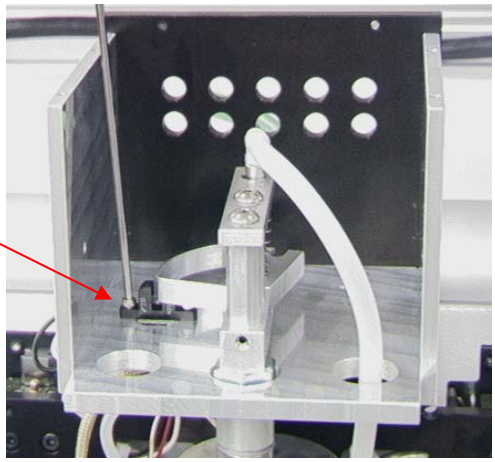


Figure 30

12. Remove the ground wire that is located on the left side of the heater assembly.

Requires 3/32” hex wrench

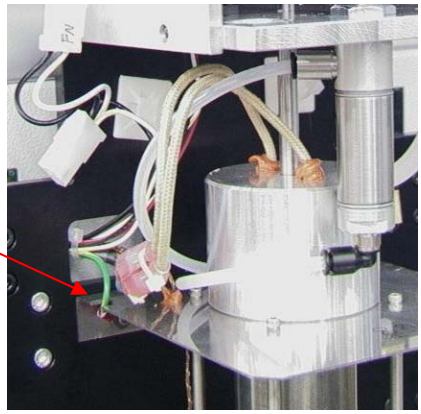


Figure 31

13. Disconnect the hose on the top of the heater assembly.

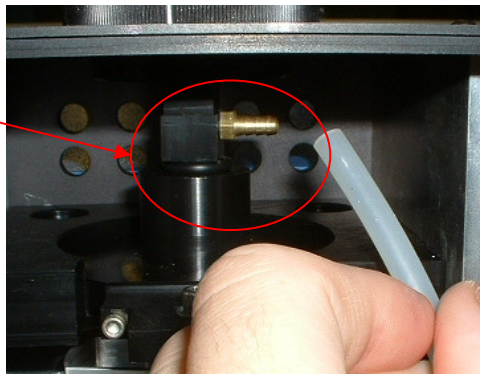


Figure 33

14. Disconnect the hose on the right of the heater assembly.

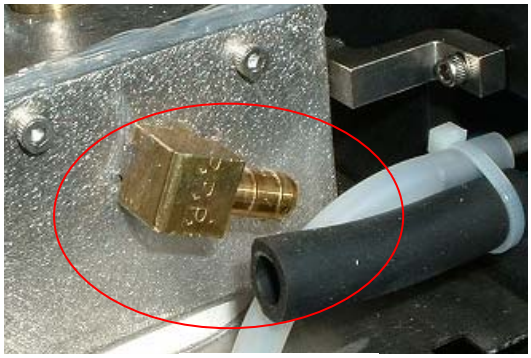


Figure 34

15. Open the rear door (requires 4mm hex wrench) and disconnect the sensor flag as shown. The indicated ty-wrap must be cut.

Cut ty-wrap

Requires 3/32" hex wrench

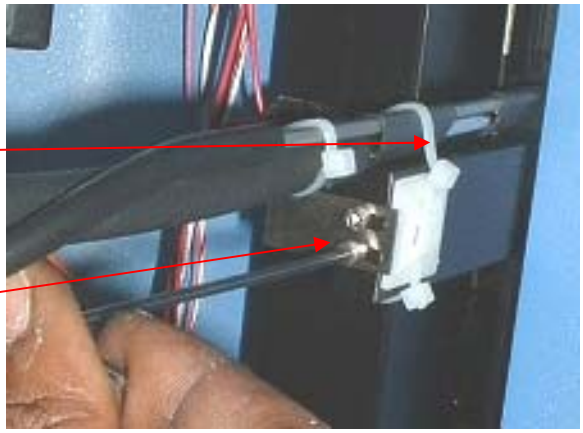


Figure 35

16. Locate the wire harness that is located in the back of the unit. Unwind the protective wire spiral covering to gain access to the wire connectors. Find the 2 sensor wires (i.e., brown with yellow stripe); they have dots on them. Cut the ties and disconnect them, DO NOT CUT THE WIRES. Pull these 2 wires through to the front. Identify and mark the wires so they are not reversed during reassembly.

