



HAKKO FR-1418 BGA REWORK SYSTEM

Operation and Maintenance Manual

Rev 2004-06



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1.0 System Overview

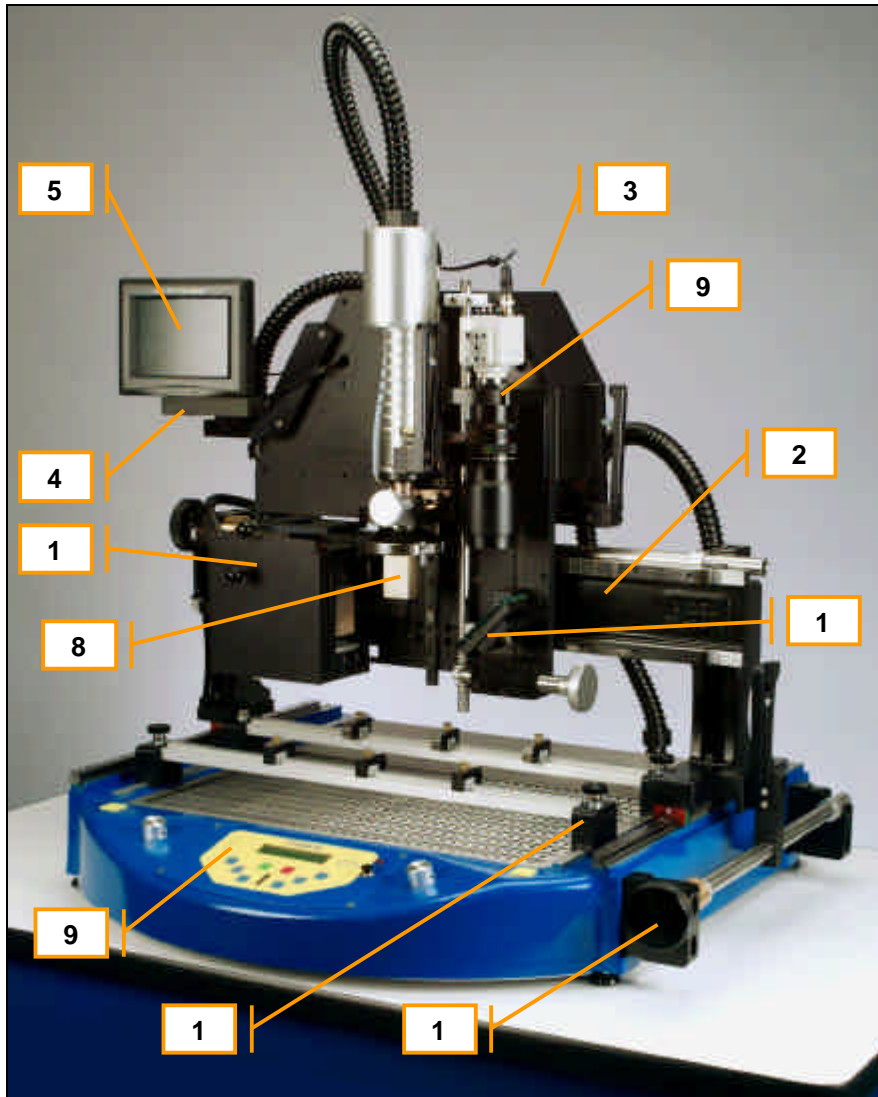


Figure 1: FR-1418

ITEM NO.	DESCRIPTION
1	BASE ASSY
2	BRIDGE ASSY
3	HEAD ASSY WITH REAR ENCLOSURE
4	LCD ADAPTER PLATE
5	LCD MONITOR
6	PC CPU (OPTIONAL)
7	PC MNTR, KBD, TRACKBALL (OPTIONAL)
8	NOZZLE SET STANDARD
9	CAMERA/ZOOM LENS ASSY
10	PCB (BOARD) FIXTURE
11	OPTICS TRAIN
12	MIRROR ASSEMBLY
13	FINE- ADJUST MECHANISM

The above picture and table is meant to familiarize the user with the terminology used to describe the major components of the FR-1418 BGA Rework Systems. The figures below describe the specific features and controls found on FR-1418 BGA Rework Systems. Not all features and controls will be found on all systems, as they vary according to the specific model and options purchased. The items described in the following figures will be referred to throughout the rest of this manual.

Front Panel:

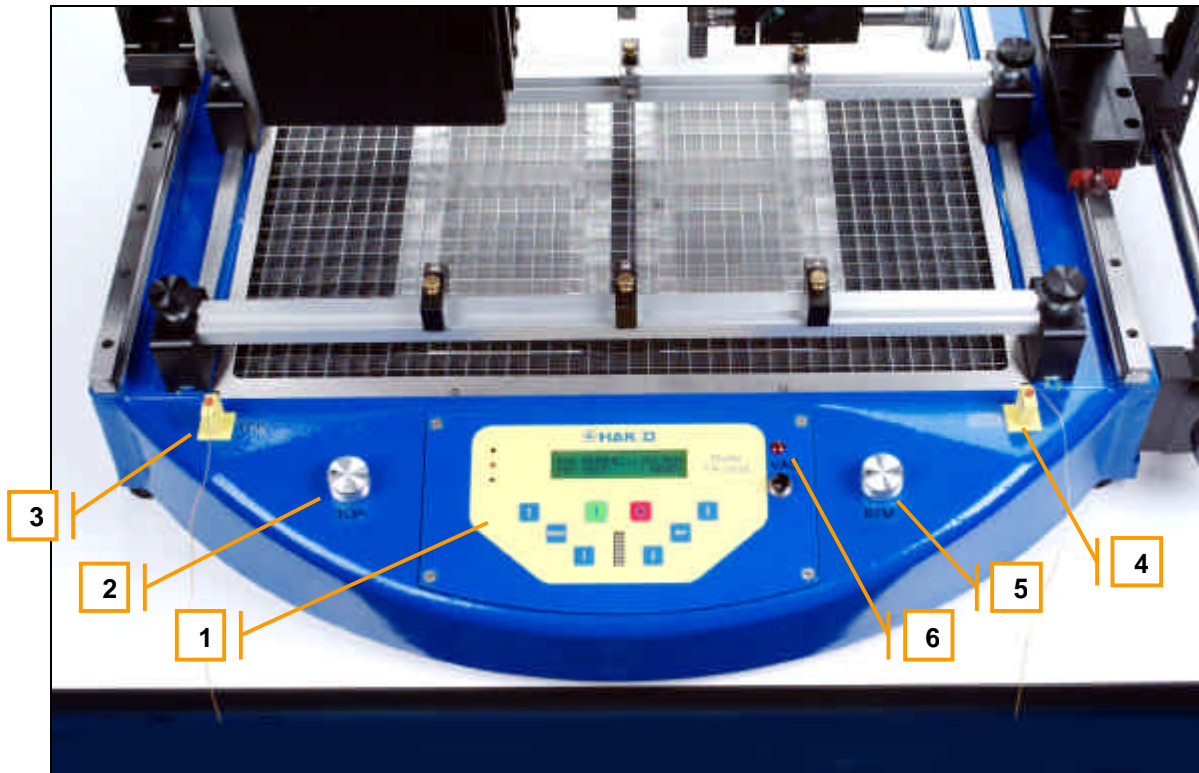


Figure 2: Front Panel Controls

Item	Description
1	HMI / Operator Keypad w/ LCD
2	Top (Part) Lighting Intensity Control
3	Teach Thermocouple Input (TCH or TC1)
4	Spare Thermocouple Input (TC2)
5	Bottom (Board) Lighting Intensity Control
6	Vacuum Switch and Indicator Lamp*

**Note: Some systems may have a footswitch or no switch when controlled by a Host PC.*

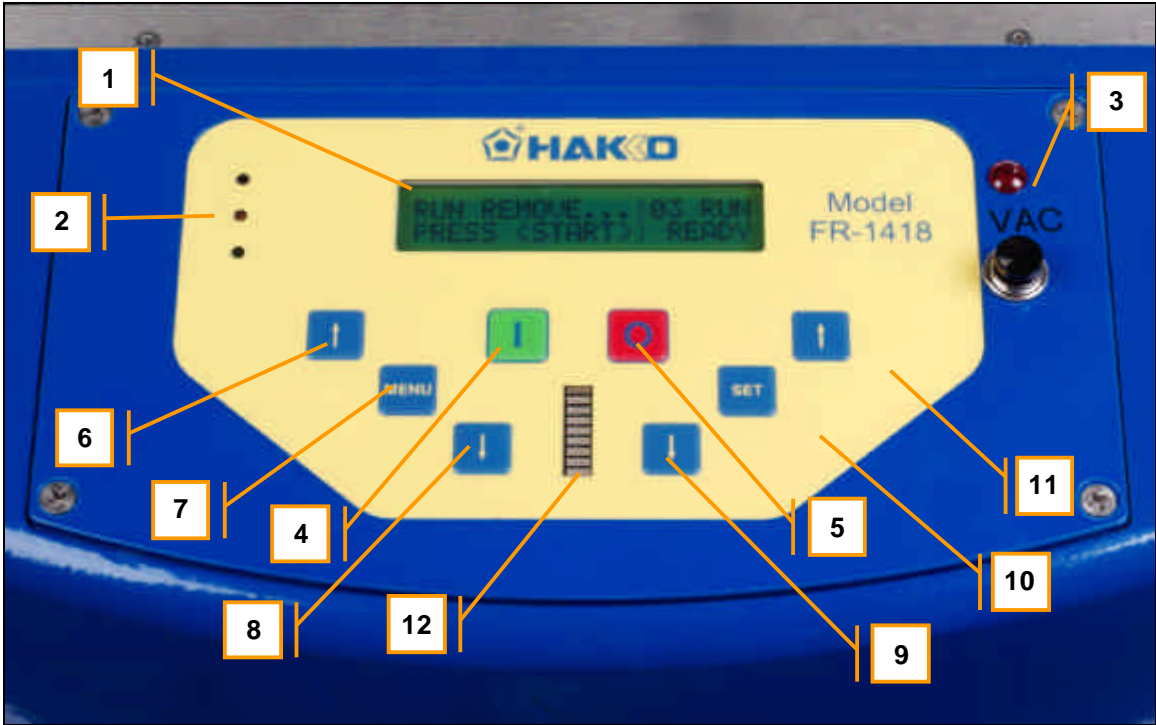


Figure 3: FR-1418 HMI Panel Details

Item	Description
1	LCD Screen / Message Window
2	L.E.D. Status Indicators
3	Vacuum Toggle Switch and Indicator
4	Start Button, or <Start>
5	Stop Button , or <Stop> or <Esc> or <No>
6	Menu Up Button , or <M?>
7	Menu Button , or <Menu> or <Yes>
8	Menu Down Button, or <M?>
9	Set Data Up Button , or <S?>
10	Set Data Button , or <Set> or <Enter> or <Toggle>
11	Set Data Down Button, or <S?>
12	Bar Graph Progress Indicator

Note: When the unit is controlled by an optional PC with Advanced Software Option, the display will read: "UNDER HOST CONTROL" and all keypad actions are ignored. All functions are accessible through the PC software.



Figure 4: Lighting Intensity Control

Turn clockwise to increase intensity, and counterclockwise to decrease intensity.

The TOP lighting (left hand knob) affects the brightness of the video camera image in the UP direction. This is the PART or NOZZLE image. The BTM lighting (right hand knob) affects the image brightness in the DOWN direction. This is the BOARD image. By varying the intensity in both directions, the user can view a superimposed image of the PART or NOZZLE and BOARD for installation or removal of SMT components.

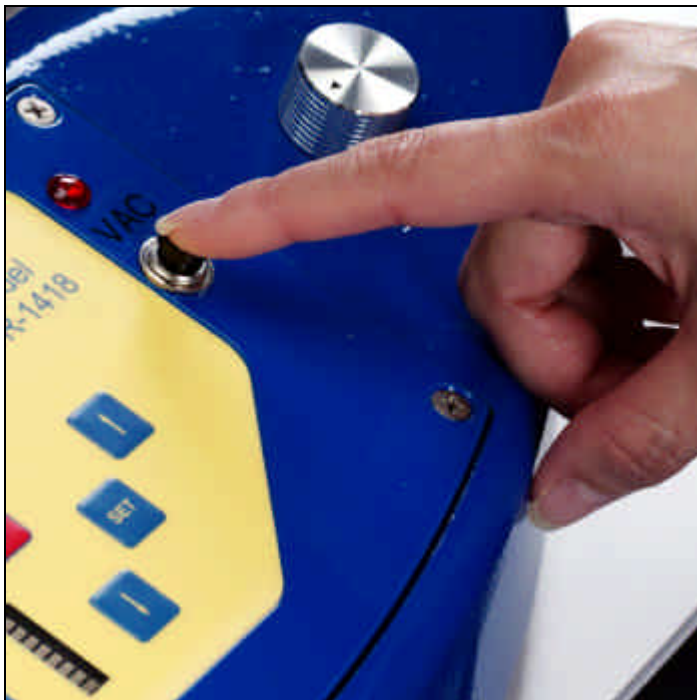


Figure 5: Vacuum Control

Vacuum can be manually controlled by a front panel pushbutton, footswitch, or PC software.

