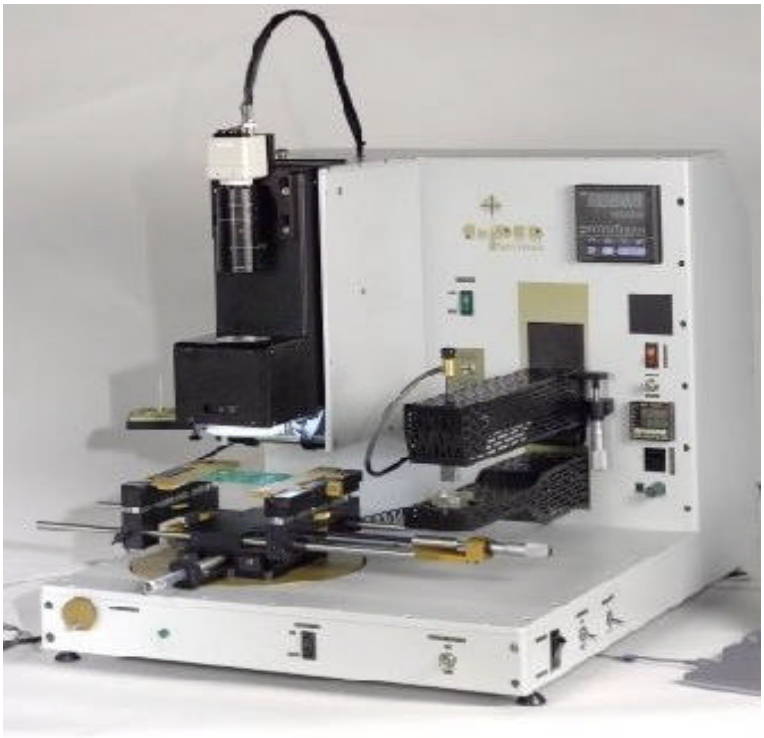
Automated Production Equipment, Inc.

Sniper II SMT/BGA/Chip Scale Placement and Rework System

7007-5001

OPERATOR'S MANUAL

Revision XVI January 25, 2002



IMPORTANT! PLEASE READ THE FOLLOWING STATEMENT

The responsible body shall be made aware that if the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

1. **Introduction**

2. **Getting Acquainted**

3. **Installation, Setup and Vision Test Operation**

4. **Reflow Setup and Reflow Test Operation**

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1. INTRODUCTION

The A.P.E. SNIPER II^{TM} SMD-7007-5001 combines precision visual alignment with top and bottom preheat/reflow for complete rework processing of SMT, BGA, and Chip-Scale components. The SNIPER II is the next generation of rework systems, designed for the new world of chip-scale packages, as well as traditional fine-pitch SMDs. Its split-

vision alignment utilizes the latest technology in optical engineering and alignment design. It provides absolute control in positioning all ultra-fine pitch QFP, CSP, and µBGA components, together with large ceramic or plastic BGA devices. The heart of the vision system is the Dichroic Alignment Beam Image Splitter (DABIS), a contemporary innovative refinement in imaging dual fields to enhance and complement the processed image.

The heating system incorporates all the best features of the popular and proven Flo-Master^{TM} high power/low temperature rework system, providing controllable top and bottom heating, preheating capability, and the ability to create, store, and run thermal profiles, recreating those used in the initial manufacture of the circuit assembly.

Using the SNIPER II, an operator may remove a defective component, accurately position a replacement component within an accuracy of +/- 0.001", and safely solder attach that new component to the PCB. The ability to preset positioning parameters, as well as to create and store complex thermal profiles, ensures precise repeatable processing and a robust process, component after component, and board after board.

Therefore the SNIPER II brings together two powerful systems - the Sniper II placement unit with its DABIS split imaging optics, and the Sniper II heating and rework system, to create one complementary synchronous unit - the SNIPER II^{TM} SMD-7007-5001.

This manual is designed and intended for personnel actually using the SNIPER II, and contains an overview of the machine itself, how to unpack, inspect, assemble, and power up the unit. It also contains a brief overview of the rework process, and how to use the SNIPER II to remove and replace defective components, and how to accomplish light assembly. The operator will learn how to create, test, store, retrieve, and modify thermal profiles for removal, and to program the controller. If you have questions regarding the use of the machine that are not answered in the manual, contact the A.P.E. factory at (305) 451-4722 or email techsupport@ape.com. We would appreciate your comments, and they will help us create a better manual for you, your co-workers, and your colleagues in the field.

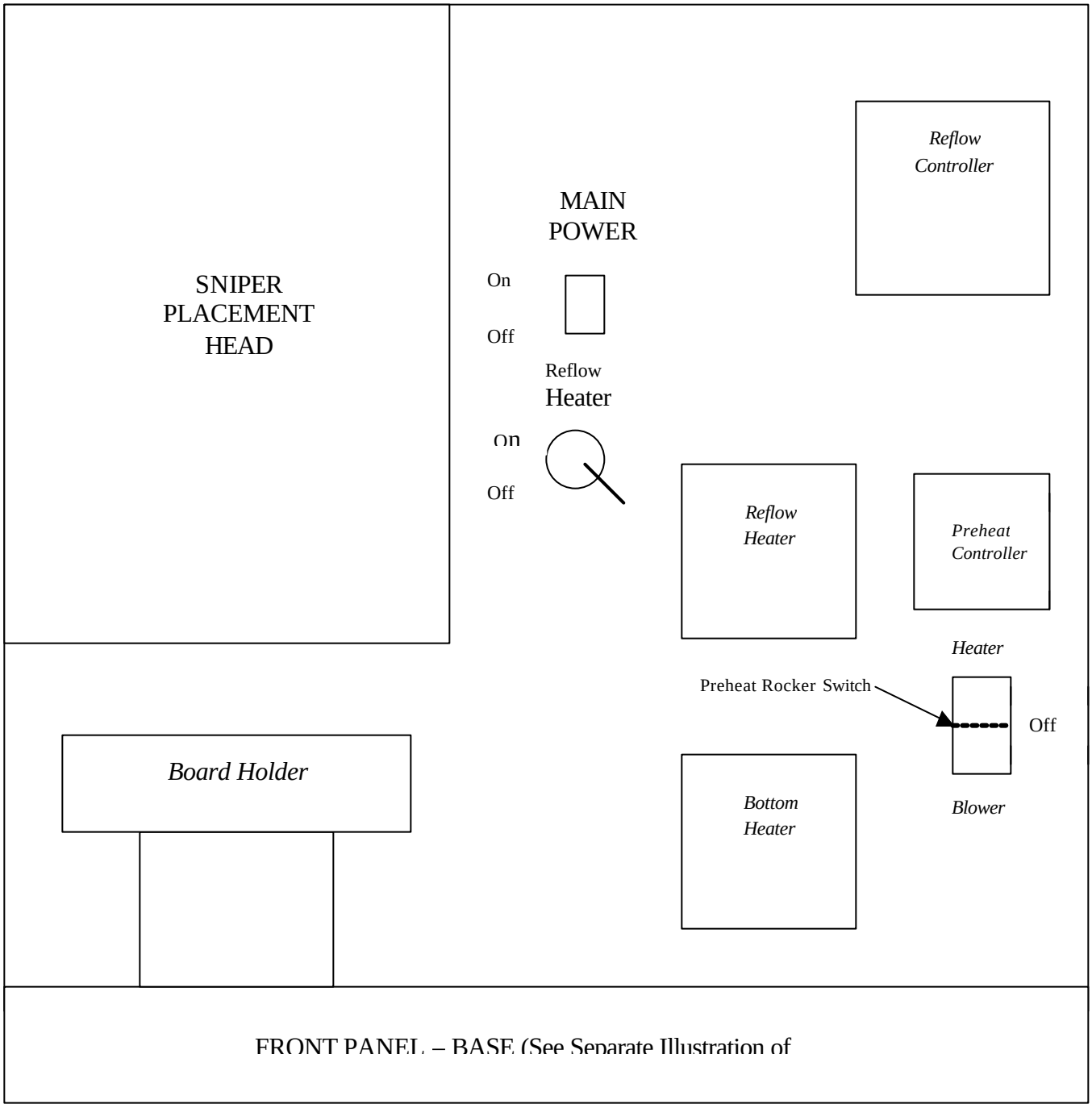
Lastly, *Please read and review this manual in its entirety before assembling or operating the SNIPER II!*

The SNIPER II is a sophisticated, though user-friendly system; and although the system has been assembled and factory-calibrated, some final light assembly and calibration is necessary before operating the SNIPER II. The SNIPER II is a highly precise unit, and should be checked and fine-tuned by the operator for his or her own particular application before operating. This manual will tell you how to do it right, in easy-to-follow steps.

2. GETTING ACQUAINTED

Key Operational Features of the SNIPER's Vision System:

- ***Superimposed Images:*** The DABIS system allows the contact array of the component to be viewed from the underside and superimposed over an image of the contact land pattern on the PCB or substrate.
- ***Precision Component Alignment:*** Precision micrometers align the two lead patterns and a Camera focus provides for high magnification position alignment.



SNIPER (Alignment & Placement) and Sniper Flo-Master (Heating/Reflow Soldering) Controls: Front View

Figure 1

- ***Automatic Positioning:*** Once registered, the component is automatically positioned by pneumatic control, lifting the vision system clear of the placement vector and allowing a precise Vertical Placement Drive (VPD) to accurately orient the component to the contact land pattern.
- ***Macro Imager:*** For large QFP, high pin count components and some large BGA devices, it is necessary to use the Macro Image Scope, a precision mirror Second Stage Splitting Imager, which simply slots into place between the camera and the DABIS allowing only two of the diagonals (four (4) sides) of the component to be brought into view, by adjustment of a precision mirror
- ***Repeatable Alignment:*** The component is first supported in a template nest, seated within a Reflex Register. The register is then moved to a location under the vacuum pickup on the Vertical Placement Drive (VPD). Thus providing repeatable selection from the same registration every time.
- ***Stable, Precise Placement:*** When placing delicate components to fine tolerances, emphasis on stability of engineering is paramount. The reinforced VPD provides a stable final positioning operation, and is adjustable in the Z-axis for pressure sensing.
- ***Final Positioning:*** A selection of Vacuum Pickup Barbs has been designed to ensure adequate clearance of adjacent components and obstacles around the positioning area. Consequently, the length of each barb is 0.80" (20.3mm), which should provide sufficient depth of penetration.
- ***Vacuum Board Holder:*** The SNIPER II includes a standard 12" x 16" (305 x 406mm) vacuum-actuated PCB holder, which quickly glides into position on a Kevlar Base. Precision micrometers facilitate adjustment in the X and Y-axis, and the Rotary feature of the table provides Theta (rotational) adjustment. Optional Kits are available for larger board types.
- ***Template Nest:*** A template nest aligns the component package within the register and protects the device during the pickup operation.
- ***Vacuum Pickup:*** The Vacuum Pickup Barb supports the component during the registration alignment and automatically releases the component during placement.
- Key Operational Features of the Sniper II SMD-7007-5001-NAV Rework System:
- ***High Power/Low Temperature Rework:*** The Sniper II is a fully integrated dual top and bottom heating system designed to handle all BGAs, military-type boards, and commercial applications requiring an efficient level of power versus temperature.
- *Preheat:* A bottom "Preheat" and "In-Process" heat source ensures stability of board temperature, reducing the necessary top reflow temperature, thereby following a more precise profile structure for the component undergoing rework.
- *Independent Preheat Control:* The bottom heat source is an independently controlled integral system with its own "preheat" and "process time" control. An

important feature is the power available, optimizing the energy performance flowing below and into the work piece, preventing unnecessary overheating.