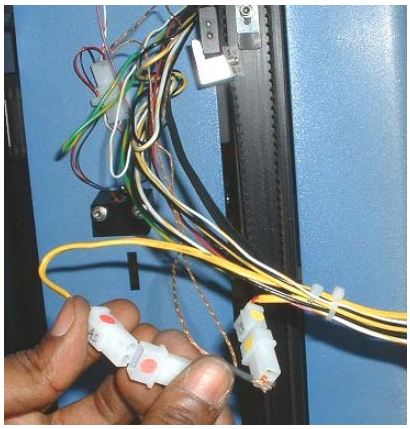


Figure 36

17. From the back, pull the remaining disconnected wires through the heater mounting plate.

Figure 37

18. Remove the 16 hex socket head screws holding the heater assembly to the rails. Be sure to hold the assembly or it will fall when the last screw is removed.

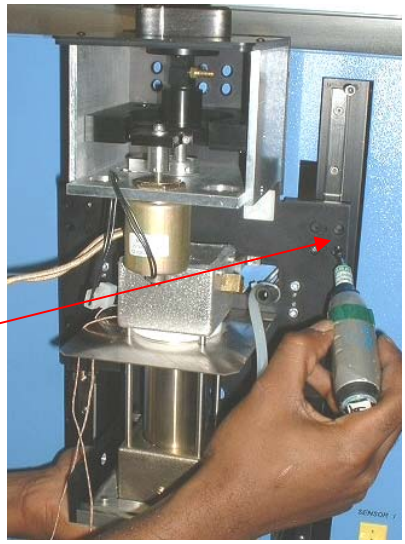


Figure 38

19. Carefully remove the heater assembly from the rails. Guide the vacuum line and tubing through the mounting plate.

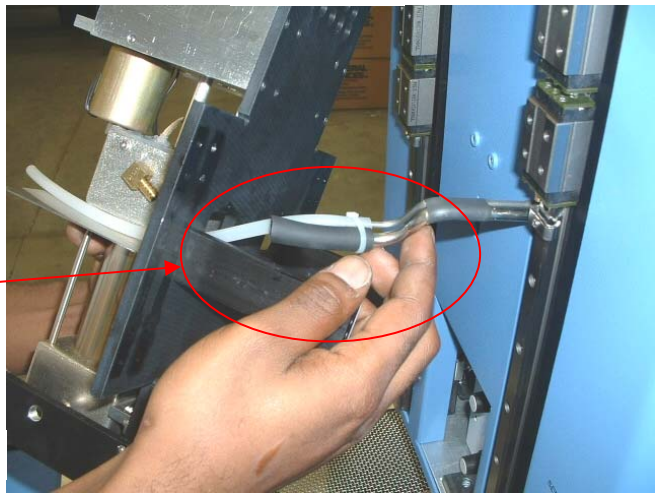


Figure 39

Installation

1. Carefully install the new heater assembly on the rails. Guide the vacuum line and tubing through the mounting plate. Make sure that the hoses are not pinched. Refer to figure 39.

2. Make sure that the belt bracket rests on the lift bracket before installing the mounting screws.

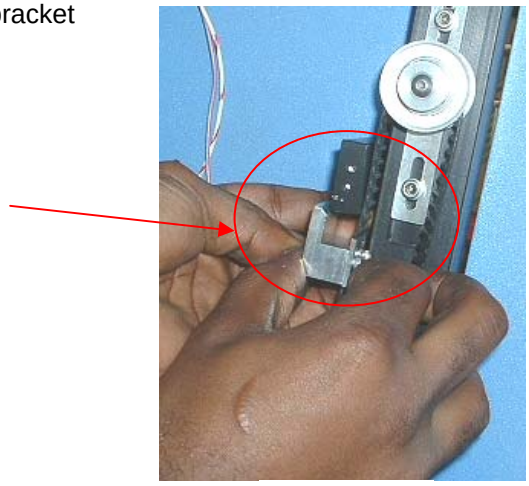


Figure 40

3. Install the 16 hex socket head screws holding the heater assembly to the rails. Continue holding the heater assembly until several of the screws are installed. Do not completely tighten any of the screws until all screws have been installed.