At any time the machine is in a normal RUN mode, actuating the vacuum switch will toggle the vacuum from OFF to ON or from ON to OFF.

The vacuum switch is also used during semi-automatic operation to release the PART from the vacuum tip when placing a part on the BOARD, or when placing a part in the NEST, to indicate to the controller that it is



Figure 6: Thermocouple Inputs (TCH Shown)

The FR-1418 has (2) Thermocouple (T/C) inputs. The LH input is the TEACH or TCH input, and the RH input is the SPARE or TC2 input. These are Type K T/C inputs. 36Gauge, fine wire, Teflon insulated T/Cs are recommended.

The TCH input is used to measure the solder joint temperature. The TC2 input can be used to measure temperature at any point on the board or part being soldered.

Note: There must be a T/C or jumper plugged into each port in order for the machine to operate in TEACH or RUN Modes. The system will generate a fault message if either channel is open.

Board Fixture and Axis Definition:

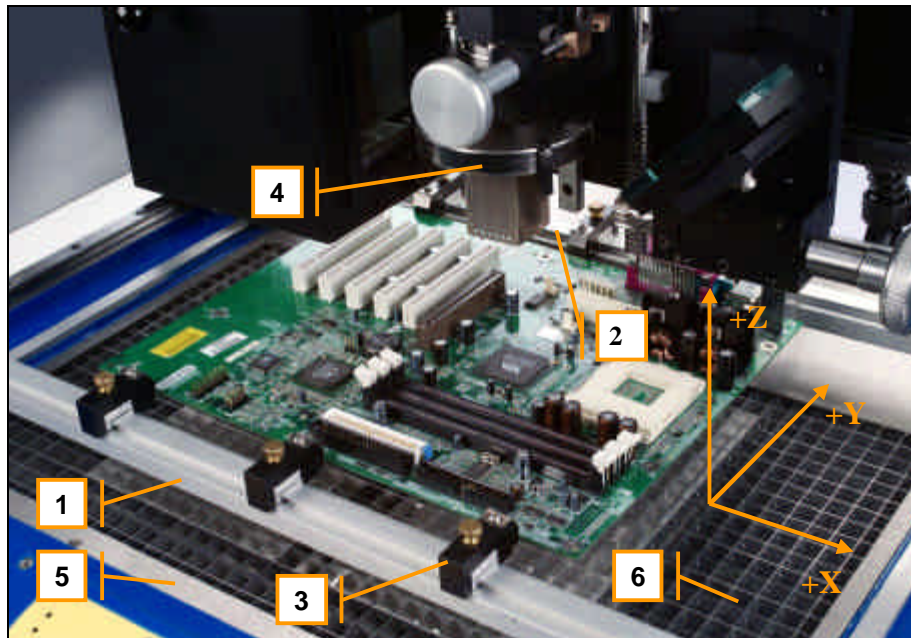


Figure 7: Board Fixture

The standard board fixture consists of front (1) and rear (2) dovetail rails with adjustable spring clips (3) attached to them. The rear dovetail rail may be adjusted front to back to allow holding boards (also called PCB or PWB) of varying depths. To adjust the rear rail, loosen the black knobs at both ends, and slide the rail forward or backward using one hand on each end. Keep the rear rail parallel to the front rail for easiest adjustment without binding. For convention, left to right on the machine is called the X-Axis. The front to back direction is called the Y-Axis. The heater head (4) travels up and down in the Z-Axis.

Axis Adjustment Controls:



Figure 8: X-Axis Fine Adjust Knob



Figure 9: X-Axis Adjust Handle



Figure 10: Y-Axis Fine Adjust Knob



Figure 11: Y-Axis Adjust Handle

Figures 8 through 11 show the X and Y Axis adjustment controls for positioning the heater head relative to the board loaded into the board fixture. To move the head left or right, squeeze the X-Axis adjust handle, and push or pull the head to the desired position. To move the head front to back, squeeze the Y-Axis adjust handle and push or pull the head to the desired position. Fine adjustments, such as when aligning a part or nozzle to a PCB, can be made by rotating the fine adjust knob for the each axis.



Figure 12: Theta Adjust

The lower heater head can be rotated by turning the Theta Adjust knob. This rotates the nozzle and the vacuum pick-up, so that the part and/or nozzle can be aligned to the PCB in the Theta, or rotational, direction. The Theta adjust is a precision assembly with limited travel in either direction. Take care not to continue to turn the knob once the Theta has been adjusted to the end of travel to avoid damaging the assembly. (Also see: Nozzle Installation)



Figure 13: Z-Axis Adjust Handle (1)



Figure 14: Z-Axis Fine Adjust Knob (2)

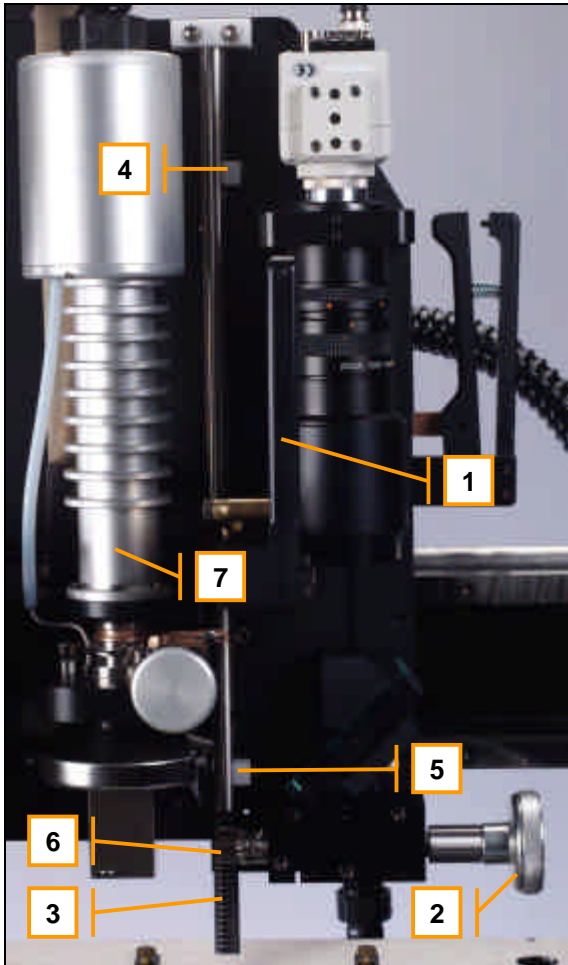


Figure 15: Z-Axis Rack Gear Assembly

Adjusting the heater head height (figures 12 through 14):

The Z-Axis adjust handle (1) is attached to the heater head. It is used to select the rough position of the heater head (7). This position is either UP or DOWN. Squeezing the adjust handle disengages a pin from the Z-Axis fine adjust rack gear assembly (3), allowing the head to be lifted or lowered to the top (4) or bottom (5) travel stop. There is a slot in the rack assembly at either end of travel in which the pin engages when the adjust handle is released. The Z-Axis Fine Adjust Knob (2) rotates a pinion gear (6), which moves the rack assembly up or down. This provides additional up and down adjustment of the head when it is in either the UP or DOWN rough position. During general use the rack assembly should always be adjusted UP using the knob, unless the operator is in the process of picking, placing or soldering a part. This ensures that there will be adequate clearance between the heater nozzle and the board or nest when a rapid move is made between the UP and DOWN rough positions.

Heater Head and Nozzle Installation:

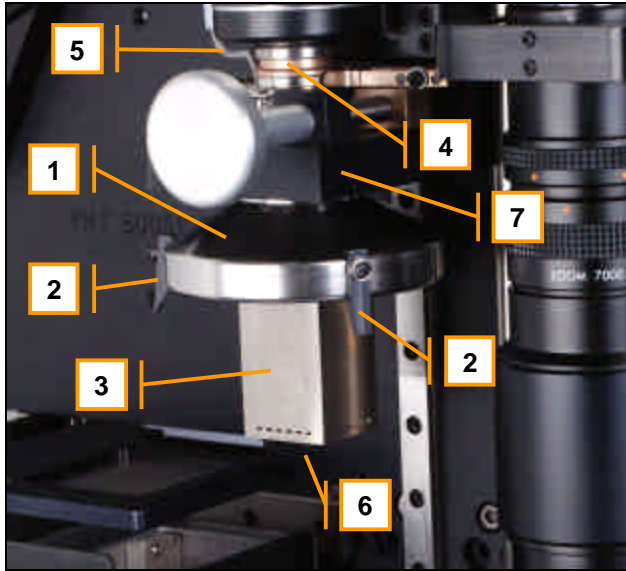


Figure 16: Lower Heater Head Details

The lower heater head assembly is supported by the theta adjustment bearings, which are mounted to the heater plate (7). The lower heater housing (1) rotates using the theta adjust (Fig. 12). The heat path from the upper heater head (Fig. 15, Item 7) to the lower heater head is closed by a spring-loaded bronze seal (4). Vacuum is generated by a venture in the rear head enclosure. The vacuum tip (6), not visible in Fig. 16, receives vacuum through a Teflon tube connected to the vacuum transfer pipe (5). The vacuum tips are interchangeable for placing and removing different size and weight SMT parts. Interchangeable nozzles (3) are held into the lower heater housing (1) by three spring-loaded clips (2).

Changing Nozzles:

Heater nozzles are available in different sizes, end-shapes, and styles. They are generally low-mass stainless steel shrouds with a machined top flange or hub which engages the lower heater housing. To remove a nozzle (3), grasp the shroud and tilt the lower end of the nozzle slightly away from one of the spring loaded clips (2), while pulling straight down. To insert a nozzle, center the theta adjustment (see note), hold the nozzle by the shroud, insert the vacuum tip through the opening in the top of the nozzle, place the flange of the nozzle over two of the spring clips (2) at a slight angle, and then push the nozzle straight up until the other side of the flange snaps past the third spring clip.

⚠ CAUTION! Nozzles may be VERY HOT! Hot nozzles can cause severe burns. Use adequate hand protection when changing a hot nozzle, or wait for the nozzle to cool before changing.

Note: The range of theta adjustment for the heater head is limited. Attempting to force the theta adjustment beyond its intended travel will damage the assembly. To minimize the possibility of this occurring, observe the following: Before installing each nozzle it is best to center the theta adjustment in its travel range and install the nozzle at the approximate rotation angle required for installation or removal of the SMT part (usually 0, 90, or 45 degrees.)

Video Camera and Optical Alignment System: (Figures 17 & 18)

A video/optical system aids the operator in aligning the nozzle or part to the board. To use the alignment system, put the head in the UP position, and slide the optics train (10) to its right-most position underneath then nozzle. Top lighting (1) illuminates the part and/or the end of the nozzle and vacuum tip. Bottom lighting (2) illuminates the board. Light reflected from the part and board travels through the Beam-splitting Prism (3), reflects off the Flat Mirror (4), into the Zoom Lens (9), and finally onto the CCD imaging device in the Video Camera (8). The camera transmits a video

signal to an LCD flat screen, an analog monitor, or a PC for high magnification viewing of the superimposed part/board image. The intensity of the part or board image can be adjusted by varying the light intensity. The video image is adjusted using the focus (5), zoom (6), and f-stop (7) controls on the zoom lens (9). Always focus the camera on the BOARD and adjust the Z height of the part or nozzle to focus the top image. When focusing a part, adjust the Z height of the part so that the pitch of the leads on the part matches the pitch of the in-focus pads on the board. This is easiest when the X/Y/Theta adjusts are used to set the leads on the part parallel to, and one-half pitch offset in the Y direction from the pads on the board.