- *Temperature Profiles:* Any number of Computer generated Profile Pattern Recipe's (PPR) may be created and stored in a computer disk file. Sixteen (16) PPR's are available for recall using the Controller only, (not connected to a PC).
- *Mechanical Control:* The Sniper II has been engineered to operate on a standard workbench and includes a Board Holder with built-in X-Y axis for precise alignment.
- *Linear Air Delivery:* The Heat Acceleration Chamber and delivery Nozzle Block are designed to provide maximum air spin of the airflow through the nozzle, ensuring minimal temperature differences.

Using the SNIPER II SMD-7007-5001, you can achieve the following:

- Remove a defective component
- Align, Place, and Solder attach a component - either as a replacement for a defective one, or as a single-site post-assembly soldering operation, or prototyping operation
- Remove a defective component, clean and prep the site, then Align, Place, and Solder attach a replacement component - a complete rework operation.

3. SNIPER II INSTALL AND SETUP.

1. Unpack and check for missing parts or damage

2. It's important to make sure that a strong, rigid, and stable bench or table supports your SNIPER II system. It is also very important that the unit be level.

3. Install the Air Pressure Regulator at the rear of the Sniper II, but do not connect shop air at this stage.

4. Remove the metal shipping/alignment pin, which secures the VPD, it can be located through the vertical placement assembly (Optics Unit). It is very tight and some force is required to remove (pull out).

5. **<u>Do not connect</u> the Power Supply cord from the mains outlet to the rear of the machine at this stage.** Ensure all switches are in Off position as follows:

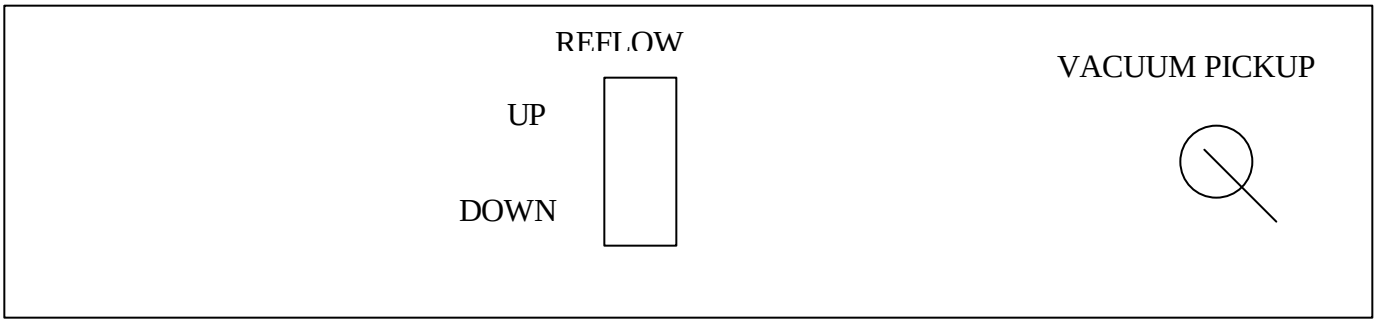
5.1. Power "Off" Green Switch

5.2. Reflow Red Switch under top Controller to "Off"

5.3 Bottom Preheater is controlled by a black three stage switch located at bottom right, switch to Center "Off" Position.

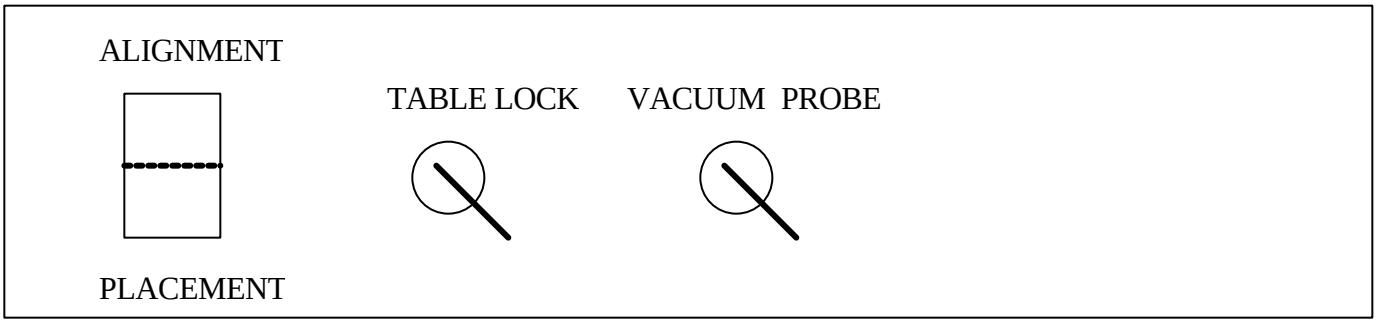
5.4. Reflow "Continuous/Foot Pedal, set to "Foot Pedal"

Figure 2



SNIPER front of base., Reflow"Z" rocker switch moves the upper arm of the Sniper Flo-Master either up or down to the part, as needed.; Vacuum Pickup toggle "switches on or off the SNIPER component pickup(NOT the Sniper Flo-Master reflow pickup).

Figure 3



Sniperbase, right-hand side, Press black rocker switch to the" Alignment" position for viewing a component prior to alignment and placement. Move to the "Placement" position for actual part placement. "Table Lock" vacuum-locks the board holder assembly in place; this is an on/off toggle switch. "Vacuum Probe" turns on reflow vacuum for part removal..

5.5. Alternative Reflow Vacuum Pick Up Switch on right side, set to "Off/Down"

5.6. Table Lock, set to "Off/Down"

5.7. VPD Switch, set to "Alignment", switch in "UP" position.

5.8. VPD Vacuum Pick Up, set to "Off/Down"

5.9 Reflow Z Axis, set to "Down"

6. Install Camera using the U Mounting Bracket and four (4) shoulder screws provided. Plug in the BNC Coax video cable located at the top of the Sniper II and connect to "Video Out" of the Camera. Connect Camera power connector to "Power In" of the Camera. The

acrylic Safety Shield may now be installed, but it is recommended that the shield be left until the machine is ready for normal 0peration.

7. Position Monitor near Sniper II. Connect 6ft (1.83 meters) coax cable from Monitor (Video in) and (Video Out) at rear of Sniper II. Connect Monitor power cable to one of the Auxiliary Power Outlets at rear of Sniper II.

8. Assemble the Halogen Light (Page 15) and connect to one of the 120V outlets on the bottom rear panel (Page 14). Unpack and set up the Board Carrier Workholder, and make sure that its coiled vacuum cord is attached to both the Vacuum Barbs on the workholder and on the front face of the machine.

Component Reflex Register. This swings under the VPD so that the DABIS vacuum pickup can "capture" the component and place it on the PCB.

9. Plug in the power cord provided to a 120V source (120V Machines only) main power connection, uses a "computer" style 3-prong power cord.

10. Swing the Reflex Register out from under the VPD, to prevent damage on the initial downward cycle and ensure that the Emergency Stop Switch is assembled and in the ON position.

11. Connect air to the Air Regulator installed at the back of the machine and adjust to 80 PSI.

12. Turn on the Green Power switch and wait (one) 1 minute.

13. Switch Alignment/Placement to the Placement position. The VPD should now lower to Placement position. The motion should be smooth and not jarring.

14. If the VPD does not actuate, it may be necessary to adjust the "Soft Start" in the rear of the machine. An inspection hole can be found to the right of the "Air In", on the back panel. A brass adjustment screw can be seen through the hole off center to the left. With the machine on, use a 3/8" flat Screwdriver, through the inspection hole to adjust. Adjust fully clockwise and then back 1/8". When turning the main power off-on, a "pop" should be heard, and then a delayed "pop." The delay can be 5-15 seconds dependant upon adjustment. If there is no delayed pop then the Soft Start will need to be set up as per the instruction in Section 18 of this Manual. An APE Engineer or representative should only perform this adjustment.

Tools Required:

Allen Wrenches

Pliers, Smooth Needle Nose

Screw Drivers 1/8, 3/8 Flat, & 1 + 2 Phillips,

9/16" & 5/8" Wrenches

VISION TEST OPERATION USING TEST PCB AND DUMMY BGA

This test will enable the user to become familiar with selecting a component, aligning to the PCB and placement of the component.

Mount a sample or test board in the board carrier workholder. Next, place a DUMMY component - appropriate to the PCB footprint where the component will be placed - right side up (or connection-side down) in the Reflex Register.

Make sure that you press the ALIGNMENT rocker switch, located on the right-hand side of the base. The Vacuum Barb will be in the "Component View", upper or "Rest" position. Swing the Register over and under the VPD. Now move the rocker switch to the "Component Placement" position. The Vacuum barb assembly will come down, fully extended, to the top of the dummy component.

Use the Height adjustment Screw on the Reflex Register to adjust the Register beyond the extended length of the Vacuum Pick Up. Then switch on the Vacuum toggle on the front of the base of the unit. Gently adjust the Reflex Register Upward until the vacuum easily picks up the component. Press the Alignment side of the rocker switch, and the component will be lifted up into the view position. Now swing the Register out of the way. ALWAYS RAISE THE VPD BEFORE LOCATING THE REGISTER, DO NOT TRY TO REMOVE THE REGISTER UNTIL THE VPD IS RAISED, THIS COULD RESULT IN DAMAGE TO THE LOWER LIGHT.

Make sure that the PCB in the board holder is NOT under the VPD! Press the "Component Placement" side of the rocker switch, and the pickup rod will extend again. Lift the cover/shield up over the DABIS assembly. Gently slide the Workholder under the placement rod with the vacuum held component. Now adjust the two Z-axis knobs on the Workholder so that the component barely touches the board. The two Z-axis knobs provide a close tolerance for gentle resting of the component to its complimentary footprint. Now press "Component View" again, so that the VPD returns to the rest position, for Up/Down viewing of component and Footprint.