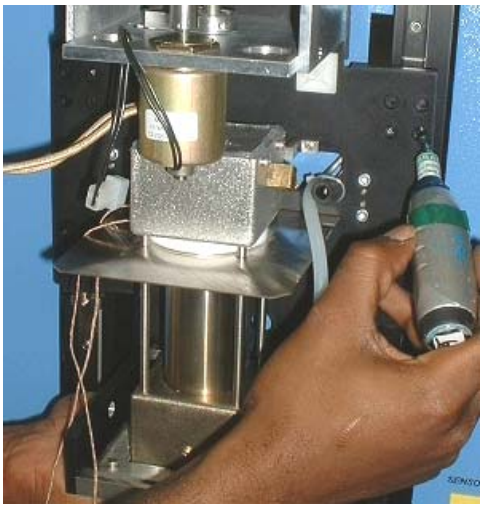


Figure 41

4. Pull the disconnected wires back through the heater mounting plate.

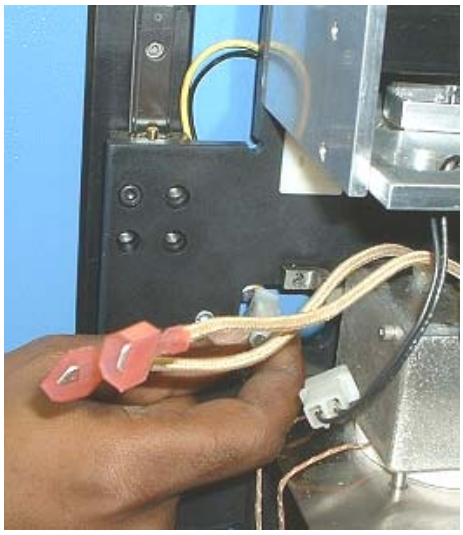


Figure 42

5. Run the sensor wires through front panel the way they came out, reconnect and tie. Make sure they are connected to the appropriate one. Rewind the protective wire spiral covering over the wires.