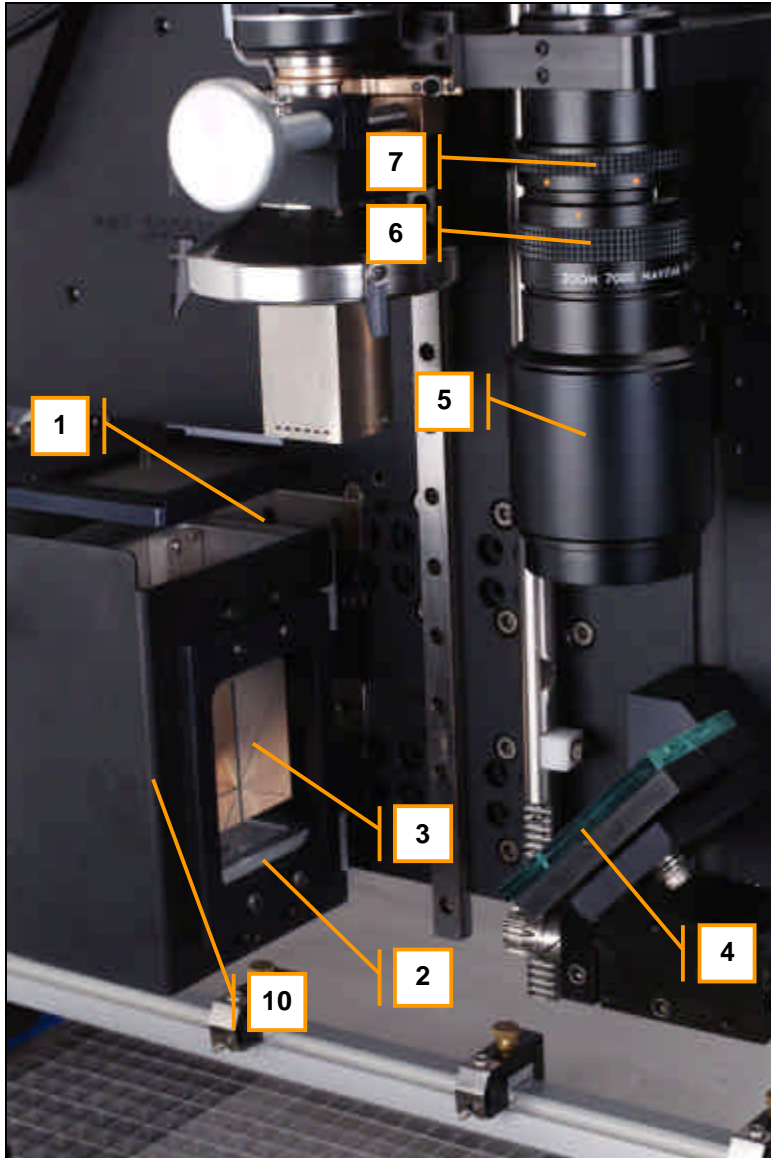


Figure 17: Optics Components

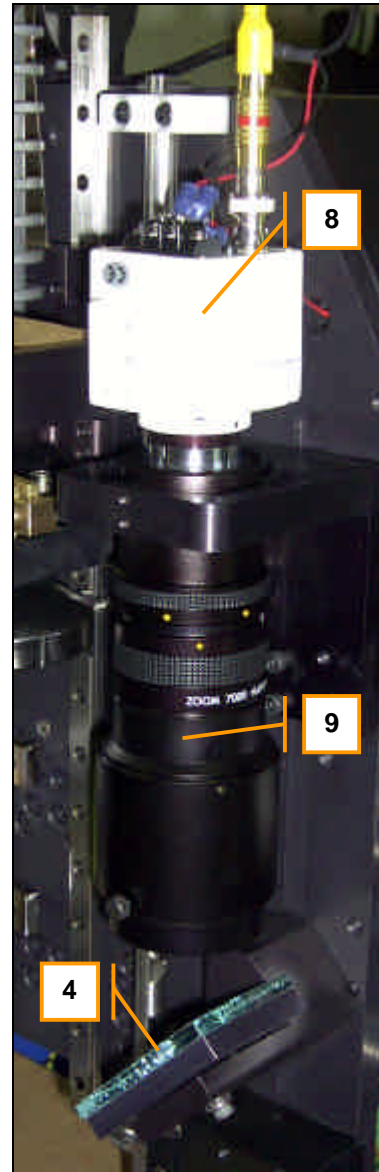


Figure 18: Camera & Zoom Lens

Part/Component Nest:

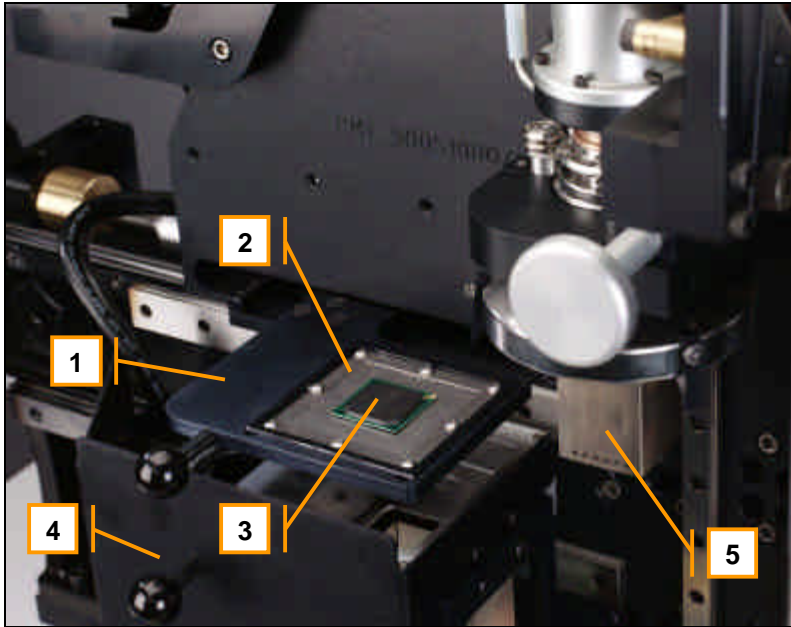


Figure 19: Part Nest

A nest (1) is provided for aligning a part to the heater nozzle, and for receiving a hot part after it has been de-soldered from the board. The system is furnished with a generic plate (not shown) which fits into the nest to aid in aligning new parts with the heater nozzle (5). Component Print Frames, or CPF (2), also fit into the nest, and are available for stencil printing solder paste onto BGA (3) and some other SMT components.

With the head UP, extend the nest to its right-most position to align the center of the nest insert (2) with the nozzle (5) for receiving hot parts, or transferring a new part to the nozzle.

Note: The nest and optics train are shown in their retracted positions. The nest (1) and optics train (4) must be fully retracted for the head to be lowered to the DOWN position.

Rear Panel:

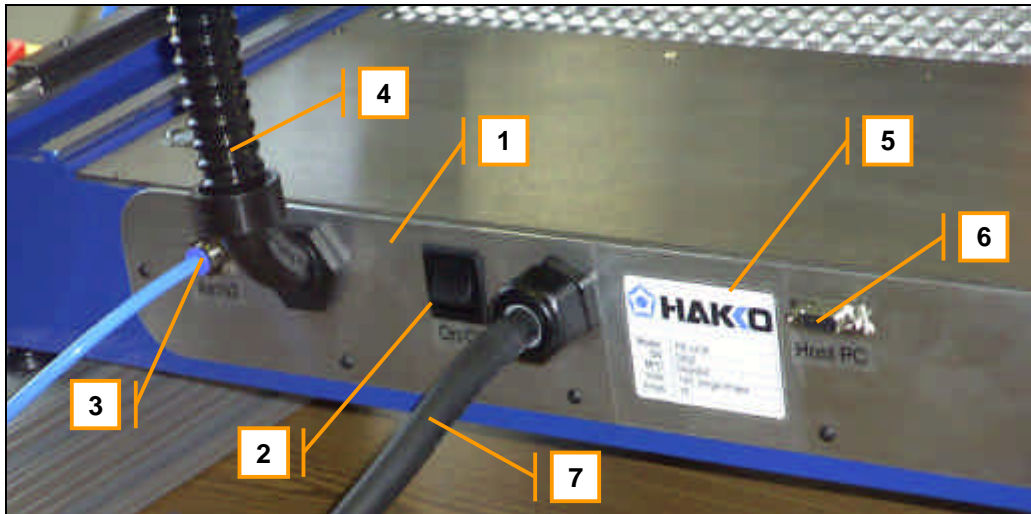


Figure 20: Rear Panel

Item	Description	Item	Description
1	Rear Panel	5	Serial Number Decal
2	On/Off Switch (Power Switch)	6	Host PC and/or Options Connector(s)
3	Air/N2 Supply Inlet (1/4" Tubing)	7	Power Cord
4	Services to Head Assembly		

2.0 Unpacking and Installation:

The rework system packaging may vary due to the specific model purchased, options installed, and shipping/transportation requirements. The following figures provide a general guide for unpacking the system.

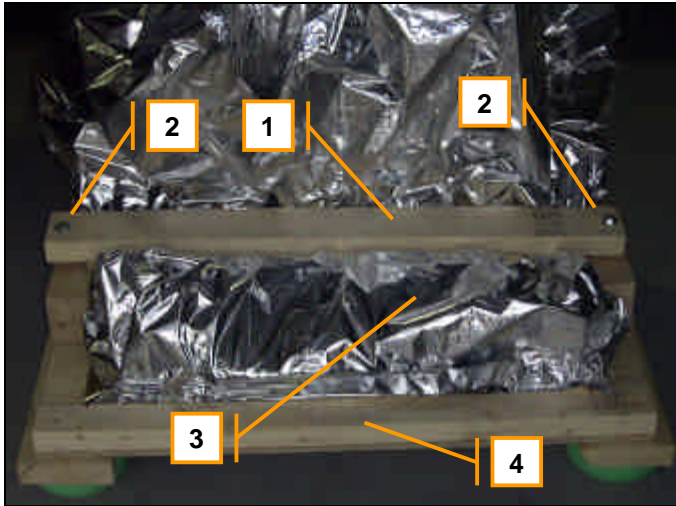


Figure 21: Outer cardboard or crating removed

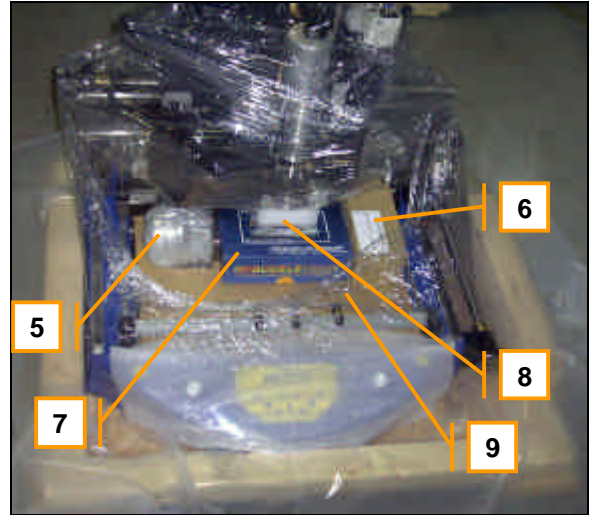
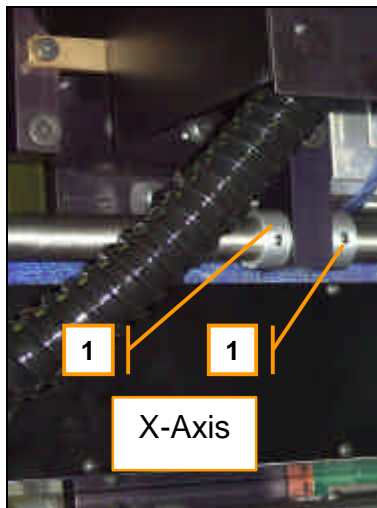
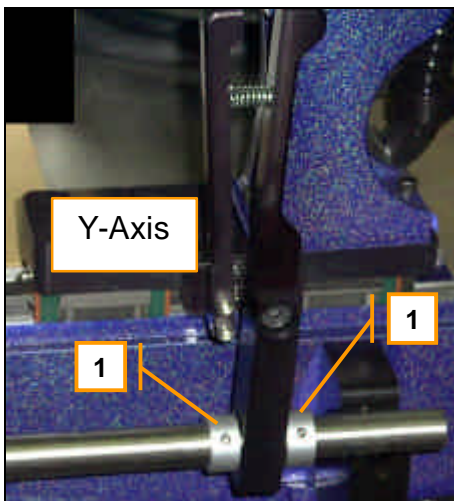


Figure 22: Bracing and Plastic Removed

To unpack the machine:

Remove the outer cardboard or wooden crating material. Remove the two 5/16 lag bolts (2), and the hold-down brace (1) from the cushioned skid (4). Remove the outer plastic sheeting, shrink wrap or optional vapor-barrier bag (3). Remove the nozzle kit (5), accessory pack (6), and any LCD monitor (7) and/or optional equipment. The machine can now be lifted off the skid using at least two people. The uncrated machine weighs approximately 140 pounds. Place the machine on a stable bench with a solid top. The bench should not wobble or bend under the weight of the machine. If necessary adjust the four leveling feet so that the machine sits flat on the bench without rocking. Remove any final shrink wrap, plastic or foam, except the foam block (8) under the head. Raise the head to remove the final foam block. Remove the cardboard (9) covering the bottom heater.