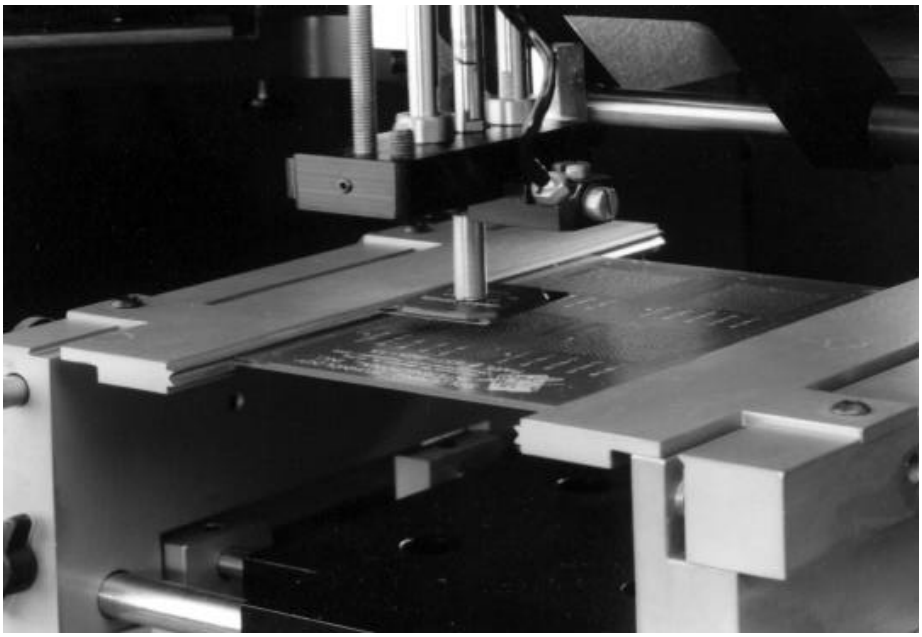
Congratulations! You have now set up your SNIPER II for pickup and placement. Now with the Workholder under the DABIS, line up the balls or leads on the bottom of your component, with the corresponding pads on the PCB, use the focus on the Camera for adjustment. Once you have completed the "rough" alignment, switch the TABLE LOCK toggle on the right-hand side of the base to "lock" the Workholder in place. Use the MICROMETERS on the Board Workholder to adjust the X and Y alignment, and then make the final theta adjustment. Now press "Component Placement" and place the component; switch off the VACUUM PAD toggle. Then press "Component View" to lift the pickup and DABIS assembly up and out of the way.

Now make sure that the REFLOW "Z" switch on the front of the machine is DOWN. Turn the TABLE LOCK toggle OFF and slide the Workholder over to the Reflow Heaters, around from the front so that the bottom heater can slide beneath the board. The MICROMETER adjustment next to the back of the top heater arm controls how far DOWNWARD the arm will travel to bring the heater nozzle to the component. Adjust

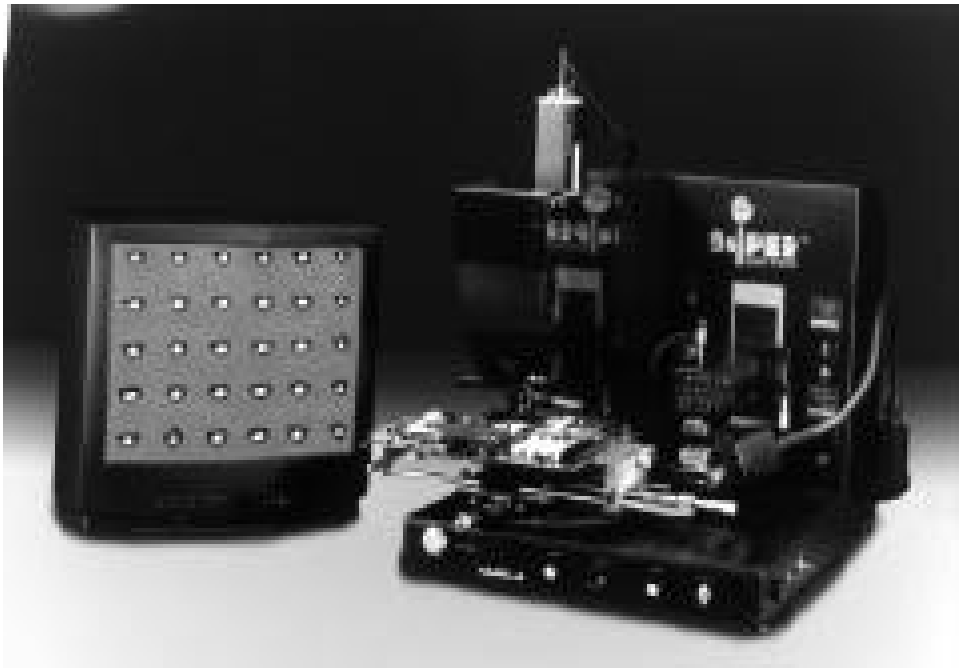
the nozzle UPWARD so that it clears the board and component. Now press the UP side of the REFLOW "Z" switch, and when the arm moves up, slide the Workholder/board/component directly under the nozzle. Press the DOWN side of the switch. Use the micrometer to adjust the clearance between the nozzle outlet and the component. The proper clearances are described later in this manual in the Sniper II section, so read on!

In a nutshell, then, here is the procedure for alignment and placement:

1. Place a board in the Workholder, and the appropriate component in the Reflex Register.
2. Switch on VACUUM PAD.
3. Move the Reflex Register under the VPD (which should be in the rest or "Alignment" switch position).
4. Press "Placement". The VPD should extend to pick up the component.
5. Press "Alignment". The component will be picked up for viewing.
6. Move the Reflex Register out of the way.
7. Move the board and workholder under the VPD. Rough align.
8. Press TABLE LOCK toggle.
9. Focus and Fine align.
10. Press "Component Placement". VPD will place the component on the board.
11. Switch off VACUUM PAD.
12. Press ALIGNMENT. VPD will move up out of the way, leaving the component properly placed on the PCB.
13. Turn off TABLE LOCK.
14. Press REFLOW "Z" UP. The Sniper II top arm will move up and out of the way.
15. Move the workholder and board into position between the Sniper II heaters.
16. 15 Press REFLOW "Z" DOWN. Sniper II arm will move down to the component. You are now ready to reflow the component into place!



SNIPER II "Placing" a BGA on a circuit board. Proper alignment and system adjustment is critical to achieving excellent results!



SNIPER II with color monitor showing properly aligned BGA component and pads on a PCB.

4. SNIPER II REFLOW SETUP AND OPERATION

The Sniper II is an advanced, programmable hot air-based rework system for removing and replacing BGA, Micro BGA, Chip Scale Package (CSP), QFP, SMD, and essentially all types of surface mounted components from all types of circuit boards.

The Sniper II uses directed forced hot air to gently heat electronic components at a rate of 12.7 CFM to the temperature required to "reflow" or melt the solder connecting their leads to the circuit board. This forced air is provided by an internal blower and heated by a special resistive element in a tubular chamber. A similar system is used for bottom heating to preheat the circuit board prior to actuating the top reflow heat cycle and to maintain constant temperature during reflow.

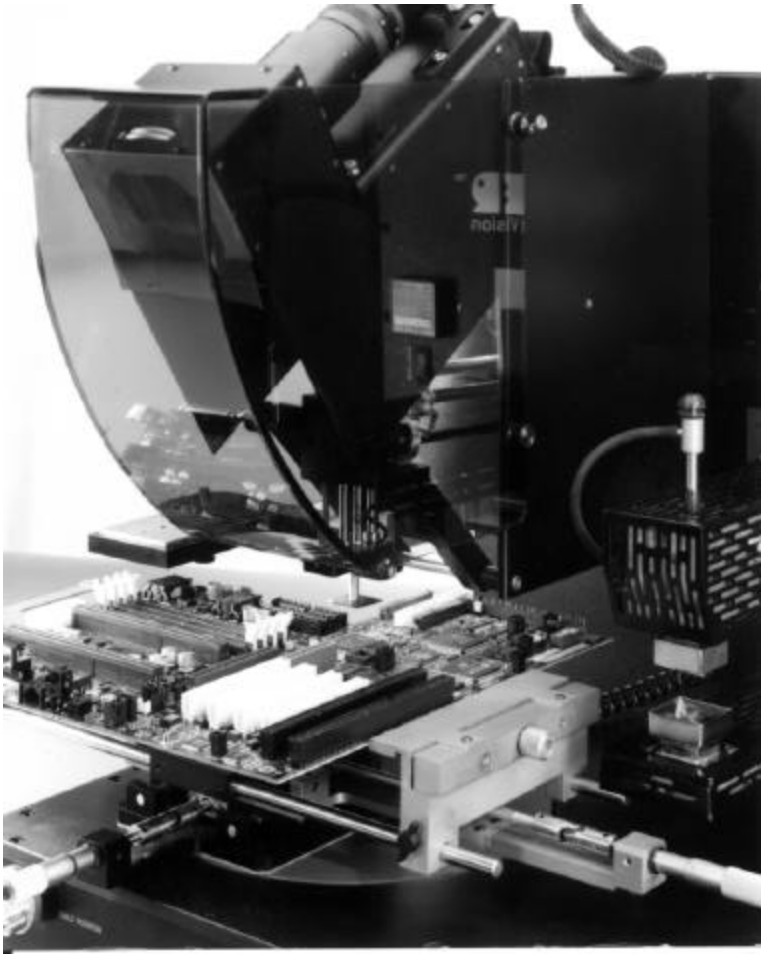
Simply described, heated air is directed through a nozzle to the surface and lead attach areas of the target component. Many different interchangeable nozzles are available, because there are many different sizes and styles of components. The goal is to heat the target component, hence the use of a nozzle approximately matched to the size of the component. Once the component has reached the desired temperature and the solder has melted, a vacuum pickup device lifts the component off the circuit board. Microprocessor-based programmable storage controllers control the temperature of the heated air - as well as the rate that it heats up. These are essentially the "brain" of the unit.

The Sniper II incorporates a vacuum pump to pick up components at the nozzle, once they have reflowed. This pickup is not to be confused with the SNIPER II placement; it is simply the means of safely removing a defective component from the assembly at the point of reflow. Using a vacuum pickup is much safer than trying to physically pry the component off, whereby delicate pads on the board can be damaged. The Sniper II vacuum pickup gently removes the component once all the solder connections are safely liquid.