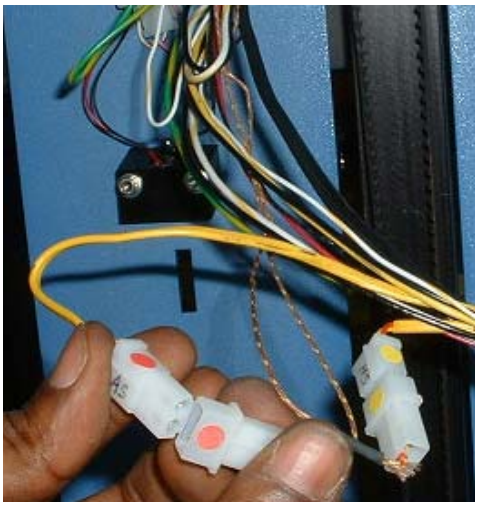


Figure 43

6. Reconnect the vacuum line support bracket. Install a new ty-wrap.

Figure 44

7. Reconnect the hose on the right of the heater assembly.

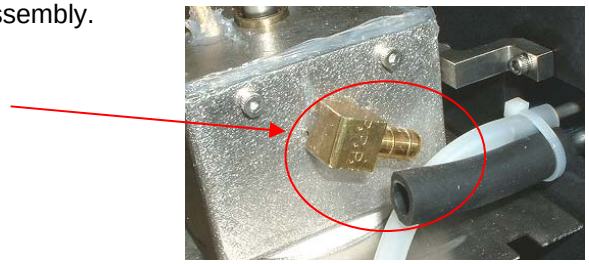


Figure 45

8. Reconnect the hose on the top of the heater assembly.

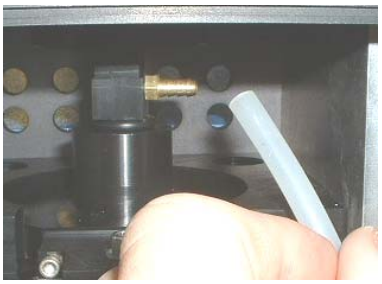


Figure 46

9. Reinstall the ground wire that is located on the left side of the heater assembly.

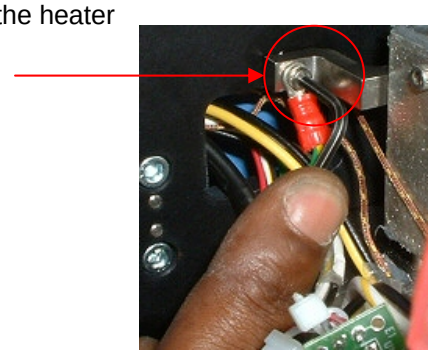
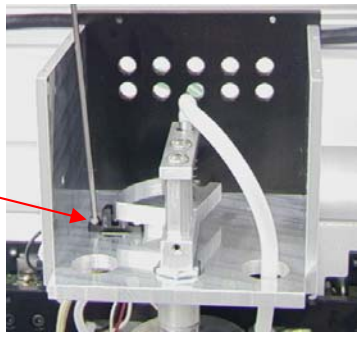
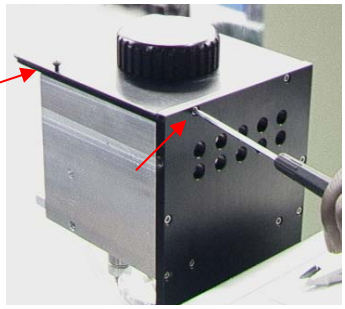


Figure 47

10. Reinstall the pick solenoid sensor.



11. Install the solenoid pick sensor cover and four screws.



12. Reconnect the pick solenoid wiring on the left side of the heater assembly.

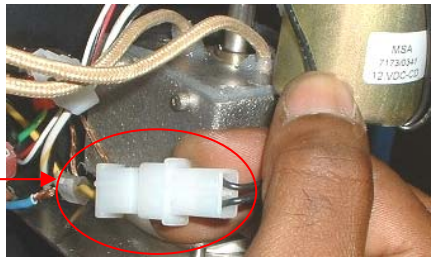


Figure 49

13. Reconnect the main heater wiring on the left side of the heater assembly. It does not matter which one is attached to which.