Figures 22 & 23: Axes Blocked

Stop Collars (1) are used to secure the axes for shipment. Loosen the #10-32 set screws and slide the collars out of the way.

Power and Air/N2 Connections:

Connect air or nitrogen to the rear panel fitting using ¼ inch plastic tubing. (See Fig. 20) The supply gas must be clean, dry and regulated to 60PSI. The supply should be capable of delivering 5 CFM minimum continuous supply at 80 PSI. Poor filtration or wet air lines will degrade heater and pneumatic component performance.

Plug the power cord into an appropriate, dedicated outlet. It is now safe to turn on the power to the machine. The machine will run through a brief self-check on power-up and then be ready for operation. See section 4.0 Operation and Programming and Section 7.0 HMI Software guide for more information.

Repackaging the system:

Reverse the procedure above, taking special care to secure all moving parts as indicated.

Note: The minimum packaging for local delivery or relocating of systems requires that the machine be securely fastened to a cushioned skid, with the head blocked, axes locked, bottom heater covered, and system shrink-wrapped as described in this section.

3.0 Process Overview

This section is intended to provide a brief and general overview of the SMT rework process using the FR-1418. Your process and corresponding requirements may vary considerably.

The typical rework process using this equipment would include the following three phases, each of which has several steps.

Rework Phases

- I. Component Removal
- II. Board and Component Preparation for Installation
- III. Component Installation

Rework Phase I - Component Removal

Typical steps:

1. Load the board with the part to be removed in the board fixture. (Fig. 7)
2. Align the nozzle with the part using the video image and X/Y/Theta adjust knobs (Fig. 8-12, 17, 18)
3. Retract Optics and lower head near board (Fig. 13-15)
4. Press <Start> to initiate the RUN/REMOVE Heat Cycle (Fig. 3, Section 4.0, Section 7.0)
5. When the heat cycle is complete, the vacuum comes on. Adjust Z height to pick up the part (Fig. 14)
6. Raise heater head (Fig. 13-15)
7. Move the nest/CPF under the hot part (Fig. 19)
8. Lower the head near the nest and press the VAC switch to drop the part and continue the cycle.
9. After a timed cooling step, the cycle is complete.
10. Retract the nest and raise the head. (Fig. 19, 14)

Note: See the items referenced after each step for additional information in this manual.

Rework Phase II - Board and Component Preparation

Practices vary widely, but they may consist of the following steps:

1. Remove Excess Solder With Iron (Fig. 24)
2. Level the pads with solder wicking braid (Fig. 25)
3. Print fresh solder paste onto BGA balls using CPF stencil (Fig. 26) Note: In many cases for plastic BGA components with Eutectic solder balls, a thin coating of flux paste is applied to the board in lieu of adding additional solder paste.

4. Load CPF With BGA Into Nest (Fig. 19)

Rework Phase III – Component Installation typically consists of the following steps:

1. Load PCB Onto Adjustable Board Fixture (Fig. 7)
2. With the head UP, load the part in the nest and slide it under the nozzle (Fig. 13-15, 19)
3. Press <Start> to initiate the RUN/INSTALL cycle. The vacuum turns on. (Fig. 3, Section 4.0, Section 7.0)
4. Adjust the head Z height down to pick up the part and then up away from the nest (Fig. 15)
5. Retract the nest and extend the optics train (Fig. 19)
6. Using the video image and X/Y/Theta adjustments, align the leads (balls) on the part to the pads on the PCB (Fig. 8-12, 17, 18, 27, Section 4.0)
7. Retract the optics train, move the head to the DOWN position. (Fig. 19, 13-15)
8. Adjust the Z height so the part is just touching the board (Fig. 15)
9. Press the VAC button or footswitch to release the part and continue the cycle (Fig. 3)
10. Adjust the Z height so the nozzle is approximately 1/8 inch above the top of the part (Fig. 15)
11. The cycle continues heating through Preheat (PH), Soak (SK) and Reflow (RF) steps. (Section 7.0)
12. The cycle progresses to the Cooling (CL) step, while air flows through the heater nozzle to freeze the solder joints. The cycle is complete. (Section 7.0)
13. When the board has cooled sufficiently, remove it from the board fixture (Fig. 7)
14. Proceed to electrical test, visual inspection, or x-ray inspection of the reworked assembly as required

*** End of Process ***

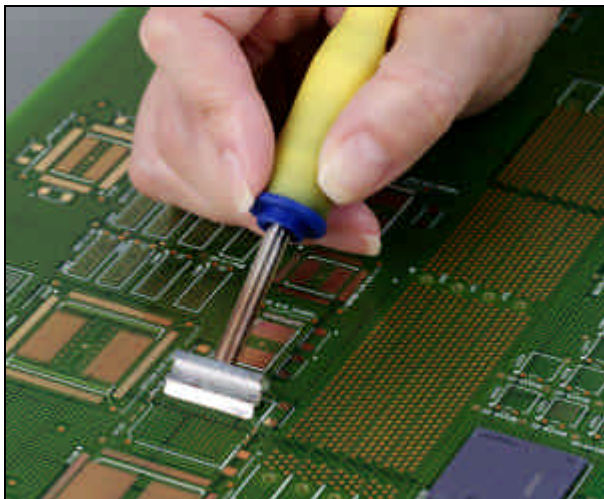


Figure 24: Removing Excess Solder

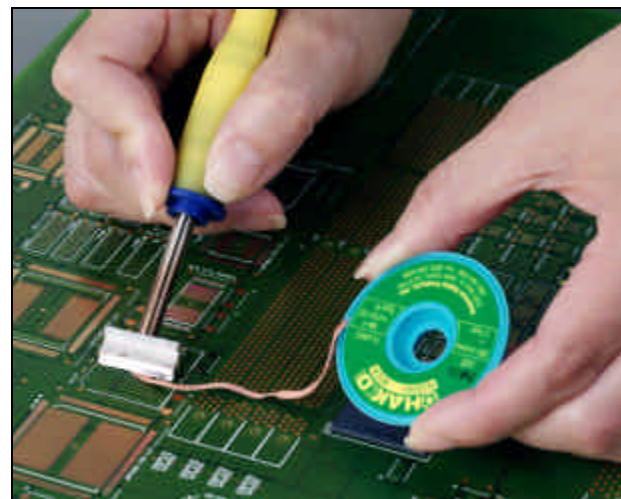


Figure 25: Leveling Pads using Solder Wick & Flux

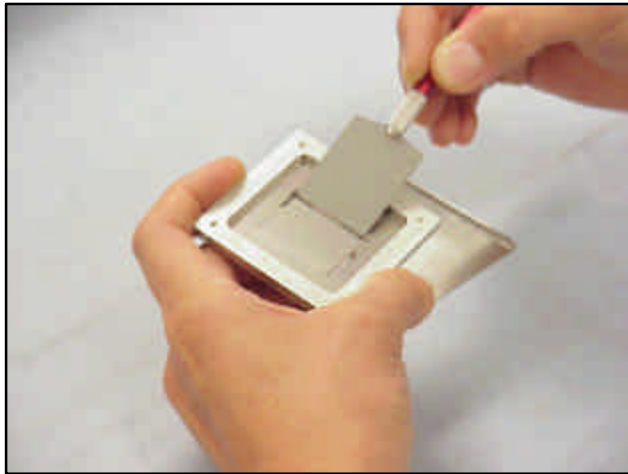


Figure 26: Printing BGA with Solder Paste

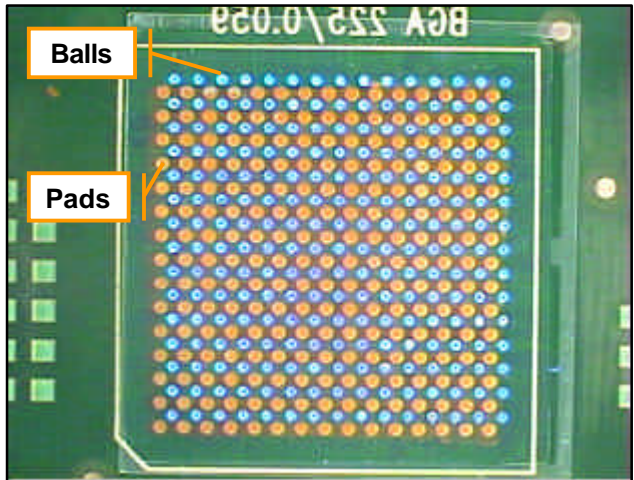


Figure 27: Aligning the Part

4.0 Operation

Note: The operation and programming of the FR-1418 requires that the operator have reasonable proficiency with the features, controls and processes described in Sections 1.0 and 3.0 and Appendix A of this manual. Read and understand sections 1.0 and 3.0 and Appendix A before proceeding to operate and program the equipment as described in this section.

Note: Consult the references in parentheses after each item for additional information or description relevant to each topic.

General Warnings:

1. Keep in mind that the system is designed to melt solder joints on very dense boards. The heaters are very powerful and can reach internal air temperatures exceeding 450 C (840° F). Surfaces of the heater, PCB, nozzle, and other components can be VERY HOT. Always use caution to prevent accidental burns, especially when changing nozzles, unloading boards or parts, or when working around the heater head area.
2. Never touch any glass optics components with bare hands.
3. Never wipe any glass optics components with rags or paper towels. Use an optical wipe, camera lens tissue, eyeglass wipe, or other material which will not scratch the glass.
4. Never touch the sides (unpolished faces) of the prism. The oil from your hands can penetrate the bonded seam and adversely affect the image quality.
5. Never touch the halogen bulbs for the part/board lighting, or the bottom heater quartz lamps with bare hands. The oils from your skin can cause hot spots on the bulbs/quartz lamps, resulting in cracking or coating failure.
6. Maintain good ESD prevention procedures when handling electronic parts and boards.

7. Always disconnect the unit from the electrical and pneumatic supplies before servicing or maintenance.

Powering the System:

1. Check that air/N₂ and power are properly connected.
2. Turn the power switch to the 1 (On) position. (Fig. 20)
3. Observe startup messages on LCD screen. Wait for READY. (Fig. 3)
4. The system is in INSTALL/RUN or REMOVE/RUN mode, with the last-used recipe loaded in memory. (Appendix A)

Operation for Part Removal (De-soldering):

1. Load the desired Recipe using the MENU buttons (Fig. 3, Appendix A)
2. Select REMOVE/RUN or REMOVE/TCH mode using the MENU buttons. If REMOVE/TCH is selected, place the tip of the TCH T/C in contact with the part solder joint. (Fig. 3, 6, Appendix A)
3. Insert the proper nozzle into the heater head (Fig. 16)
4. Insert the standard nest plate into the nest (Fig. 19)
5. Align the nozzle to the board using the video alignment optics. (Fig. 17, 18)
6. Lower the head to the rough DOWN position and then adjust the nozzle height to approximately 1/8 inch above the part to be removed. The nozzle should NOT be touching the part. (Fig. 13-15)
7. Press <Start> to initiate the heating cycle. The system will progress through Preheat (PH), Soak (SK) and Reflow (RF) steps at the programmed top and bottom heater settings. When in REMOVE/RUN mode, the system will run at the programmed step heater settings for the step times programmed in the recipe. (This is a time-driven cycle.) When in REMOVE/TCH mode, the system will heat at the programmed step heater settings until the TGT temperature is reached by the TCH T/C. (This is a temperature driven cycle, and is dependent on T/C feedback. Make sure the T/C is securely in contact with the solder joint to ensure accurate temperature readings.) An L.E.D. bar graph progressively illuminates from bottom to top, indicating progress through the cycle (Fig. 3, Appendix A)
8. At the completion of the RF heating time, the vacuum will turn on, and the system will begin to beep. Adjust the Z height (Fig. 15) to bring the vacuum tip in contact with the top of the part, and allow the vacuum to engage the part.
9. Adjust the Z height back away from the board at least 1/2 inch, and then raise the head to the rough UP position. (Fig. 15)
10. Slide the component nest under the hot part, and lower the head near it. (Fig. 19)
11. Press the VAC button to release the part from the tip, and initiate the Cooling (CL) timed step, then retract the head away from the nest.
12. The cycle is complete when the CL timer reaches the programmed value.

Note: Once the vacuum turns on at the completion of the RF recipe step, the operator has 20 seconds to remove the part from the board and place it in the nest (Steps 8 through 11, above.) If the VAC button is not pushed within 20 seconds, the system will go into an alarm fault mode and terminate the run to prevent accidental board overheating.

Note: When in REMOVE/TCH mode, the step times in the recipe are updated automatically upon the completion of the TCH cycle.