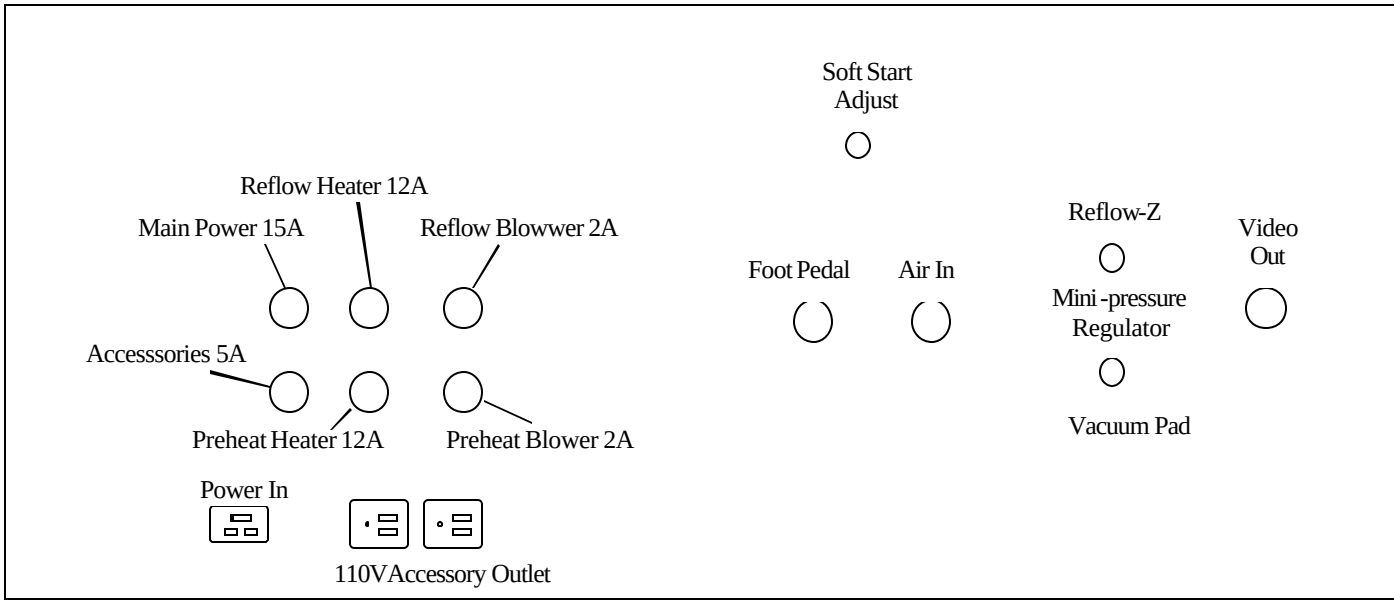
Controls for the Sniper II are located on the front of the unit. These include the following:

- Main Power On/Off
- Top Heater Controller
- Top Heater Reflow Switch
- Bottom Heat Controller
- Bottom Reflow Cycle Switch, dedicated three (3) position black switch with top position for the Heat cycle, a middle OFF position and a bottom position for Cool Down

- Six (6) Reflow Nozzles are also provided, together with an SMT Tool Kit and extra RTV Silicone Rubber Vacuum Pick Up Cups, these parts should be inventoried and stored where they can be retrieved without delay or difficulty.



SNIPER II, shown placing a BGA component on a circuit assembly. The PCB is held in the board holder, which can be "locked" into position once the component has been aligned with the pads on the board. Once the BGA has been accurately placed, it can be soldered in place using the Sniper II heating system shown on the right.



Take note of the back of the SNIPER II. The following illustration shows the back panel of the SNIPER II, and the location of the various connections and elements:

Fuses:

Reflow Blower: 2 Amp Part # H0175
Reflow Heater: 12Amp Part # H0139
Main Power: 12 Amp Part # H0139
Accessories: 5Amp Part # H0176

Note the ground socket on the right-hand side of the front panel. The socket is a ground only to the cabinet of the unit and cannot expose the operator to machine operating current.

Take note of the back of the SNIPER II. The illustration shows the back panel of the SNIPER II, and the location of the various connections and elements, listed as follows:

Your SNIPER II is equipped with a black gooseneck halogen lamp to illuminate the work area. This lamp attaches to the right hand side at the rear of the cabinet. Four tapped holes are provided in the table for this purpose. Power is provided by an 110V outlet at bottom rear panel of the Sniper II.


Halogen Lamp

Your SNIPER II is supplied with a PC Board Holder, capable of holding up to a 24" x 32" PCB, but with a standard 12" x 16" fitted. Board adapters can be attached to the PCB edge holder bars to secure larger boards. Make gross adjustments by loosening the set screws

(Black knobs, as shown) and retightening when the desired width is reached; use the tensioning adjustment (as shown) to adjust the amount of pressure needed to hold the board in place.

Select the appropriate heater nozzle from those supplied with your unit. Locate the underside of the top or upper heater nozzle. Note the machined circular socket, and four retainer screws attached to the nozzle.

Now note the shape of the nozzle, and the circular top with four indents. Nozzles mount bayonet-style onto the heater head. Align the four semicircular holes in the nozzle top with the four retainer screws in the heater head. Push the nozzle in and then turn so that the nozzle cannot drop out. The nozzle does not "lock" in; it can be turned continuously if need be, or until the holes line up with the screws again and the nozzle can be removed. Practice a couple of times, and then try inserting, removing nozzles several times without looking. Learn to "feel" the location of the screws and machined receptacle with the nozzle. Keep in mind that during operation, the nozzle will be hot, so a hot pad, or an inverted cool nozzle socketed, either outside or inside the hot one, can be used to capture the nozzle for change. The Bottom Heater Head will accept either one of the four (4) Pre-Heat Nozzles supplied with the unit. Select one that's appropriate for the area to be bottom heated and fit as above.

5. POWER UP AND TEST ROUTINE - SNIPER II

NOTE: NEVER OPERATE THE SNIPER II WITHOUT A NOZZLE IN PLACE AND NEVER SWITCH OFF THE SYSTEM ABOVE 120 F (48 C) IN EITHER OF THE RED DISPLAYS

1. Once the SNIPER II has been assembled and plugged into a power source, it is ready for power-up and testing. First ensure that a nozzle has been inserted in the top heater arm, as described in the previous paragraph. Depress the Main Power On/Off switch to the ON position. The green-colored switch will illuminate, indicating that power is ON.

2. Bottom Preheat Cycle:

2a Turn on the black Bottom Preheat Cycle Switch, from the middle (OFF) position to the bottom Blower position, the Controller will light up and indicate "SELF TEST" as it momentarily runs through its test sequence. The unit's blower will immediately begin operating, and will blow a stream of cool air up through the nozzle. The upper ORANGE L.E.D. indicator will indicate ACTUAL AIR TEMPERATURE in degrees Fahrenheit or Celsius, dependent upon Factory set up. The bottom GREEN L.E.D. will indicate STOP. The Upper Position of the switch will make the bottom pre heater ready for control by the top reflow controller. Once the bottom switch position has been checked the pre heat switch should be left in the top position.

3 **Top Reflow Heat Cycle**

3a 8100-P300 Sixteen (16) Segment Controller

Ensure that the "Reflow Mode Selector Switch" on the left of the machine is in the "Reflow Continuous" Up position, depress the Red Top Heat Reflow Control Switch to ON, the Controller will light up and indicate that it's running through a test sequence. The unit's blower will immediately begin operating, and will blow a stream of cool air down through the nozzle. To test the function of the 8100-P300, go to Section 7 of this manual and enter the Test Example. Once the Test Example is entered, press "Run". The Controller's Upper Display will indicate ACTUAL nozzle air temperature as it ramps and the operator will be able to "feel" the heated air coming out the nozzle.

3b Be careful not to put fingers or hands on or too near the nozzle, as it can injury. The controller will commence gradually heating the air stream to the Profile Pattern Recipe (PPR), Set Points displayed in the lower Display. **CAUTION HOT AIR CAN CAUSE INJURY**.

3c Once the PPR is completed the Controller 8100-P300 will automatically reset ready for a further cycle.

4. With the Main Power switch still ON, test the vacuum pump. To do this, switch the Vacuum toggle switch to "Internal Pump" a sound from the Vacuum Pick Up will indicate that the vacuum venturi is operating. Depress the Vacuum Pick Up Assembly plunger and feel the bottom of the suction cup with a smooth flat surfaced object. There should be suction, indicating that vacuum is present.

At this point, you have completed the assembly and initial power-up and test of the basic Sniper II system. Now this manual will explain its method and theory of operation, and will show you how to use, program, and maintain your Sniper II, as well as how to assemble and use the various options available with the system.

6. BOARD HOLDER, NOZZLE SELECTION AND REWORK PROCEDURES

The standard adjustable circuit Board Holder can accommodate boards up to 12" wide. Most PCBs will be smaller. An expansion Kit takes the Board size to 24" width. The Board Holder consists basically of two supports with adjustable edge-holding fingers, resting independently on a precision micrometer adjusted XY platform. Both supports can slide back and forth across the adjustment bars, and can be fixed in position by tightening black-knobbed friction screws as shown on Page 19.

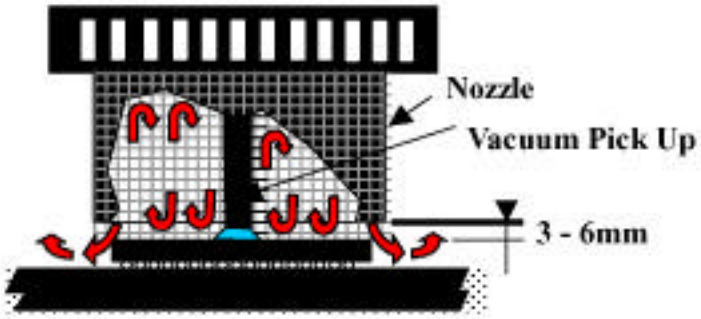
The inside edges of the Board Holder supports are grooved so that thin boards may be held securely without dropping. The Board Holder features a unique adjustable gentle constant pressure clamping action designed to hold boards securely. To adjust the holder, secure the left side support of the Board Holder, using the Black Friction Knob on the front and set one edge of a board in the groove of the fixed edge holding finger. Loosen the other support by the Black Friction Knob and move the adjustable edge holder finger out to within 1/4" or so of the edge of the board. In other words, the distance between the

two fingers should be LESS than the length of the board. Now tighten the Pressure Adjust Screw on the right support and effectively “clamp” the board in place in the holder.

Some boards will be too thin and delicate for much clamping pressure. Finger supports are available for smaller boards.

Nozzle Selection

The height of the Nozzle above the component should be 1/8” to 1/4”, if there is too much space between the nozzle and the component, adjust the micrometer on the side of the Top Heater and adjust until the component is directly under the nozzle with the correct spacing for air escape.

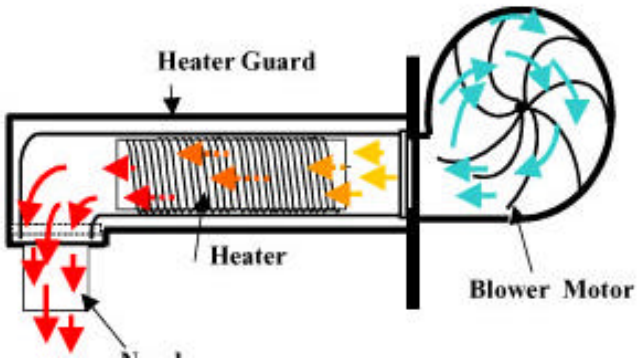


If the height of the nozzle to the component is incorrect, adjust the Z-axis micrometer for the correct distance.

Switch the “Reflow Mode Selector Switch” on the left of the machine to “Reflow Continuous.” center the component under the reflow nozzle. See Section 7 for instructions on programming the 8100-P300 Controller. In these instructions we suggest a few simple configurations, which will provide the User with a program, which will remove without damage, but it will be necessary to program according to the User’s specification. At what time the component will lift from the PCB will not be known at this stage.