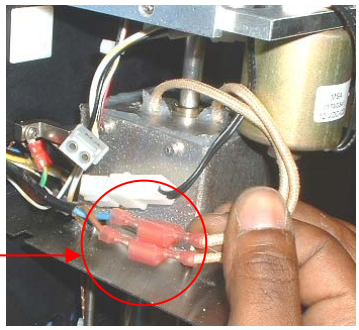


Figure 50

14. Bring the heater cover up near the heater assembly. 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.

Figure 51

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

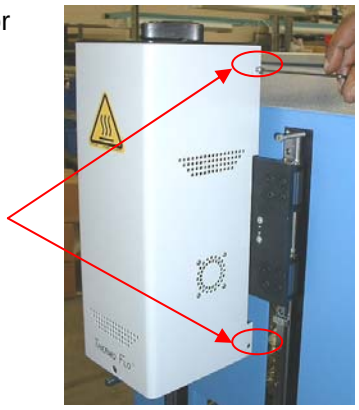


Figure 52

17. Remove the metal retainers from the lower rail assemblies.

Figure 53

18. Remove the installed hex head screw in the rails to avoid the accidental removal of the reflow head assembly.

Figure 54

19. Reinstall the 4 hex socket head screws on each rail cover on the left and right sides of the heater.

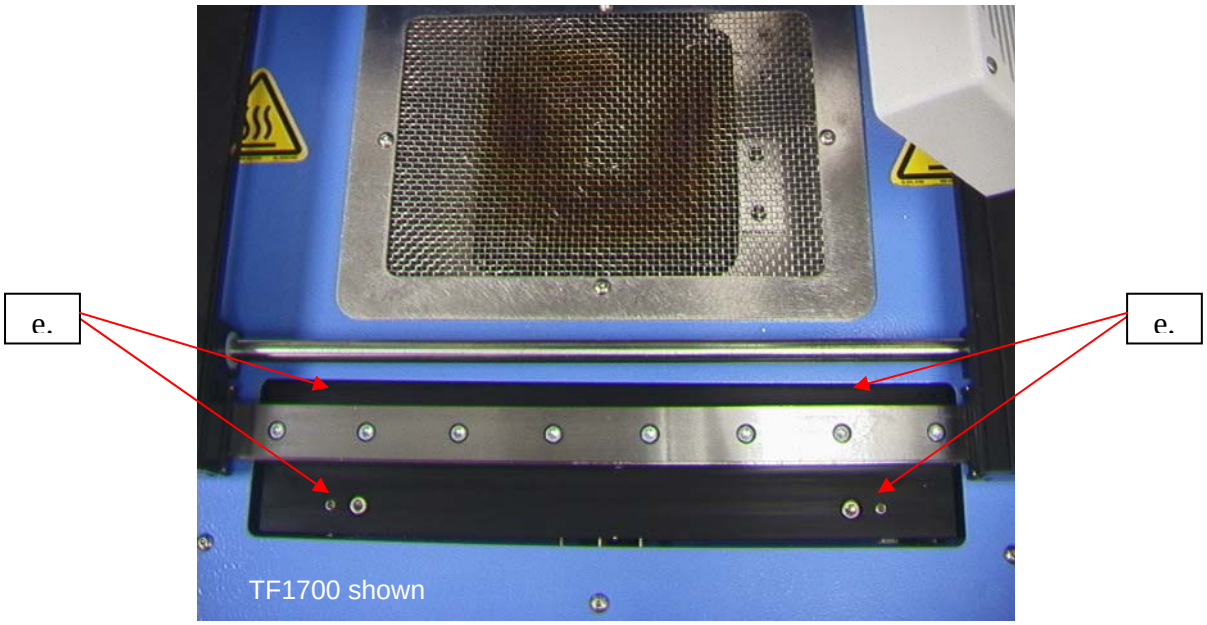
Figure 55

20. Reinstall the nozzle and vacuum pick.

21. Test the heater.

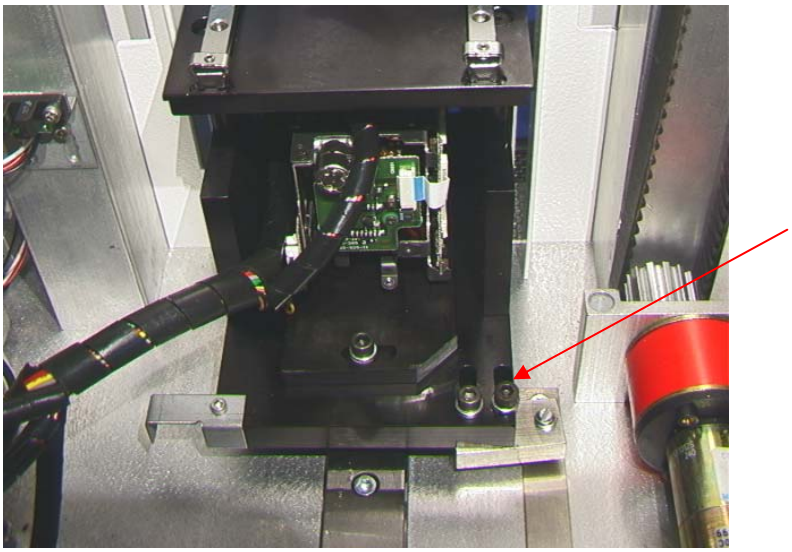
11. Adjustments and Alignments

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.