Operation for Part Installation (Soldering):

1. Load the desired Recipe using the MENU buttons (Fig. 3, Appendix A)
2. Select INSTALL/RUN or INSTALL/TCH mode using the MENU buttons. If INSTALL/TCH is selected, place the tip of the TCH T/C in contact with the part solder joint. (Fig. 3, 6, Appendix A)
3. Insert the proper nozzle into the heater head (Fig. 16)
4. Insert the part into the nest with the standard nest plate or optional CPF. Solder paste or flux paste may be pre-applied to some components when using a CPF. Orient the part to meet any polarity requirements for the PCB assembly. (Fig. 19, Section 3.0)
5. With the head in the rough UP position, slide the nest under the heater nozzle (Fig. 19, 13-15)
6. Press <Start>. The vacuum turns on.
7. Adjust the head down to pick up the part, and then raise the head away from the nest (Fig. 15)
8. Align the leads on the part to the pads on the board using the video alignment optics. (Fig. 17, 18)
9. Lower the head to the rough DOWN position and then adjust the nozzle height to place the part on the board. The part should touch, but not push on the board. Press the VAC button or footswitch. The heaters will turn on and the cycle will continue with the PH step after a short delay which allows the vacuum to dissipate. Immediately adjust the nozzle Z height to approximately 1/8 inch above the part. The nozzle should NOT be touching the part. (Fig. 13-15)
10. The system will progress through Preheat (PH), Soak (SK) and Reflow (RF) steps at the programmed top and bottom heater settings. When in INSTALL/RUN mode, the system will run at the programmed heater settings for the step times programmed in the recipe. (This is a time-driven cycle.) When in INSTALL/TCH mode, the system will heat at the programmed step heater settings until the TGT temperature is reached by the TCH T/C. (This is a temperature driven cycle, and is dependent on T/C feedback. Make sure the T/C is securely in contact with the solder joint to ensure accurate temperature readings.) An L.E.D. bar graph progressively illuminates from bottom to top, indicating progress through the cycle (Fig. 3, Appendix A)

11. Cooling (CL) is the last timed step. When this is complete, adjust the head away from the part, and then raise the head to the rough UP position.
12. The board may be removed when it has sufficiently cooled.

Note: When in INSTALL/TCH mode, the step times in the recipe are updated automatically upon the completion of the TCH cycle. (See Appendix A for detailed information on the recipe.)

5.0 Options

A variety of nozzles, vacuum tips, accessories and factory installed options are available to meet the needs of different rework applications. Consult your sales representative for the most up-to-date information on accessories and options. Some major system options are briefly described below. Additional operation and maintenance supplements to this manual may be supplied with some options.

Major System Options:

1. Two-Zone Bottom Heater – This option provides a second, 10 x 12 inch bottom infra-red heating zone which can be turned on or off in any heating step of each recipe. The total bottom heat area with this option installed is 12 inches in the Y direction and 20 inches in the X direction. The left-hand zone is Zone 1 in the recipe, while the right-hand zone is Zone 2.

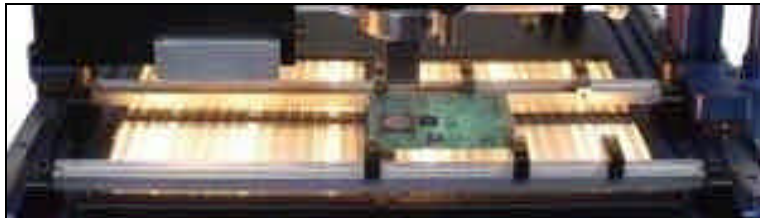


Figure 28: Two-Zone Bottom Heater Option


2. PC Temperature Profiling and Control Software – An advanced software control and temperature profiling software package is available that allows the rework system to be controlled by a Pentium™ class PC with its serial port connected to the HOST PC connector (Fig. 20) on the machine's rear panel. This software also allows the recipes to be created and stored on the PC. Thermocouple data can be plotted real-time, stored, and analyzed using software tools for measuring ramp rates, time above melting temperature, and more. The customer can purchase software only, and provide their own PC, or the software can be preinstalled on a PC with a frame-grabber card for viewing the video camera images using a 15 inch or 17 inch PC monitor. (This option may not currently be available for all models.)
3. Automatic Motorized Z Axis – This option is only available if option 2, above, is installed. It is only available as a factory-installed option. The Heater head is driven by a motorized

lead screw, making the Z-Axis of the machine automatic. This allows more automated rework cycle operation, with the pick-and-place operations programmed into the recipes, and controlled by the PC software. (This option may not currently be available for all models.)



Figure 29: Automatic Motorized Z-Axis Option

6.0 Maintenance and Troubleshooting

 **Important:** Always disconnect the unit from the electrical and pneumatic supplies before servicing or performing maintenance.

Maintenance:

Linear Bearing Rails

All linear bearing rails should be cleaned once a month with a tack rag to remove debris, dust and dirt from the rails. A Medium lubricant such as Way Oil should be applied to the X-Y and Z rails/linear bearing rails once every three months. At the factory, we use Mobil™ Vactra #2 (ISO 68) Medium Way Oil.

Bottom Heater

IMPORTANT: NEVER TOUCH THE HEATER LAMPS WITH BARE HANDS!

The bottom heater should be cleaned of dust and debris as needed. If large amounts of dust and debris accumulate inside the bottom heater, remove the top cover and collimator grille, vacuum the interior, and clean the reflectors and bulbs with isopropyl alcohol and a wipe.

Prism & Mirror

IMPORTANT: NEVER TOUCH THE PRISM OR MIRROR WITH BARE HANDS!

Natural oils from your skin may cause permanent damage to the surfaces or bond interfaces. The prism and mirror should be cleaned once (1) a month with a non-abrasive tissue. Lens cleaner (preferred) or isopropyl alcohol can be added to the tissue to remove difficult or heavy deposits. If alcohol is used however, a second pass with a dry non-abrasive tissue is recommended to remove any haze. At the factory we use Bausch & Lomb Sight Savers #8566.

Vision Calibration

The vision system on the machine should be verified and/or calibrated annually. This is completed using the Calibration Kit included with the machine. A detailed procedure is explained below.

Z-Axis Lead Screw Shaft (for systems with Motorized Z-Axis)

This should be lubricated once (1) every six months. Manually drive the top heater head down to the bottom home position, then turn the Power OFF. The shaft should be lubricated with a heavy grease which will not melt or run at moderate temperatures, preferably a Lithium Grease compound (12-Hydroxy Lithium Complex). At the factory we use StaPlex Premium E.P.. Restore power, and “Home” Z-Axis.

Other

The machine should be kept clean to prevent build up of flux or other substances or objects that may degrade performance or damage the machine.

Troubleshooting:

Below is a general guide for troubleshooting certain operational problems. Consult a qualified service technician if you do not understand basic troubleshooting techniques, or if the problem can not be identified and corrected using the information provided in this manual.

Troubleshooting table:

Symptom	Possible Cause	Corrective Action	References
Weak vacuum at tip	Worn or damaged vacuum cup	Replace the vacuum cup	Fig. 29
	Leaking vacuum system	Find and repair leaks in the vacuum system	Fig. 29, 30
	Insufficient supply pressure or volume	Increase supply pressure above 60 PSI. Check supply capacity meets CFM requirements and check supply tubing.	Fig. 20 Section 2.0
Part is not placed accurately compared to video image	Improper Z height when vacuum is turned off	Review Section 4.0 for proper placement technique.	Section 4.0
	Part sticks to vacuum cup and then drops back to board inaccurately	Clean vacuum tip, use a different size vacuum tip, or modify Z height used when placing and releasing the part on the board.	Section 4.0 Fig. 29
	Optical calibration is inaccurate	Verify and/or re-calibrate according to the procedure below.	
Bottom heater does not turn on as programmed	A quartz lamp is burnt out	Inspect the lamp filaments. Replace burnt-out lamps	Fig. 33, 34
	A short circuit caused a blown fuse	Find and correct the cause of the short circuit, then replace the fuse.	
Part or board lighting does not work	A halogen bulb is burnt out	Inspect the bulb filaments. Replace burnt-out bulbs	Fig. 31, 32
Vacuum tip not centered in video window	Optics train stop requires adjustment	Check and/or adjust the optics train stop as described in the optical calibration procedure	Fig. 35
	Flat mirror requires adjustment	Check and/or adjust the flat mirror as described in the optical calibration procedure	Fig. 36

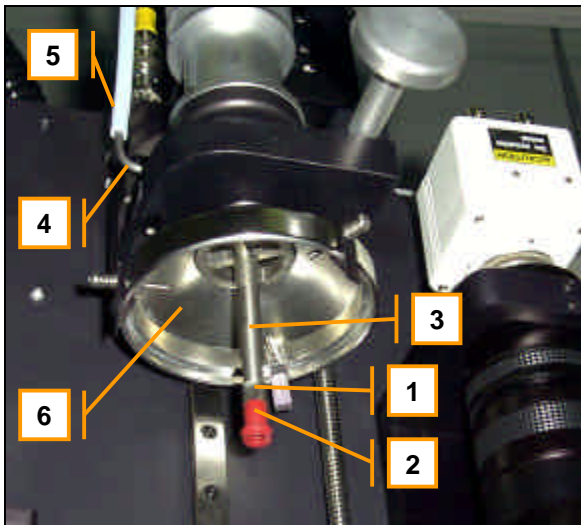


Figure 29: Vacuum Pick-Up System

Interchangeable vacuum tips (1), which may or may not have a silicone vacuum cup (2), are screwed into the vacuum stem (3) with #10-32 threads. The vacuum transfer tube (4) pipes the vacuum from the tubing (5) to through the lower heater housing (6) to the stem. A vacuum generator (Item 2, Fig. 30), generates the vacuum pressure. A leak anywhere in this system may cause weak vacuum at the tip.

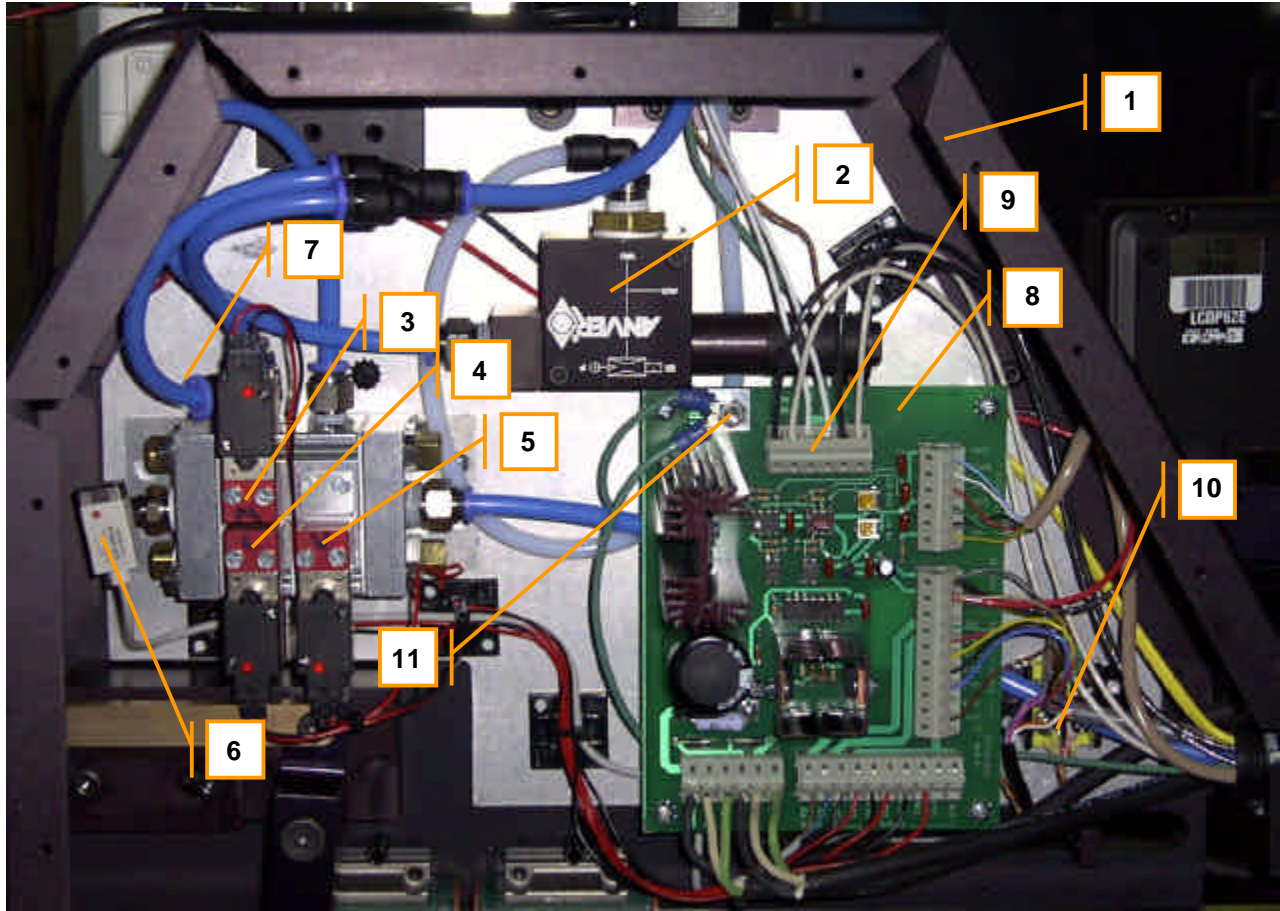


Figure 30: Rear Head Enclosure Details

Item	Description	Item	Description
1	Rear head enclosure	7	Low air flow control needle valve
2	Vacuum generator	8	Head distribution/dimmer board
3	Medium air flow solenoid valve	9	Heater power connections
4	Low air flow solenoid valve	10	Heater T/C connection
5	Vacuum generator feed solenoid valve	11	Ground connections
6	Air pressure switch		

Routine Service Procedures:

1. To change the part or board lighting halogen bulbs found on the standard optics train, follow the steps outlined in Figures 31 and 32, below.
2. To change the bottom heater quartz lamps, remove the base cover plate (Fig. 7, Item 5) and collimator grille (Fig. 7, Item 6), and then follow the steps outlined in Figures 33 and 34, below.
3. To replace fuses, first find and correct the cause of the blown fuse, then remove the base cover plate (Fig. 7, Item 5), locate the appropriate fuse on the power board (Fig. 35, Item 3), and replace the fuse with one of the same type and rating. Reinstall the cover.