Once a component has been removed, a new one must be reattached in its place. In the case of BGA components, all solder must be removed from the PCB pads and an SMT Tool Kit is provided to assist in site preparation, all tools and materials necessary are included in the kit. For standard SMT Components, such as QFP devices, surface tension has kept some solder on the pads, and the solder may resemble upside-down icicles, the pads can be *hot air leveled* if sufficient solder remains rather than removing all the solder and replacing, before a new component can be soldered in place. A documented procedure is available from APE at tech@apecorp.com. It should also be understood that as the Sniper II reflows at low temperatures, the original solder can be reused without adding solder.

Replacement of components involves three separate sub-procedures: *preparation* of the board to receive the component, such as hot air leveling or adding



additional solder to the pads, if so desired or required; *placement* of the component and aligning it properly on the pads; and *reattachment* of the component by heating up the leads and lead attach areas to melt the solder and reestablish the physical and electrical connections between the component and the circuit board, i.e. create a new solder joint. *Never operate the Sniper II without a nozzle in place, as this will significantly reduce the life of the heater!*

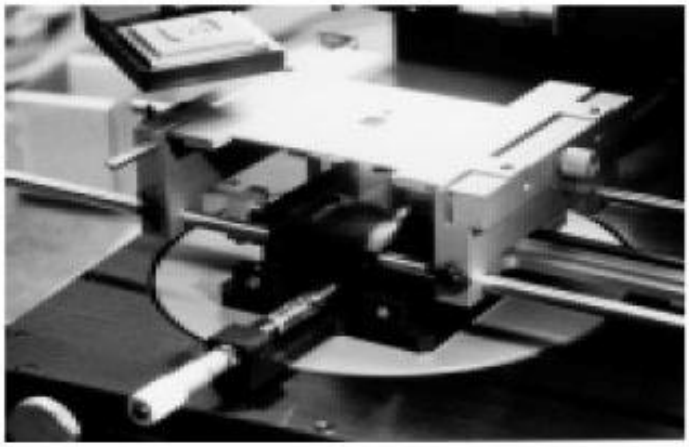
The above Illustration shows the scheme of air flow through the Sniper II - from the blower through the heater tube, into the heater head, and down and out through the nozzle. A close-up of the nozzle area illustrates how the heated air flows down through the nozzle; over the total area of the component, and directly onto any lead attaches area. As the air contacts the component, leads, pads, and solder joint, it gives up its thermal "load" of heat, transferring it directly or indirectly to the component and the solder joints. The spent air, now cooler, moves up and away from the surface of the board.

A vacuum connection between the Circuit Board Workholder and the SNIPER II base supplies the vacuum power to lock the workholder in place during component placement. Make sure that it is properly connected at all times!

The "Z" motion micrometer adjustment adjusts how far DOWN the top heater travels when the "Z" motion switch on the front of the SNIPER II base (See Figure 2) is actuated. Using this adjustment, the user can accurately set the clearance between the end of the nozzle and the component being processed.

The Sniper II heats with *directed forced heated convection*. Heated air (convection) is directed at the component and solder joints by the nozzle, forced by the blower. The operation and the selected air temperature is assisted by the bottom heater, which has been used to either preheat the circuit board prior to reflow and/or to apply bottom heat during the reflow process, allowing a lower top temperature to be used thus reducing any stress to board and components.

When bottom heating is finished, make sure that the 3-position black rocker switch on the front of the machine is in the COOL position,(Bottom) not the central OFF position. Not allowing the heater to cool down after the process can damage the heater.



The Board Workholder is shown beneath the SNIPER II. The platen can be rotated either using the knob on the front of the SNIPER II base (visible at extreme left, lower corner of photo), or theta can be adjusted on the Board Holder in later revisions. The workholder can move freely between the SNIPER II/VPD placement unit and the Sniper II heater, or can be vacuum-locked into position using the TABLE

In the diagram below, **Figure 1** shows the nozzle too close to the component; the convection cannot escape the nozzle, and therefore, fresh heated air cannot reach the component continuously. In **Figure 2**, the nozzle is too far away. Too large a gap between the nozzle and the component will allow the hot air, to escape from under the

nozzle without effectively heating the component or solder joints. It will also create a laminar (or horizontal) flow across the circuit board, heating other components that you don't want to heat. It will also result in longer removal times, resulting in unnecessary heating of adjacent component and the circuit board.

Figure 1 **Figure 2** **Figure 3**

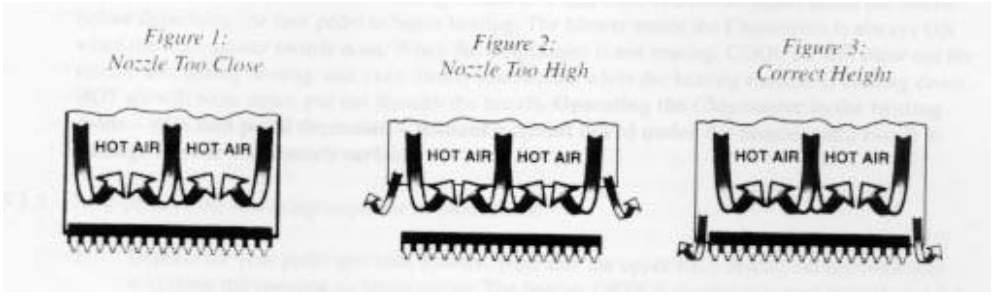


Figure 3 shows the correct height relationship of nozzle to component, with approximately 1/8" to 3/8" gap for airflow escape. 1/8"-3/8"

The same problem of heating adjacent areas occurs when nozzles that are too large or too small are used.

Figure A below shows a nozzle too large for the component. Adjacent areas are being heated that should not be, including small chip caps.

Figure B shows a too-small nozzle being used. Only the center of the top of the component is being effectively heated. Air flows out across the flat surface of the component, heating adjacent components. The BGA or component being heated does not achieve a uniform heating across the total area of the component, therefore, heating time is prolonged because heat must migrate *through* the component itself at a slower rate to reach the lead attach area.

Figure C shows the correct nozzle for use with the component.

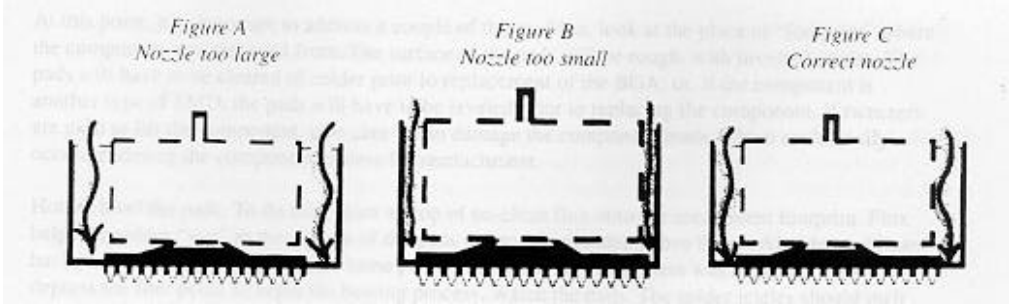


Fig A **Fig B** **Fig C**

Now that we have selected a board and component to rework with a top reflow nozzle suitable for the component and with the board secured in the Board Holder, which is in position with the Preheat Heater under the board, set the nozzle to the correct height above the component by the micrometer height adjuster on the right side of the Top Reflow Heater, the Heater should be in the down position selected by depressing the front "Reflow Z"control switch: we are now ready to remove the component from the circuit board.

Component Removal

1. Switch the black Bottom "Reflow Cycle Switch" to the top position, the bottom blower will turn on and the Controller will perform a Self Test and then follow the Ramp profile to the preheat temperature selected.

2. Depress the "ENTER" and "DOWN" keys on the controller to zero time, then depress the Preheat Timer Button to activate the Timer, time will start counting to record the preheat cycle, example 2 minutes, the desired result is, warp control and/or component/board stabilization, pre heat time will differ per type of application.
3. The most simple Profile Pattern Recipe (PPR) example is PPR #1, which is programmed at reaching 450 F in 60 seconds, then holding 450 for three minutes. The other PPR's increase in segments, and the User should determine the one most suitable.

4. The top blower is always ON when the red Top Reflow Control Switch is on. When the Sniper II is not heating, COOL air will blow out the nozzle. But during heating, and even shortly afterwards, while the heating element is cooling down, HOT air will blow down and out through the nozzle**. Operating the Sniper II in the heating mode, without a circuit board under the nozzle could result in harm to the operator.**

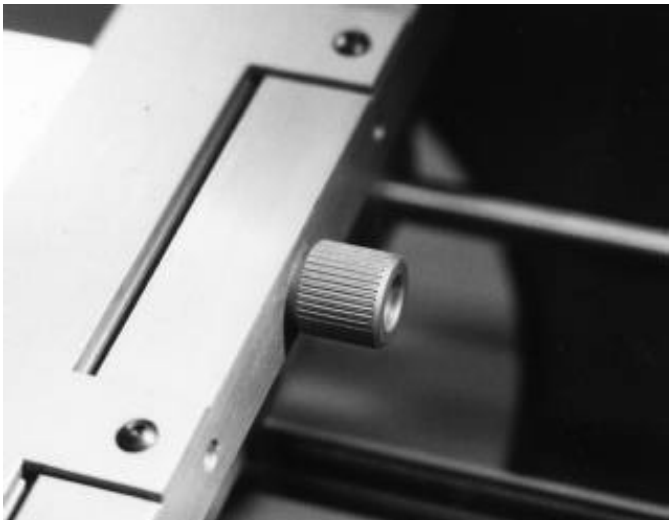
5. Once the program is entered, press the "Run" key on the Controller Note that the upper RED display on the controller will show the ramping air temperature (PPR). The bottom display will display the Set Point of each segment.

6. When the Top Controller RED display reaches (example) 250 F, turn on the vacuum pump. Depress the Vacuum Pick Up Assembly plunger in the heater head until it touches the component top. Remove your finger. The plunger should STAY DOWN, held to the component by the force of the vacuum.

7. Continue the program until the component *lifts off* the board, picked up by the vacuum plunger. Note the segment and the time that the segment had left to run. From this information the User can calculate the correct PPR to establish.

8. Allow the board to cool a little then raise the Top Heater Head by depressing the "Reflow Z" switch; slide the board holder out from under the nozzle. The component will still be held up by the vacuum plunger, either grip the component using tweezers and remove the component, or carefully allow the component to drop onto a flat surface close to the nozzle by turning the vacuum off.