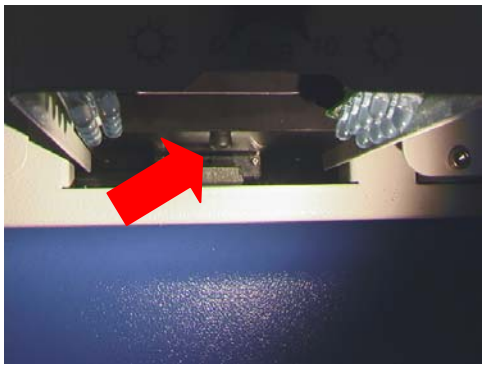


f. Adjust the smaller four screws to bring the platform and PCB level with the vacuum pick. Loosening a screw will raise that portion of the platform. Tightening a screw will lower that portion of the platform. To keep the screws tight for every bit you loosen a screw, tighten the opposite screw equally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

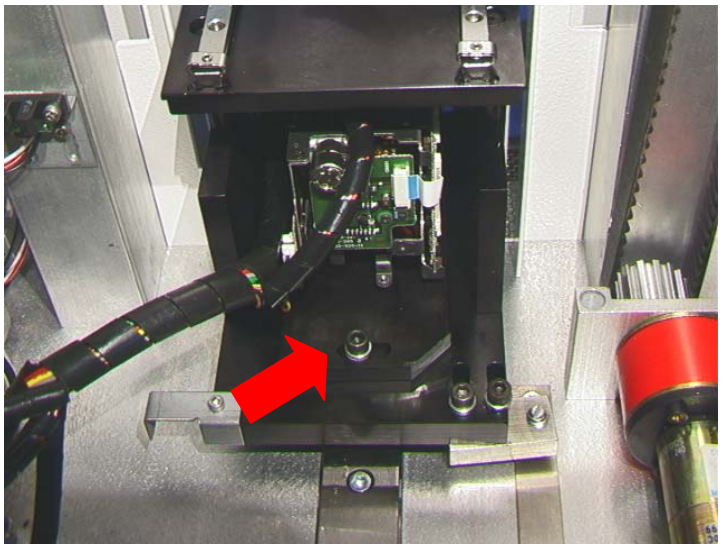
2. Camera alignment. The camera must be aligned to the nozzle on the heater head.
   a. Insert a nozzle in the heater head.
   b. On the Profile screen, adjust all the heaters to minimum temperatures.
   c. Go to the setup screen and click on calibration. Advance to the focus step and click on the green focus button.
   d. Loosen the nozzle retention screw and rotate the nozzle so its 4 sides are aligned with the edges of the viewing window.
   e. Zoom in on the image so it fills the viewing area.
   f. If the nozzle edges are too far back:
      i. Open the back of the BGA workstation.
      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.
   g. If the nozzle edges are off right to left:
      i. Open the back of the BGA workstation.
      WARNING: DO NOT TOUCH LIVE CIRCUITS!
      ii. In front, loosen the screw protruding under the camera housing.

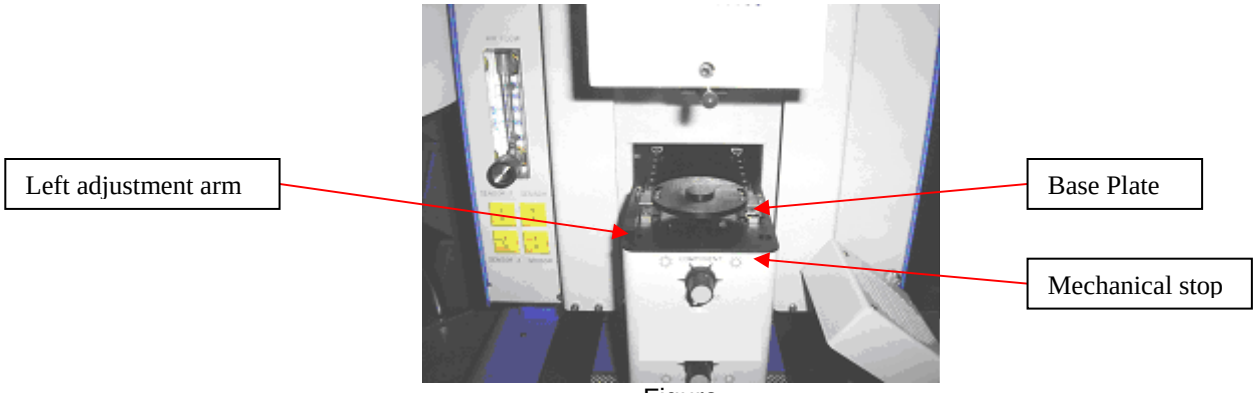


iii. In the back, loosen the screw in the center on the back of the camera housing.