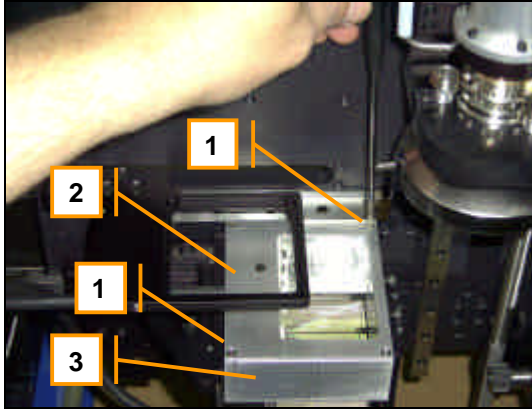


Figure 31: Removing the lighting cover

Remove the four corner screws (1) securing the top or bottom lighting cover (2) as required. Carefully pull the cover straight out of the housing (3) with the bulb mount (4) still attached. See Fig. 32, replacement bulbs must be of the exact type as the original equipment (75 W Max.)

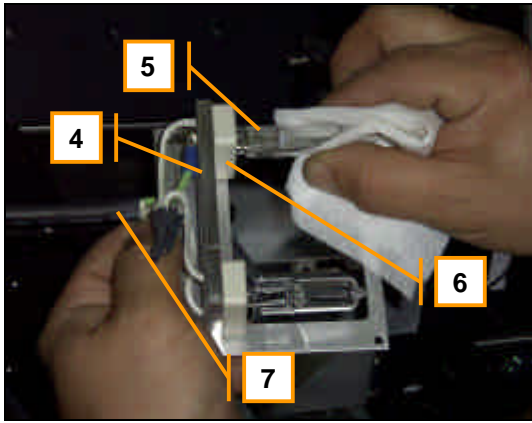


Figure 32: Changing halogen bulbs

Pull the bulb (5) straight out of the socket (6) and insert the new bulb in the reverse fashion. It may be necessary to slightly bend the contact pins on the new bulb to fit the socket. **Do not touch the bulbs with bare hands.** Be sure to observe the handling warning stated at the beginning of this section. Take care not to pinch the supply wires (7) when replacing the cover.

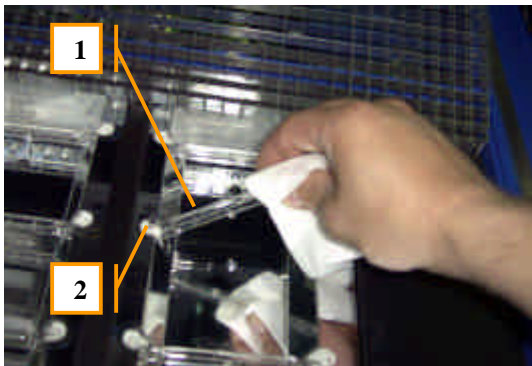


Figure 33: Replacing the bottom heater quartz lamps

Grasp the lamp (1) near one end. Push slightly towards the opposite contact block (2), then tilt the lamp up and out of the heater assembly as shown. Do not touch the bulbs with bare hands. Be sure to observe the handling warning stated at the beginning of this section. Insert the new lamp in the reverse manor.

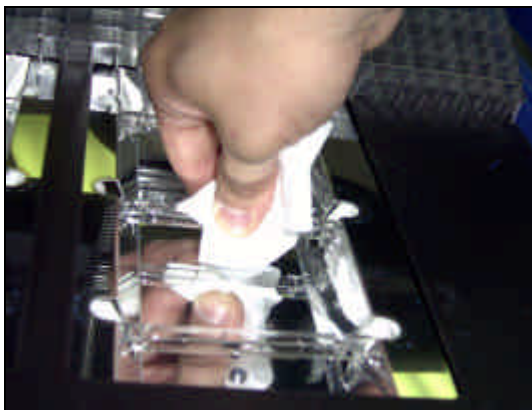


Figure 34: Checking the bottom heater lamp contacts

Grasp the lamp (1) near the center. Push the lamp slightly toward one contact block (2), then the other. You should feel some movement in each direction as the contact springs flex. The lamp should not rattle or feel loose. The lamp should be supported only by the pins in the contact blocks. Rotate the lamp a small amount, in both directions, about its long axis to feel that the bulb is securely seated on the contact pins.

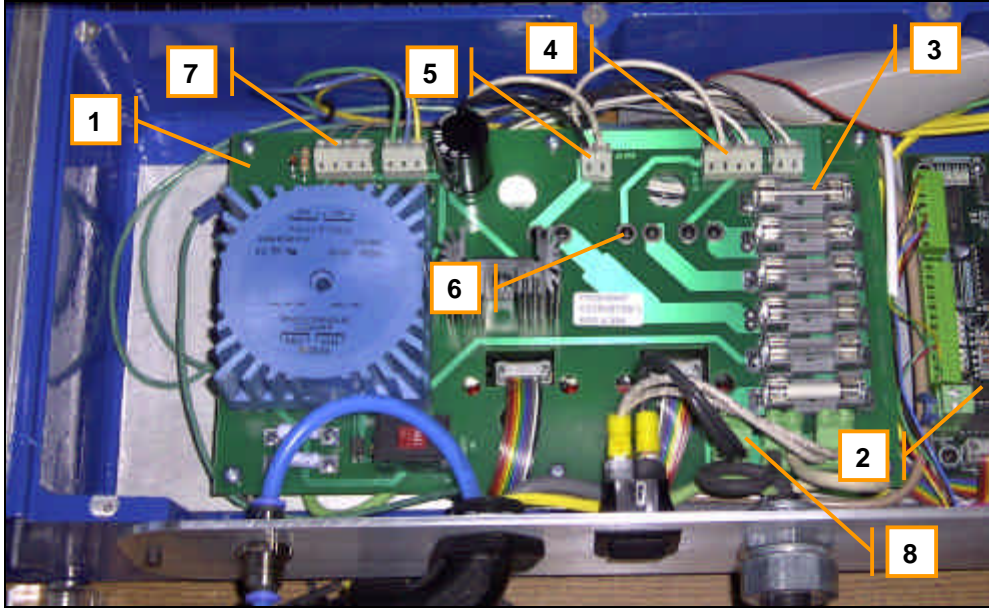


Figure 35: Power Distribution Board

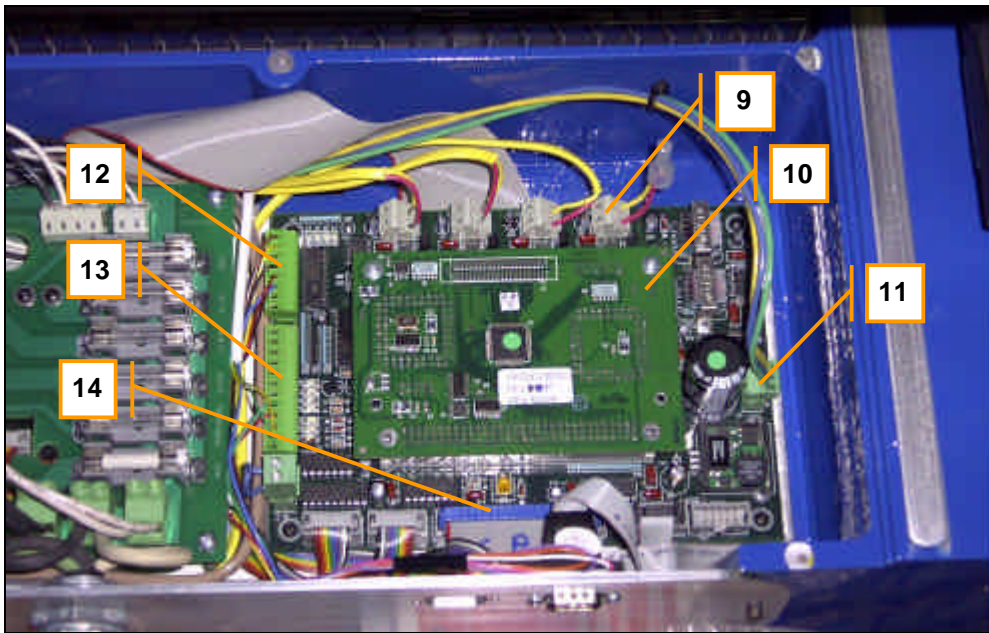


Figure 36: I/O Board

Table for Figures 35 and 36:

Item	Description	Item	Description
1	Power distribution board	8	Main power connections to/from power switch
2	I/O board	9	Thermocouple input terminals
3	Fuses (Individually identified on board)	10	CPU board (plugs into I/O board)
4	Top and bottom heater power terminals	11	12 and 24 VAC from power board
5	Optional Zone-2 heater power terminals	12	Output connector
6	Power control module electrical connections	13	Input connector
7	12 VDC output connector	14	Ribbon cable to front LCD HMI Panel

Optical Calibration and Adjustments:

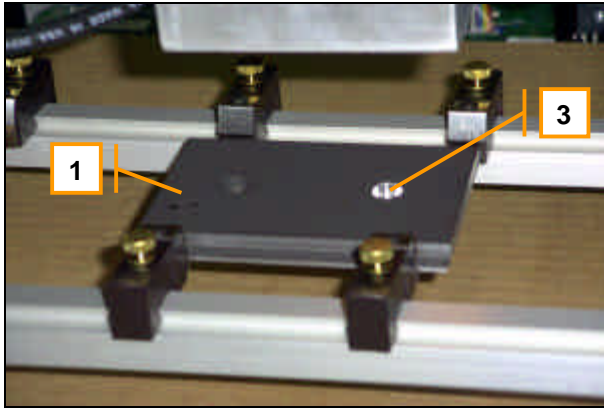


Figure 37: Calibration Plate

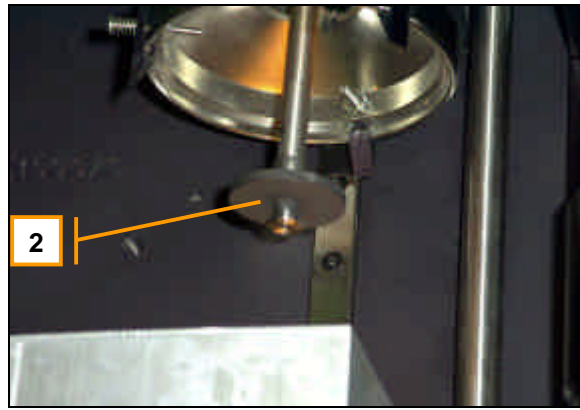


Figure 38: Calibration Tip

Calibration Procedure:

1. Remove the covers from the camera lens and light housing (Fig. 17) and install the calibration plate (1) onto the board support.
2. Remove the nozzle and vacuum tip (Fig. 29) and install the calibration tip (2). Adjust the optics train stop according to Figure 39 if necessary.
3. Adjust the mirror according to Figure 40 if necessary.
4. Move the head to the rough DOWN position and then adjust the Z height so the calibration tip (2) is just above the blind hole (3) in the calibration plate (1).
5. Align the calibration tip with the plate as shown in Figure 41.
6. Use the video alignment system to view the superimposed image of the tip and the hole in the plate. It is important not to allow the X and Y axes to move at this time.
7. If the tip and hole in the plate appear concentric, then no adjustment of the prism is required. If the tip and hole appear misaligned, adjust the prism according to Figures 42 and 43.
8. Replace the vacuum tip, and any covers which have been removed.