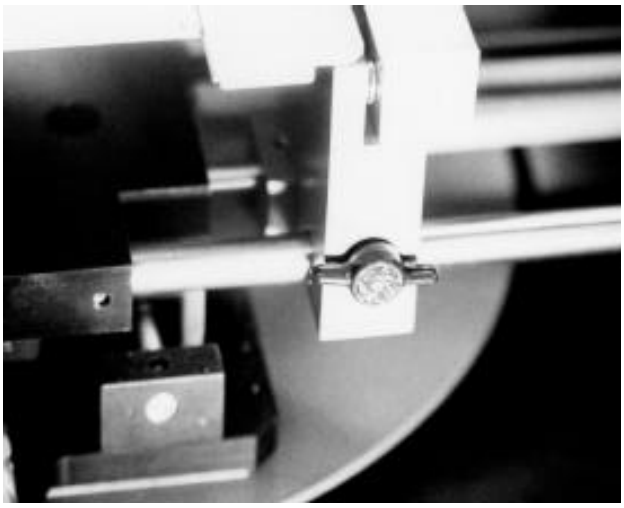
At this point, it's important to address a couple of things. First, look at the place or "footprint" where the component was removed. The surface of the pads will be rough, with inverted icicles. The pads will have to be cleared of solder prior to replacement of the BGA; or, if the component is another type of SMD, the pads will have to be leveled prior to replacing the component. If tweezers are used to lift the component, take care not to damage the component leads, which could easily occur, rendering the component useless for reattachment.



The orange anodized Pressure Adjust on the right-hand side of the Circuit Board Workholder allows the user to "tension" the board-gripping feature of the workholder.

For non-BGA components, Hot air level the pads. To do this, place a drop of no-clean flux onto the component footprint. Flux helps the solder "wet" to the surface of the pads and to other solder. Move the Board Holder and component contact area back under the top heater nozzle and lower the Heater. Then press "Run" on the Controller to return to the reflow temperature and time. Watch the pads. The solder icicles should melt and the solder should form nicely rounded "pillow" shapes, and become very shiny. This process should take less than the time to remove the component as the mass of the component is removed, it may not be necessary to preheat or apply bottom heat during this operation. Release the foot pedal and allow the board to cool for a minute or so.

Remove the board and Board Holder from beneath the nozzle. Now clean the contact pads using the Pad Prep Pen and Cleaning Brush supplied in the SMT Tool Kit or by other means available, it is also recommended to finally clean with an Antistatic wipe, now change to the no-clean paste flux supplied in the kit, and apply to the pads spreading evenly using the flux brush, the paste flux will provide better wetting: place the component on the pads using the Sniper II Split Vision System. Once the component or BGA has been properly placed in position on the prepared circuit board, move the Board Holder back under the nozzle, lining it up carefully, repeat the preheat cycle operation for the same time period as removal. Edit the PPR by adding 10-15 seconds to the Reflow removal segment time.



These Black friction Knobs allow gross adjustment of the width of the Circuit Board Workholder.

When a PPR has completed the system will switch the Top Controller off, the component is reflowed. molten solder surface tension ensures that the leads line exactly on their respective pads. Switch the bottom heater to the Cool Down position, allow the solder to cool and solidify before moving the board and Board Holder.

7. SMD-7007-5000 CONTROLLER SYSTEM

The Sniper II "brain" is a sophisticated microprocessor-based patented time/temperature controller. The programmable storage controller allows the user to create, duplicate, test, store, and instantly recall rework profiles, named Profile Pattern Recipes (PPR). Programming may either be directly with the Controller keypad, or by a Computer Graphical Interface Program supplied with the Sniper II.

Operating Procedure for APE Sniper II Rework Profile Controller

A: Model 8100-P300

The 8300-P300 Profile Controller provides sixteen (16) Profile Pattern Recipes (PPR), each containing up to sixteen (16) segments. Each of the 16 segments of a PPR comprise a target temperature and a time period, either to ramp or to soak, therefore the entire process can contain several temperature levels, including cool down if so required.

The Controller also controls the rework sequence and automatically switches off the reflow heater once the end of the cycle has been reached. The operator depresses a "RUN/HOLD" key to restart the program.

The Sniper II Controller may be programmed by the keypad on the front panel of the Controller or by using the optional "Windows" software, via an RS-422/RS432 interface. This feature enables the system to run without a computer or optionally to take instructions directly from a Pentium PC, using Windows 95/ 98 or 2000.

This procedure only provides instruction on the operation and programming of the Controller by the keypad. See Section 14 for the Graphical Display Window software.

B: Determining a profile:

Several factors need to be considered in the creation of a rework profile:

- Type and construction of Component
- Size of component
- Component thermal specification
- Size and construction of the PCB and the area in which the component to be reworked is located.
- Warping characteristics
- Thermal Threshold of PCB
- Metallurgic structure of the solder (Eutectic, high temperature or low temperature?)

Then there are also considerations of throughput and the pressures to rework safely but within a certain time. This factor is often more important in volume production environments where a profile similar to the Convection oven is impractical.

Once these factors have been considered a profile can be created.

Usually the smaller the component, the less complicated the profile and the quicker the rework time. In our example the application is expected to take approximately 3 minutes.

A micro BGA could take from 1.25 minutes to 2.30 minutes. Note that the actual time for your rework will depend upon observation during trials. We recommend the optional Thermal Tracer Kit 8300-9660 for sensor tracing during development. It is not necessary to waste a large number of components as the behavior of a single component can be tested a number of times and the final stage of reflow time extended or reduced as required.

C: Examples:

To assist the User, we have listed four (4) programming examples as a guide that can be used to initially help remove a component. The most simple of these is Profile Pattern Recipe (PPR) # 1. Then increasing in difficulty to PPR #4.

In all our examples we have taken a typical FR4 PCB of 10" x 8"(254 x 203mm) with 4 layers, reworking a Perimeter BGA of 225 sphere contacts, using eutectic 63/37 solder throughout the PCB.

D: Method for developing a Profile Pattern Recipe.

1. First sketch a graph of the profile that you consider may achieve the desired reflow condition. The original convection oven profile pattern may assist in doing this. A good place to start is as described in PPR # 3 to initially ramp the temperature to 250 F, 125 C over 20 seconds and then soak for a similar period. Increase again to 350 F, 175 C with a second soak and then increase to as high a temperature and for as long a period that reflow occurs.

This is only a suggestion, however for each application the optimum profile pattern will need to be developed. For large components, the profile should be designed such that during the final soak, the PCB and Chip are near the eutectic condition, at that point the temperature should be ramped so that reflow occurs within a short period not allowing the component to cascade. Also do not forget that the bottom heater, although not covered in this procedure is an important function of the overall process and the temperature and preheat time should be carefully considered. In all four of our examples we would suggest a bottom temperature of 175 C and preheat for 30 seconds, prior to operating the reflow controller. Continue to run the bottom heater throughout the operation.

PPR Examples 1, 2 and 4, provide alternatives, which may be more suitable.

Method:

1. Select the Profile Pattern number; up to sixteen16 profile patterns may be created. This is the profile # that will be recalled for the operation.
2. Enter the profile pattern segments, these will be labeled as "Level" and Time", segments 1-16.
3. Mark the end of the profile pattern, when the final segment has been included.
4. Reset ready for testing the profile pattern operation.

Make any necessary changes to the profile pattern after testing.

Diagram of profile pattern example # 3:

1. Profile Pattern # 1

2.	Ramp Temperature Level	125 C	Segment 1
3.	Ramp Time	20 seconds	
4.	Soak Temperature Level	125 C	Segment 2
5.	Soak Time	20 seconds	
6.	Ramp Temperature Level	175 C	Segment 3
7.	Ramp Time	25 seconds	
8.	Soak Temperature Level	175 C	Segment 4
9.	Soak Time	40 seconds	
10.	Ramp Temperature Level	250 C	Segment 5
11.	Ramp Time	20 seconds	
12.	Soak Temperature Level	250 C	Segment 6
13.	Soak Time	30 seconds	
14.	Ramp Temperature Level	150 C	segment 7
15.	Ramp Time	30 seconds.	

Total Time of process including cooling: 3 minutes and 5 seconds

E: Controller functions and instructions on Profile Pattern Recipe (PPR) entry:

1. Turn on system and await completion of “Self Test”
2. Profile Pattern Selection and segment programming for Example PPR # 3.:
3. Press “PTN””
4. Select PPR # to be set, using Up/Down keys.
5. Press “SET”, to save
6. Press “SET” to enter PPR
7. Press “SET” to enter “Edit” Mode
8. Using Up and Down keys, enter the first segment, first level temperature, in example # 3, this is 125 C.
9. Press “SET”
10. Using Up and Down keys, enter first segment ramp time of 20 seconds.

11. Press “SET”

12. Using Up and Down keys, enter the second segment, second level temperature of 125C

13. Press “SET”

14. Using Up and Down keys, enter the second segment soak time of 20 seconds.

15. Continue to enter all 7 segments in the same manner.

16. After the 7th segment ramp time of 30 seconds has been entered press “SET”, which will take you to the 8th level, now press the “PTN/END” key. This will display “Pend” and finalize the profile pattern at the end of the 7th level and end the program. If this is not entered the profile pattern will continue through all 16 segments. Note that for the Computer Graphical Display software the PTN/END should not be entered.

17. Press “RESET” key.

F: Editing a profile pattern:

To edit the above example, simply retrace the segments as detailed above and make any required change to a value. To increase the number of segments in a profile pattern, continue pressing “SET” to the “Pend” display and press the “PTN/END” key, this will clear the end of program command and enable you to add to the program. Press the “PTN/END” key again when finished and press the “RESET” key to end the sequence.

G: To test or to execute the Program:

1. Select Desired profile pattern

    a. Press “RESET”
    b. Press “PTN/END”
    c. Press Up and Down key to select the Pattern # to execute
    d. Press “SET” or “PTN/END” key to make settings effective.
    e. Press “RUN/HOLD” to execute the profile pattern.

(Note it is not possible to edit a profile pattern, while the program is executing.

The operator need only press the “RUN/HOLD” key to execute a subsequent rework profile pattern, once the pattern has been selected.

G: Intervention of Program Execution:

If the Controller is in the “UNLOCK” mode (see Section G) it is possible to use the following functions when executing a program.

1. Pressing the “RUN/HOLD” key during the profile pattern execution temporarily stops the program. The set – value at that time is maintained during the program control. Pressing the “RUN/HOLD” key again, starts the program from the temporary stop.

2. Pressing the “STEP/R, SET” key for more than 1 second during the profile pattern execution moves the program to the next segment in the pattern.

G: Setting Key Lock Function:

The setting key lock function is used to lock the “SET” and “STEP/R, SET” keys. Locking these keys prevents accidental or operator intervention. However it should be noted that as none of the setting modes can be recalled, the set – value cannot be checked.

1. Press “MONI/MODE” key for more than 2 seconds to change to action mode display
2. Press “MONI/MODE” key to show the setting key lock display, (UNLCK).
3. Press the Down key to set to lock (LCK), the action is effective immediately when the change is made, the UNLCK is dimmed and the LCK is lighted.

H: Changing temperature scale F/C

Caution: Changing scale will result in Engineer settings changing. See 16. Appendix A, for default settings.

1. Press “MONI/MODE” and “SET” key at same time
2. Using Up and Down key set input type to 0 (zero) for Celsius or 2 (two) for Fahrenheit
3. Press ‘SET”
4. Press “RESET”

Start Out With A “Cool” Circuit Board

It’s a general rule that, when establishing a profile, or when heating, you start out with a circuit board that is at room temperature.