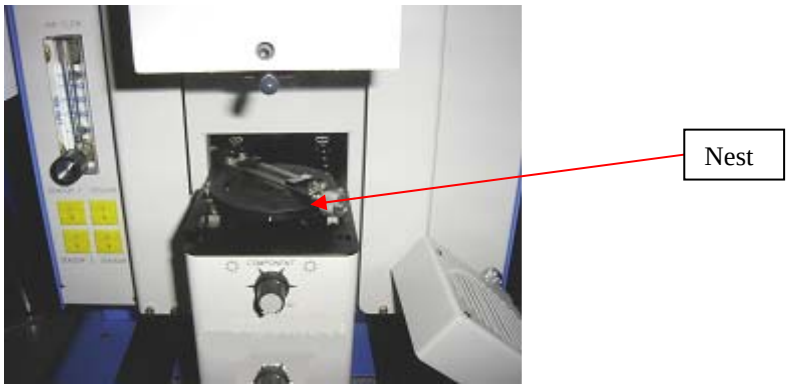


iv. Rotate the camera until the left and right sides of the nozzle are centered between the sides of the viewing area.
v. Tighten the screws.

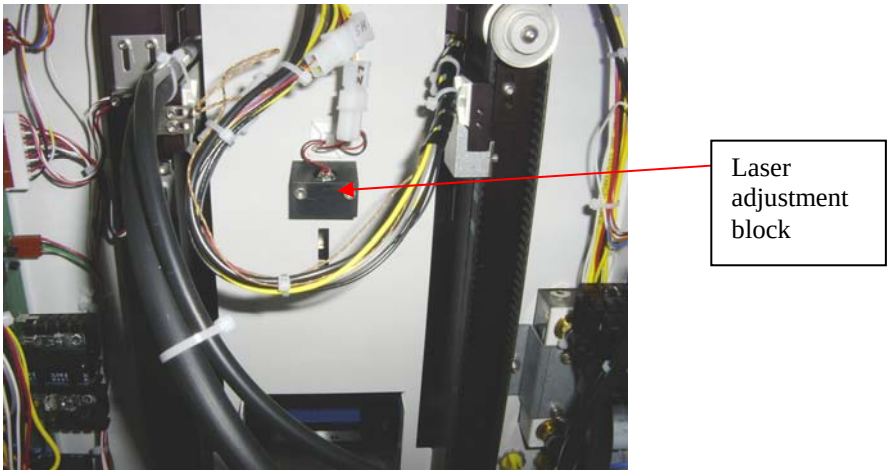
4. Component Nest Platform alignment. This adjustment is to align the nest to the nozzle.
   a. Loosen the 4 allens on the component nest base plate, the 2 allens on the left adjustment arm, and the one allen on the mechanical stop.
   b. Place the component nest platform on the camera housing.
   c. Adjust the component nest all the way open.
   d. Click on the pickup button. BE PREPARED TO CLICK ON THE STOP HEATER ARM BUTTON. You want to stop the nozzle above the nest.
   e. Now step the nozzle down using the arrows so the corners of the nozzle are just inside the corners of the nest where the component would normally be.
   f. Adjust the nest closed and adjust the nest position so the corners of the nest are contacting the corners of the nozzle, front and back.
   g. Tighten the allen screws on the base plate and on the left adjustment.
   h. Push the mechanical stop against the bearing sleeve and tight that allen.
   i. Click on home.



Figure



5. 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. Make sure the camera is aligned with the nozzle first. (Step 2)
   c. Open the back of the BGA workstation. **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.



12. 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.

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