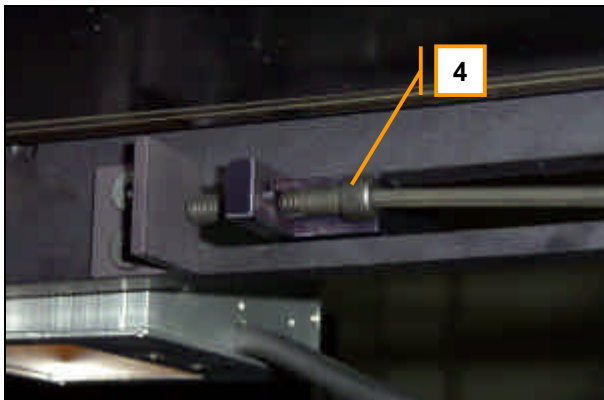


Figure 39: Optics train stop adjustment

Bring the head to its uppermost position. Move the optics train to the right until it stops (Fig. 17). Adjust the Z height so the calibration or vacuum tip is just above the top lighting and visually check that the tip is centered left to right with respect to the prism. Gage the centering of the prism with a graduated scale, if one is available. If the optics train position requires adjusting, adjust the stop screw (4) accordingly.

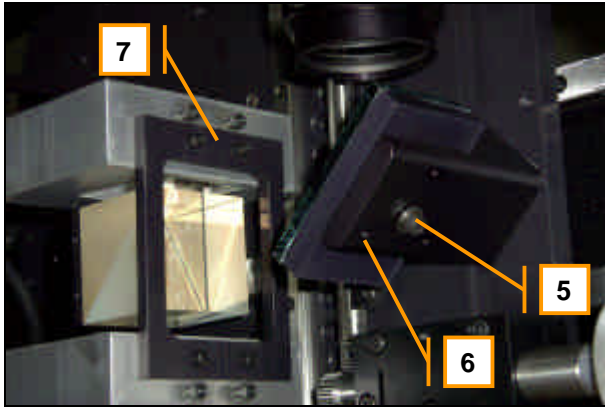


Figure 40: Mirror adjustment

Return the head to its uppermost position and turn on the LCD monitor. Move the optics train (7) to its right-most position. Loosen the locking screw (5) on the mirror bracket very slightly and, using the three set screws (6), adjust the mirror so the nozzle tip appears in the center of the video image. Adjust the lens zoom control through its entire travel to ensure the image remains centered on the screen. Re-tighten the center screw.

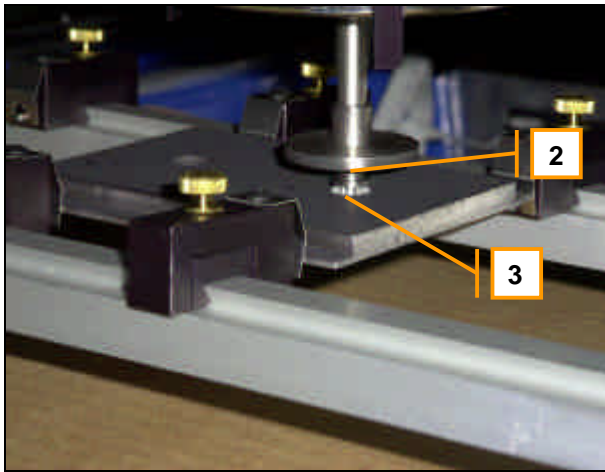


Figure 41: Aligning the calibration tip with the plate

Adjust the head down and align the calibration tip (2) with the blind hole in the calibration plate (3) using the X and Y fine adjustments. Adjust the X and Y axes so that the tip can be moved easily in and out of the hole in the Z direction.

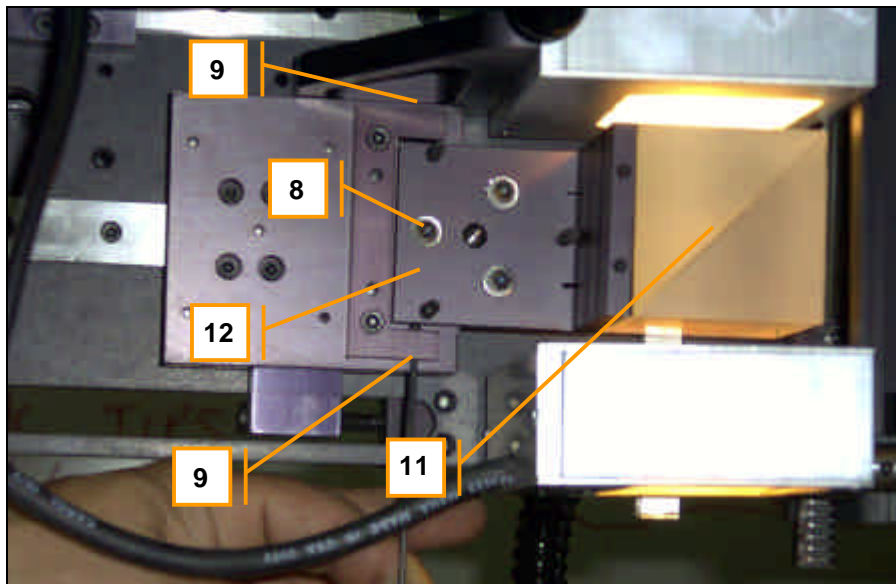


Figure 42: Prism Left/Right Image Adjustment

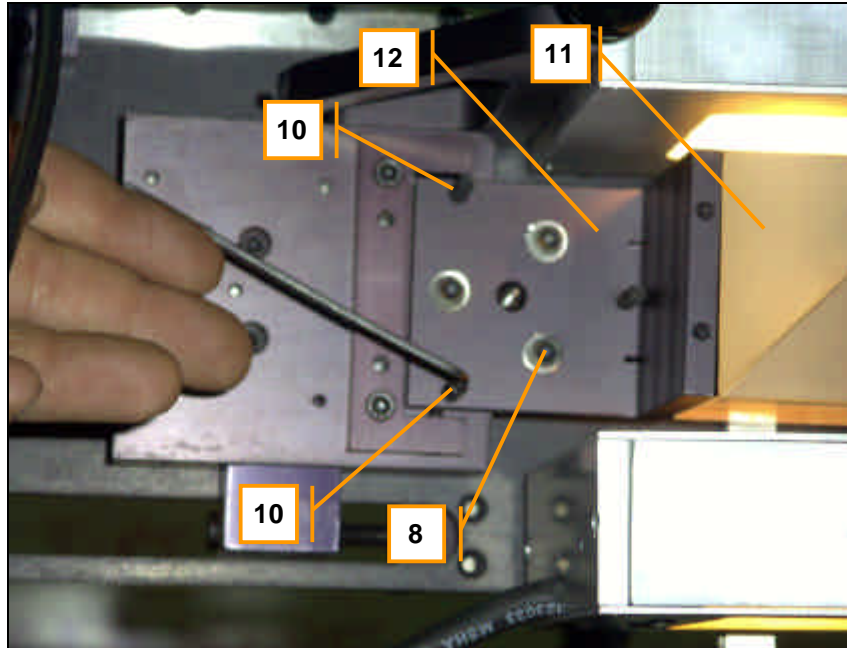


Figure 43: Prism Front/Rear Image Adjustment

To Adjust The Prism:

The prism (11) is bonded to an adjustable mount (12), which allows it to be oriented squarely to the Z-Axis. This can correct any optical image misalignment observed during the calibration procedure, above. Do not adjust the prism mount for any reason, unless the above calibration procedure indicates you should do so. Slightly loosen the three socket head cap screws (8) on the prism bracket. To correct a left-to-right image misalignment, adjust the set screws (9) to produce the desired effect. To correct a front-to-back (top-to-bottom on video monitor) image misalignment, adjust the set screws (10) to produce the desired effect. (Note: When adjusting the set screws, loosen one and tighten the opposite one.) After accomplishing the alignment of the two images, gently tighten the three socket head cap screws on the prism bracket. Watch the video image as the screws are tightened to ensure that the images stay aligned.

7.0 HMI Software Guide

FR-1418 FRONT PANEL OPERATION

POWER-ON & RUNNING A RECIPE

First application of power:

--PLEASE WAIT--

Unit says:
"American Hakko Rework System"

AMERICAN HAKKO
REWORK SYSTEM

REV X

Note: The current software revision (X) is displayed on the right side of the screen.

Unit shows recipe ## is loaded
and ready to run by pushing <START>
(or push <MENU> to get main menu).

RUN INSTALL...
PRESS <START>

RUN
READY

Note: ## indicates recipe # which is ready to run.

MAIN MENU

From the "RUN READY" screen...
push the <MENU> keys to get additional
menu choices:

RUN MODE...
PRESS <START>

RUN
READY

Note: Mode indicates either install or remove.

Use the MENU UP, MENU DN keys
to navigate from MENU to MENU.
Push <MENU> to select the choice shown.

Select "CHANGE TO INSTALL OR
REMOVE" screen to toggle between install
and remove modes.

CHANGE TO *MODE*?
<^><v> OR <MENU>=YES

--OR--
<STOP> TO EXIT

Note: Mode indicates either install or remove.

Select "LOAD NEW RECIPE"
to go to a screen where a new Recipe #
can be chosen.

LOAD NEW RECIPE ##?
<^><v> OR <MENU>=YES

--OR--
<STOP> TO EXIT

Select "EDIT/TEACH SETTINGS"
to Edit or Teach a Recipe.

EDIT/TEACH SETTINGS?
<^><v> OR <MENU>=YES

--OR--
<STOP> TO EXIT

Select "SETUP/DIAGNOSTICS"
to enter Setup Mode (pgm password)
or run Diagnostics.

SETUP/DIAGNOSTICS?
<^><v> OR <MENU>=YES

--OR--
<STOP> TO EXIT

Select "MANUAL MODE"
to run the bottom heaters manually.

MANUAL MODE?
<^><v> OR <MENU>=YES

--OR--
<STOP> TO EXIT

Select "RAMP & HOLD MODE"
to control the bottom heaters based
on a desired set point temperature
and an actual thermocouple reading.

RAMP & HOLD MODE?
<^><v> OR <MENU>=YES

--OR--
<STOP> TO EXIT

LOADING A NEW RECIPE TO RUN

From MAIN MENU, select "LOAD NEW
RECIPE". Use the SET UP, SET DN keys
to increment/decrement the recipe #.
Push the <SET> key to accept the choice.

#00=RECIPE NAME
<^><v> OR <SET>=ENTR

Note: The unit holds 100 (#00-#99) recipes in non-volatile memory.

ENTERING THE PASSWORD

Use the SET UP, SET DN keys to enter
the 1st digit of the password and push <SET>
Repeat until all 6 password digits are entered

PASSWORD? (6 DIGITS)

Note: The system default password is 123. You must push <SET> 3 times to serve as the last 3 digits.

If the Password was incorrect, push the
<MENU> key to try again.

PASSWORD INCORRECT
<MENU> TO TRY AGAIN

--OR--
<STOP> TO EXIT

If the Password was correct, push the
MENU DN key to begin.

PASSWORD ACCEPTED
<v> FOR CHOICES

--OR--
<STOP> TO EXIT

EDITING A RECIPE

From MAIN MENU, select “EDIT/TEACH SETTINGS” and enter the password

PASSWORD? (6 DIGITS)

When the password is entered & accepted (see ENTERING THE PASSWORD) the unit asks if you want to Edit Settings Push the <MENU> key to say yes.

EDIT SETTINGS?
<^><v> OR <MENU>=YES

--OR--
<STOP>=EXIT W/O SAVE

When Editing a recipe, use the MENU UP and MENU DN keys to skip fields you don’t want to change. When changing a field, use SET UP and SET DN to change the value, then push the <SET> key to enter the value.

Edit the recipe name using SET UP, SET DN keys to change the 1st digit, then push <SET> Repeat process to enter all 16 digits. All 16 digits must be entered with the <SET> key

EDIT NAME (16 DIGITS)

EDIT HEAT 1 SETTINGS

Note: Manual displays default values.
Note: PH = Preheat

Edit HEAT 1 Top Temp using SET UP, and SET DN. Push <SET> to enter the value.

PH TOP TEMP =250C
<^><v> OR <SET>=ENTR

Edit HEAT 1 Air Flow using SET UP, and SET DN. Push <SET> to enter the value.