A single time/temperature profile will yield the same results time after time, providing that the starting conditions are the same. Always let the circuit board cool to room temperature (or very close) before beginning the Pre-Heat and Top Reflow heating cycle.

Time Signal Output:

A "Time Signal Output" provides a method of applying a Start and Stop signal to control the Bottom Heater of the Sniper II and in conjunction with the programming of a PPR; a pre heat period can be programmed into the PPR.

The Sniper II, Bottom Heater is hard wired into the top Profile Storage Controller.

Set Up:

Action	**Visual Display**
Press "Set":	
Press "Step" hold for two seconds:	TSSET (Time Signal Set)
Select PPR # using Up and Down arrows:	Pattern 1-16
Press "Set":	01-TS (Time Signal Output)
Select 1.	
Press "Set":	01-cS (Start Segment)
Select Segment # 1 (As start Segment):	
Press "Set":	01-0N (Delay Time)
Leave at "0" (No Delay Time)	
Press "Set":	01-eS (End Segment)

Select Final Programming Segment +1:

(Example: If the desired PPR contains 6 segments, then end at Segment 7)

Press "Set":

Press "Reset"

Confirmation of "Time Signal Output" (TSO)

When the PPR is running, the PPR # 1 LED will flash indicating that the TSO 1 is operational.

Example of programming a PPR with a "Time Signal Output"

It is recommended that a top heat temperature of 2/3rds the bottom temperature is applied during a preheat process. This assists in a linear heating cycle.

Sequence Example Preheat of 175 C for 1 minute 15 seconds:

1.	Profile Pattern Recipe # 1		
2.	Ramp Temperature Level	117 C	Segment 1 (Pre Heat Start signal)
3.	Ramp Time	15 seconds	
4.	Soak Temperature Level	117C	Segment 2 (Pre Heat)
5.	Soak Time	60 seconds	
6.	Ramp Temperature Level	175C	Segment 3
7.	Ramp Time	20 seconds	
8.	Soak Temperature Level	175 C	Segment 4
9.	Soak Time	60 seconds	
10.	Ramp Temperature Level	250 C	Segment 5
11.	Ramp Time	25 seconds	
12.	Soak Temperature Level	250 C	Segment 6
13.	Soak Time	10 seconds	
14.	Ramp Temperature Level	150 C	Segment 7 (End Signal)
15.	Ramp Time	30 seconds.	

(Segment 7 would be the end of the Time Signal Output, as Segment 7 is cooling)

Total Time of process including cooling: 3 minutes and 40 seconds

Profile Pattern Examples:

Example PPR # 1:

1. Press “PTN””
2. Select PPR # to be set, using Up/Down keys.
3. Press “SET”, to save
4. Press “SET” to enter PPR
5. Press “SET” to enter “Edit” Mode
6. Using Up and Down keys enter first segment temperature of 250 C
7. Press “SET” to save
8. Using Up and Down keys, enter first segment ramp time of 60seconds.
9. Press “SET”

10. Using Up and Down keys, enter the second segment, second level temperature of 250 F

11. Press “SET”

12. Using Up and Down keys, enter the second segment soak time of 60 seconds.

13. Press the “PTN/END” key. This will display “Pend” and finalize the profile pattern at the end of the 2nd level and end the program. If this is not entered the profile pattern will continue through all 16 segments. **Note that for the Computer Graphical Display software the PTN/END should not be activated**

14. Press “RESET” key.

Example PPR # 2:

1. Press “PTN””
2. Select PPR # to be set, using Up/Down keys.
3. Press “SET”, to save
4. Press “SET” to enter PPR
5. Press “SET” to enter “Edit” Mode
6. Using Up and Down keys, enter the first segment, first level temperature 250 F.
7. Press “SET”
8. Using Up and Down keys, enter first segment ramp time of 30seconds.
9. Press “SET”
10. Using Up and Down keys, enter the second segment, second level temperature of 250 F
11. Press “SET”
12. Using Up and Down keys, enter the second segment soak time of 30 seconds.
13. Press “SET”
14. Using Up and Down keys, enter the third segment, third level temperature of 450 degrees F
15. Press “SET”
16. Using Up and Down keys, enter the third segment ramp time of 60 seconds.

17. Press “SET”

18. Using Up and Down keys, enter the fourth segment, third level temperature of 450 F

19. Press “SET”

20. Using Up and Down keys, enter the fourth segment soak time of 20 seconds.

21. Press “SET”

22. Press the “PTN/END” key. This will display “Pend” and finalize the profile pattern at the end of the 2nd level and end the program. If this is not entered the profile pattern will continue through all 16 segments**. Note that for the Computer Graphical Display software the PTN/END should not be activated.**

23. Press “RESET” key. Total Time = 140 seconds

1. **Example PPR # 3**

2. Press “PTN””

3. Select PPR # to be set, using Up/Down keys.

4. Press “SET”, to save

5. Press “SET” to enter PPR

6. Press “SET” to enter “Edit” Mode

7. Using Up and Down keys, enter the first segment, first level temperature, in example # 3, this is 125 C, 250 F.

8. Press “SET”

9. Using Up and Down keys, enter first segment ramp time of 20 seconds.

10. Press “SET”

11. Using Up and Down keys, enter the second segment, second level temperature of 125C, 250 F

12. Press “SET”

13. Using Up and Down keys, enter the second segment soak time of 20 seconds.

14. Press “SET”

15. Using Up and Down keys, enter the third segment, third level temperature of 175 C, 350 F.

16. Press “SET”

17. Using Up and Down keys, enter third segment ramp time of 25 seconds.

18. Press “SET”

19. Using Up and Down keys, enter the fourth segment, fourth level temperature of 175C, 350 F

20. Press “SET”

21. Using Up and Down keys, enter the fourth segment soak time of 40 seconds.

22. Press “SET”

23. Using Up and Down keys, enter the fifth segment, fifth level temperature of 250C, 480 F.

24. Using Up and Down keys, enter fith segment ramp time of 30 seconds.

25. Press “SET”

26. Using Up and Down keys, enter the sixth segment, sixth level temperature of 250C, 480F

27. Using Up and Down keys, enter the sixth segment soak time of 30 seconds.

28. Press “Set”

29. Using Up and Down keys, enter the seventh segment, seventh level temperature of 150C, 300 F

30. Press “Set”

31. Using Up and Down keys, enter the seventh segment cool down time of 30 seconds.

32. After the 7^{th} segment ramp time of 30 seconds has been entered press “SET”, which will take you to the 8^{th} level, now press the “PTN/END” key. This will display “Pend” and finalize the profile pattern at the end of the 7^{th} level and end the program. If this is not entered the profile pattern will continue through all 16 segments. **Note that for the Computer Graphical Display software the PTN/END should not be activated**.

33. Press “RESET” key.

34. Total Time 195 Seconds

Example PPR # 4

1. Press “PTN””
2. Select PPR # to be set, using Up/Down keys.
3. Press “SET”, to save
4. Press “SET” to enter PPR
5. Press “SET” to enter “Edit” Mode
6. Select pattern to be set, using Up/Down keys.
7. Press “SET” (this will take you to the first level of the first segment in the chosen profile pattern)
8. Using Up and Down keys, enter the first segment, first level temperature, in example # 4, this is 125 C, 250 F.
9. Press “SET”
10. Using Up and Down keys, enter first segment ramp time of 60 seconds.
11. Press “SET”
12. Using Up and Down keys, enter the second segment, second level temperature of 125C, 250 F
13. Press “SET”
14. Using Up and Down keys, enter the second segment soak time of 60 seconds.
15. Press “SET”
16. Using Up and Down keys, enter the third segment, third level temperature of 175 C, 350 F.
17. Press “SET”
18. Using Up and Down keys, enter third segment ramp time of 30 seconds.
19. Press “SET”
20. Using Up and Down keys, enter the fourth segment, fourth level temperature of 175C, 350 F
21. Press “SET”
22. Using Up and Down keys, enter the fourth segment soak time of 30 seconds.

23. Press “SET”

24. Using Up and Down keys, enter the fifth segment, fifth level temperature of 250C, 480 F

25. Press “SET”

26. Using Up and Down keys, enter the fifth segment ramp time of 60 seconds.

27. Press “Set”

28. Using Up and Down key, enter the sixth segment, sixth level temperature of 250C, 480F

29. Press “Set”

30. Using Up and Down keys, enter the sixth segment soak time of 60 seconds.

31. After the 6th segment soak time of 60 seconds has been entered press “SET”, which will take you to the 7th level, now press the “PTN/END” key. This will display “Pend” and finalize the profile pattern at the end of the 6th level and end the program. If this is not entered the profile pattern will continue through all 16 segments. **Note that for the Computer Graphical Display software the PTN/END should not be activated.**

32. Press “RESET” key

Total Time: 300 seconds.

The photo at left shows the face and features of the Sniper Flow-Master’s controller. Note the Auto Tune, Output, and Alarm indicators on the center of the controller. Note the Set, Reset, and Up and Down arrow keys, across the lower part of the controller. The two display windows are the Process (upper) window and Set Point/Timer (lower) window. All of these individual indicators will be explained

The Digital Timer - How It Works

The Sniper Flo-Master’s Profile Storage Controller includes a digital timer to help you control the rework process. The timer allows you to set a specific time for a heating cycle, or to count and record the amount of time needed to achieve a certain result. This latter feature is especially important to creating time/temperature profiles. When a specific time has been set, e.g. 60 seconds, the Sniper Flo-Master’s timer counts down to

zero once the foot pedal that begins the heat cycle has been depressed. The timer will stop at zero, even if the heating continues (foot remains on the pedal). If the timer is reset to zero, it will begin counting UP (adding seconds) once the heat cycle begins and will STOP counting once the cycle is stopped by the operator (foot pedal released). The timer will display the cycle time, i.e. 45 seconds, or whatever. Each time the foot pedal is depressed to start the cycle thereafter, the timer will count DOWN to zero from whatever that cycle time (in this example, 45 seconds) was recorded.

Whenever the Sniper Flo-Master is turned on, the controller, after going through its self-test, will automatically go to the "Operator Display." This is the menu that should be displayed at all times when the Sniper Flo-Master is running. One only goes to different menus to change heating cycle parameters. To change the time, for example, begin by resetting the timer to zero. To do this, press the UP and DOWN arrow key simultaneously. The display will flash once, indicating that the timer has been reset to zero. Now press the SET key TWICE (from the Operator Display) to reach the timer set field in the Operator Menu. Use the UP arrow key to increase time in one-second increments; hold the key in to increase time rapidly. Once the time is set, press SET to return to the Operator Display.

Setting Profile

Press the SET key once to arrive at the Profile Field, the Profile number will be displayed, the profile may be selected by using the UP or DOWN arrows for profiles 1 through 4 and pressing SET to finalize the selection. The profiles are not created in this menu, only selected by the Operator.