PH AIR FLOW =MED
<^> OR <SET>=ENTER

Edit HEAT 1 Teach Target using SET UP, and SET DN. Push <SET> to enter the value.

PH TEACH TRGT=120C
<^><v> OR <SET>=ENTR

Edit HEAT 1 Time using SET UP, and SET DN. Push <SET> to enter the value.

PH TIME MM:SS 01:30
<^><v> OR <SET>=ENTR

Edit HEAT 1 Zones using SET UP, and SET DN. Push <SET> to enter the value. Repeat for both zones.

PH ZONES = 1 2
<^><v> OR <SET>=ENTR

Edit HEAT 1 Bottom Heat % using SET UP, and SET DN. Push <SET> to enter the value.

PH HEAT PERCENT 80%
<^><v> OR <SET>=ENTR

EDIT HEAT 2 SETTINGS

Note: Manual displays default values.

Note: SK = Soak

Edit HEAT 1 Top Temp using SET UP,
and SET DN. Push <SET> to enter the value.

SK TOP TEMP =300C
<^><v> OR <SET>=ENTR

Edit HEAT 1 Air Flow using SET UP,
and SET DN. Push <SET> to enter the value.

SK AIR FLOW =MED
<^> OR <SET>=ENTER

Edit HEAT 1 Teach Target using SET UP,
and SET DN. Push <SET> to enter the value.

SK TEACH TRGT=175C
<^><v> OR <SET>=ENTR

Edit HEAT 1 Time using SET UP,
and SET DN. Push <SET> to enter the value.

SK TIME MM:SS 01:00
<^><v> OR <SET>=ENTR

Edit HEAT 1 Zones using SET UP,
and SET DN. Push <SET> to enter the value.
Repeat for both zones.

SK ZONES = 1 2
<^><v> OR <SET>=ENTR

Edit HEAT 1 Bottom Heat % using SET UP,
and SET DN. Push <SET> to enter the value.

SK HEAT PERCENT 70%
<^><v> OR <SET>=ENTR

EDIT HEAT 3 SETTINGS

Note: Manual displays default values.

Note: RF = Reflow

Edit HEAT 1 Top Temp using SET UP,
and SET DN. Push <SET> to enter the value.

RF TOP TEMP =375C
<^><v> OR <SET>=ENTR

Edit HEAT 1 Air Flow using SET UP,
and SET DN. Push <SET> to enter the value.

RF AIR FLOW =MED
<^> OR <SET>=ENTER

Edit HEAT 1 Teach Target using SET UP,
and SET DN. Push <SET> to enter the value.

RF TEACH TRGT=215C
<^><v> OR <SET>=ENTR

Edit HEAT 1 Time using SET UP,
and SET DN. Push <SET> to enter the value.

RF TIME MM:SS 01:00
<^><v> OR <SET>=ENTR

Edit HEAT 1 zone using SET UP,
and SET DN. Push <SET> to enter the value.
Repeat for all zones.

RF ZONES = 1 2
<^><v> OR <SET>=ENTR

Edit HEAT 1 Bottom Heat % using SET UP, and SET DN. Push <SET> to enter the value.

RF HEAT PERCENT 60% <^><v> OR <SET>=ENTR

EDIT COOL 1 SETTINGS

Edit COOL 1 Air Flow using SET UP, and SET DN. Push <SET> to enter the value.

CL AIR FLOW =LOW <^> OR <SET>=ENTER
--

Edit COOL 1 Time using SET UP, and SET DN. Push <SET> to enter the value.

CL TIME MM:SS 00:30 <^><v> OR <SET>=ENTR

When you are done editing, push the <STOP> key. If you have made any changes, the unit asks if you want to:
Exit & Save = <MENU> key or...
Exit without Saving = <STOP> key

EXIT & SAVE CHANGES? <^><v> OR <MENU>=YES --OR-- <STOP>=EXIT W/O SAVE
--

RUNNING THE RECIPE

Push <START> to run the recipe.

Note: The following screens are displayed as the unit progresses through a cycle.

HEAT 1	<table border="1"><tr><td>T3=XXX T1=XXX 00:00 00:00</td></tr></table>	T3=XXX T1=XXX 00:00 00:00	<table border="1"><tr><td>01 RUN HEAT 1</td></tr></table>	01 RUN HEAT 1
T3=XXX T1=XXX 00:00 00:00				
01 RUN HEAT 1				
HEAT 1 (alternate screen)	<table border="1"><tr><td>T3=XXX T1=XXX T2=XXX TCHXXX</td></tr></table>	T3=XXX T1=XXX T2=XXX TCHXXX	<table border="1"><tr><td>01 RUN 00:00</td></tr></table>	01 RUN 00:00
T3=XXX T1=XXX T2=XXX TCHXXX				
01 RUN 00:00				
HEAT 2	<table border="1"><tr><td>T3=XXX T1=XXX 00:00 00:00</td></tr></table>	T3=XXX T1=XXX 00:00 00:00	<table border="1"><tr><td>01 RUN HEAT 2</td></tr></table>	01 RUN HEAT 2
T3=XXX T1=XXX 00:00 00:00				
01 RUN HEAT 2				
HEAT 2 (alternate screen)	<table border="1"><tr><td>T3=XXX T1=XXX T2=XXX TCHXXX</td></tr></table>	T3=XXX T1=XXX T2=XXX TCHXXX	<table border="1"><tr><td>01 RUN 00:00</td></tr></table>	01 RUN 00:00
T3=XXX T1=XXX T2=XXX TCHXXX				
01 RUN 00:00				
HEAT 3	<table border="1"><tr><td>T3=XXX T1=XXX 00:00 00:00</td></tr></table>	T3=XXX T1=XXX 00:00 00:00	<table border="1"><tr><td>01 RUN HEAT 3</td></tr></table>	01 RUN HEAT 3
T3=XXX T1=XXX 00:00 00:00				
01 RUN HEAT 3				
HEAT 3 (alternate screen)	<table border="1"><tr><td>T3=XXX T1=XXX T2=XXX TCHXXX</td></tr></table>	T3=XXX T1=XXX T2=XXX TCHXXX	<table border="1"><tr><td>01 RUN 00:00</td></tr></table>	01 RUN 00:00
T3=XXX T1=XXX T2=XXX TCHXXX				
01 RUN 00:00				
COOL 1	<table border="1"><tr><td>T3=XXX T1=XXX 00:00 00:00</td></tr></table>	T3=XXX T1=XXX 00:00 00:00	<table border="1"><tr><td>01 RUN COOL 1</td></tr></table>	01 RUN COOL 1
T3=XXX T1=XXX 00:00 00:00				
01 RUN COOL 1				
COOL 1 (alternate screen)	<table border="1"><tr><td>T3=XXX T1=XXX T2=XXX</td></tr></table>	T3=XXX T1=XXX T2=XXX	<table border="1"><tr><td>01 RUN 00:00</td></tr></table>	01 RUN 00:00
T3=XXX T1=XXX T2=XXX				
01 RUN 00:00				

Push any key to exit this screen.
or wait 5 seconds

CYCLE DONE... ELPSD = 00:00	01
--------------------------------	----

TEACHING A RECIPE

From MAIN MENU, select EDIT/TEACH SETTINGS and enter the password.

PASSWORD? (6 DIGITS)

When the password is entered & accepted (see ENTERING THE PASSWORD) the Unit asks if you want to Edit Settings. Push the MENU DN key to get the teach screen.

EDIT SETTINGS? <^><v> OR <MENU>=YES --OR-- <STOP>=EXIT W/O SAVE
--

Push <MENU> at the teach screen to run the Teach Mode. The unit will run normally except TCH will show on the LCD instead of RUN, and the times will be taught based on TCH actual temp reaching Teach Temp. (see Running A Recipe)

RUN TEACH MODE? <^><v> OR <MENU>=YES --OR-- <STOP>=EXIT W/O SAVE

When you are done using Teach Mode, push the <STOP> key. If you have made any changes, the unit asks if you want to: Exit & Save = <MENU> key or... Exit without Saving = <STOP> key

EXIT & SAVE CHANGES? <^><v> OR <MENU>=YES --OR-- <STOP>=EXIT W/O SAVE
--

SETUP/DIAGNOSTICS

From MAIN MENU, select SETUP/DIAGNOSTICS and enter the password.

PASSWORD? (6 DIGITS)

When the password is entered & accepted (see ENTERING THE PASSWORD), the Unit asks if you want System Setup. Pushing <MENU> from this screen allows you to program a new password. Push MENU DN and it asks if you want diagnostics.

SYSTEM SETUP? <^><v> OR <MENU>=YES --OR-- <STOP> TO EXIT

Pushing <MENU> from this screen puts you into the Diagnostic Mode.

DIAGNOSTICS? <^><v> OR <MENU>=YES --OR-- <STOP> TO EXIT
--

SYSTEM SETUP: (PROGRAMMING A NEW PASSWORD)

Use the SET UP, SET DN keys to select the 1st digit of the new password and push <SET> to enter it. Repeat until all 6 password digits are entered.

PGM 6 DIGIT PASSWORD:

After all 6 digits are entered, this screen is shown. Push <MENU>key to Exit & Save the new password, or push <STOP> to Exit without saving.

EXIT & SAVE CHANGES?
<^><v> OR <MENU>=YES

--OR--
<STOP>=EXIT W/O SAVE

DIAGNOSTICS

The state of the four input lines can be viewed on the LCD readout by pushing <MENU> at this screen.

Or push MENU DN to select next diagnostic menu choice.

TEST INPUTS?
<^><v> OR <MENU>=YES

--OR--
<STOP> TO EXIT

The four output lines can be tested using the LCD readout by pushing <MENU> at this screen.

Or push MENU DN to select next diagnostic menu choice.

TEST OUTPUTS?
<^><v> OR <MENU>=YES

--OR--
<STOP> TO EXIT

The four thermocouple inputs can be tested using the LCD readout by pushing <MENU> at this screen.

This is the last diagnostic choice. If you push MENU DN again, it starts over with inputs.

TEST THERMOCOUPLES?
<^><v> OR <MENU>=YES

--OR--
<STOP> TO EXIT

TESTING THE INPUTS

The LCD shows the state of the inputs. Push <STOP> to stop the input testing.

IN0=0 IN1=0 IN2=0
IN3=0 <STOP>=EXIT

TESTING THE OUTPUTS

Use the SET UP, & SET DN to move the cursor to the four outputs shown on the LCD. Push <MENU> to toggle the output state. Push <STOP> to stop the input testing.

OUT0=0 OUT1=0 OUT2=0
OUT3=0 <STOP>=EXIT

TESTING THE THERMOCOUPLES

The LCD shows the thermocouple temps.
Push <STOP> to stop the thermocouple testing.

XXXX	XXXX	XXXX
XXXX	<STOP>=EXIT	

MANUAL MODE

Note: Manual Mode is a bottom heat only mode.

Manual mode runs the bottom heaters manually. Push <MENU> to manually change bottom heat parameters.
Push <STOP> to stop Manual Mode.

TCH=XXX TC2=XXX ZNS=1 2 50%	MANUAL 00:00
--------------------------------	-----------------

Edit bottom heat zones using SET UP, and SET DN. Push <SET> to enter the value
Repeat for all zones

ZONES = 1 2 <^><v> OR <SET>=ENTR

Edit bottom heat percent using SET UP, and SET DN. Push <SET> to enter the value

HEAT PERCENT = 50% <^><v> OR <SET>=ENTR
--

RAMP & HOLD MODE

Note: Ramp & Hold Mode is a bottom heat only mode.

Ramp & Hold Mode runs the bottom heaters according to a temperature set point. and TCH actual. Push <MENU> to adjust the set point as well as the bottom heat parameters.
Push <STOP> to stop Ramp & Hold Mode.

TCH=XXX TC2=XXX SETPOINT=250C	R_HOLD 00:00
----------------------------------	-----------------

Alternate display in Ramp & Hold Mode.

T1=XXX T2=XXX ZNS=1 2 50%	R_HOLD 00:00
------------------------------	-----------------

Edit bottom heat Zones using SET UP, and SET DN. Push <SET> to enter the value.
Repeat for all zones

ZONES = 1 2 <^><v> OR <SET>=ENTR

Edit bottom heat percent using SET UP, and SET DN. Push <SET> to enter the value
(this is the highest percent used)

HEAT PERCENT = 50% <^><v> OR <SET>=ENTR
--

Edit bottom heat set point using SET UP, and SET DN. Push <SET> to enter the value

BOTTOM TEMP =XXXX <^><v> OR <SET>=ENTR

FAULT MODE

If you run the machine with no air pressure, you will receive this error message. Push <MENU> to clear the message and try again.

FAULT... NO AIR <MENU> TO CLR FAULT
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