Setting Temperature

Setting the temperature "Set Point", or peak temperature, is easy. What you are setting is the temperature of the air coming out of the nozzle, not the temperature of the component or circuit board. The factory default setting for the Flo-Master's Top Heat temperature is 450 degrees (F), 232 C. To change the temperature, press the SET key for three seconds from the Operator Display. The lower display window will display the letters SV#. # = Profile Number, SV = Set Point, 1 = Set Point # 1. The lower display window will indicate the current Set Point. Now press either the UP arrow key or DOWN arrow key to raise or lower, respectively, the temperature Set Point. Press SET when the desired Set Point is reached.

Advanced Programming and Process Optimization

The Sniper Flo-Master's programmable Profile Storage Controller will allow the user to create and store up to four separate time/temperature profiles for instant recall and use. The controller set point and ramp time can be controlled. In ramp/soak mode, the advanced operator can not only control the rate of ramp-up, but also program in a deliberate soak time, as the Sniper Flo-Master ramps from ambient to Set Point. The procedures for doing so are described below.

A.P.E. Storage Controller Specification and Operation

Becoming Familiar With The Controller

The 8100-0xxx controller is a digital controller used to control the temperature of the rework equipment. The controller has four operating functions: **1, Manual Mode; 2. Timer function 2; 3. Timer function 1; 4. Ramp/Soak function.**

Manual Mode: RUN/STOP is accomplished by operation of the foot pedal.

Timer Function 2: Same as Manual Mode except the controller can store four (4) profiles.

Timer Function 1: Same as Timer function 2, except operation is automated. A two second foot pedal input will start RUN mode. If timer has been reset the timer will count up, and requires a second foot pedal input to STOP. If the timer is set to a time, then a two second input will start the operation and STOP will occur when the timer reaches zero.

Ramp/Soak Mode: Operation includes four (4) profiles, each having four (4) segments. Operation stars by a two second foot pedal input and STOP occurs at the end of the preset program.

Mode is selected by Pressing SET for approx. 10 seconds. ModE is displayed. Use up and down arrows to select which mode is to be operated. Hold SET for approx. 10

seconds to return to operators menu. Proceed to appropriate section for operating instructions.

Temperature Profiles:

1. PROFILE NO. 1 Profile for small dry QFPs, LCCs, and SOICs.

2. PROFILE NO. 2 208 QFP to 225 BGA in dry state.

3. PROFILE NO. 3 352 to 400 BGAs and 304 QFPs in 50% dry state.

4. PROFILE NO. 4 >508 BGA, CERAMIC components and large ground planes on Multilayer boards.

Manual Operation

Profile is started and stopped by foot pedal input. Timer will count up, if reset before or during RUN operation. Timer will count down if timer has been preset.

1. Profile setup
    a. Press Set: SV is displayed, use up and down arrows to set temperature Set Point. Factory default: 450

Press Set: rMP is displayed. Ramp time can be set from 0 to 9 minutes 59 seconds. Factory default: 0:00

    a. Press Set: TIM is displayed. Use up and down arrows to set Ramp Time. Factory default: 0:00
2. Parameter setting mode
    a. Press SET for approx. 10 seconds.
    b. ModE Set for required mode.
    c. AL1 475
    d. ATU 0000
    e. P 50
    f. I 4
    g. D 1
    h. Ar 10
    i. T 2
    j. Pb 0 Sensor correction
    k. InP 0 = K thermocouple 1 = J thermocouple
    l. UnlT 0 = C degrees 1 = F degrees
    m. AS1 0 = No alarm 1 = Process High Alarm 2 = Process Low Alarm
    n. LCK Parameter mode SV mode
    o. 0000 unlocked unlocked

p. 0001 unlocked locked
q. 0010 locked unlocked
r. 0011 locked locked
s. Press SET for approx 10 seconds to return to operators menu.

Timer Function 2

Operation is the same as Manual Mode, except there are four profiles available. Profile is started and stopped by foot pedal input. Timer will count up, if reset before or during RUN operation. Timer will count down if timer has been preset.

NOTE: The program can be stopped by hitting the R/S key for one second.

1. Timer Setup
    a. Press SET
    b. ProF Use up and down arrows to select profile.

    a. Press SET
    b. TiM Use up and down arrows to set profile time.

2. Ramp Setup
    a. Press SET for 2 seconds
    b. SV 1 Use up and down arrows to set temperature value.
    c. Press SET
    d. rMP 1 Use up and down arrows to set Ramp time.
3. Parameter Setup
    a. Press SET for 10 seconds
    b. ModE Select required Mode
    c. AL 1 475
    d. P 50
    e. I 4
    f. d 1
    g. Ar 10
    h. t 2
    i. Pb 0
    j. InP 0 = K thermocouple 1 = J thermocouple
    k. UnlT 0 = degrees C 1 = degrees F
    l. AS1 0 = No alarm 1 = Process high alarm 2 = Process low alarm
    m. TLMT Safety shutoff timer. 0 to 10 minutes
    n.

LCK	Parameter mode	Ramp mode
0000	unlocked	unlocked
0001	unlocked	locked
0010	locked	unlocked
0011	locked	locked

4. Timer Function 1

   Operation is the same as timer function 2, except the foot pedal input is automated. Profile is started and stopped by a two second foot pedal input. Timer will count up, if reset before or during RUN operation. Timer will count down if timer has been preset and operation will STOP when timer reaches zero. Add time is also automatically added at the end of the removal cycle.

NOTE: The program can be stopped by hitting the R/S key for one second.

1. Timer Set Mode
a. Press SET
b. ProF Choose required profile.
c. TiM Use up and down arrows to set timer value.
d. AddT Set add time to On or Off to automatically add time for component replacement.
e. AddT Use up and down arrows to set add time value. This is the amount of time that will be added at end of removal cycle, for component replacement.

2. Ramp Setting Mode
   a. Press SET for 2 seconds.
   b. SV1 Use up and down arrows to set Temperature Set Point. Factory default 450 degrees F.
   c. rMP1 Use up and down arrows to set ramp time. Factory default 0:00

3. Parameter Setting Mode
   a. See Timer Function 1 parameter setting mode.

5. Ramp/Soak Mode

A maximum of four segments per pattern can be stored, and the maximum of four patterns can be stored. Further, each pattern can be linked together (Pattern link function). So, the setting of the pattern with more than four segments (Sixteen segments maximum) is possible. The linking order of the pattern can be set freely. The program is RUN by depressing the foot pedal for 2 seconds. The program will automatically STOP at the end of the preset program.

   a. Continue setting profiles 2 – 4 using steps 2a – j.

2. Parameter Setting Mode
   a. See Timer Function 1, Parameter setting mode. NOTE: The program can be stopped by hitting the R/S key for one second.

3. Program Setting Mode
    a. Press SET
    b. Porn Select program pattern
    c. Press SET twice.

4. Pattern Setting Mode
    a. Press SET for two seconds.
    b. L1-1 . Set temperature for segment 1. Press SET
    c. T1-1 Set Time for segment 1. Press SET.

d. L1-2 Set temperature for segment 2. Press SET
    a. T1-2 Set time for segment 2. Press SET.
    b. L1-3 Set temperature for segment 3. Press SET.
    c. T1-3 Set time for segment 3. Press SET.
    d. L1-4 Set temperature for segment 4. Press SET.
    e. T1-4 Set time for segment 1. Press SET.
    f. EndP Program End/link setting. 0: Operation Stop Press SET.
        1: Connects to pattern 1
        2: Connects to pattern 2
        3. Connects to pattern 3
        4. Connects to pattern 4

    a. Return to L1-1

8. REWORK CAUTIONS

As you become more familiar with the Sniper II, and rework more complex assemblies, you will need to understand more about the Sniper II abilities - and limitations - and how certain applications require specialized techniques. You will also want to protect your Sniper II so that it will give you many years of reliable service.

Nozzle Ventilation

As mentioned earlier, the Sniper II heats components with hot, forced convection. To achieve effective and efficient heating, an appropriate volume of air must always be encountering the target component in order to effect heat transfer from the air to the component. If the air is blocked, the Sniper II can't heat the component. Worse, the Sniper II heating element can overheat and shorten its life. Forced air is *always* flowing past the heater element when the Sniper II power switch is on. This cools the element between heating cycles; during heating, it allows the thermal sensor in the heater arm head to know when to add or cut electrical power to the element, because it "knows" how hot the air is. Therefore, always make sure that, during the heating cycle, sufficient convection is flowing through the nozzle for the Sniper II to operate properly. Between heating cycles, and after a shift is done, leave the Sniper II power switch ON for a few minutes to allow the convection flowing through the machine to cool the element down.

There are two instances where forced, heated convection through the Sniper II may be unavoidably restricted:

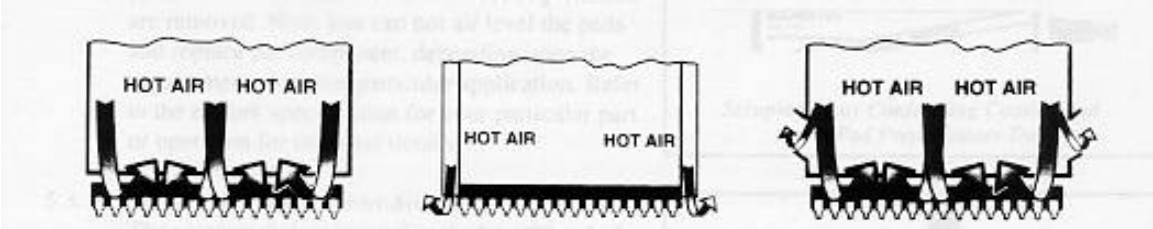
1. When a very small-diameter nozzle is used on small chip components; or 2. When it is absolutely necessary, on a mixed-technology board, to shroud the component being heated with the nozzle in order to avoid heating delicate adjacent circuitry.

In the first instance, a top-vented nozzle is used (See Illustration) so that sufficient air can escape to prevent the Sniper II from overheating. Enough heated convection encounters the component to achieve solder melting. The heated air exiting the vents minimally affects the board (a slight warming) due to the height of the nozzle.

In the second example, a side-vented nozzle is used (See Illustration). This nozzle vents hot air upward out the sides of the nozzle and away from the circuit board. It allows sufficient airflow to heat the component without heating adjacent components; however, it is much less efficient than standard single-wall nozzle types as shown in the Illustration.

Another type of nozzle often used in applications with inert gas is the focused heat nozzle. This nozzle directs forced, heated convection at the component's lead attach area specifically, while shielding the component body from direct exposure. This nozzle is unnecessary for most, if not all applications and is a possible cause of over stress to the die and cannot be used for BGA rework.

IMPORTANT NOTE: When using vented nozzles, pause the machine after 20 - 25 heating cycles and remove the nozzle. Small nozzles are HOT! Use a hot pad or pliers or other hand tool to remove small nozzles - never fingers! Then let the Sniper II cool for 15 - 20 minutes with the power switch (and blower) ON, until the controller's temperature indicator reads 120 degrees (F.) or lower, before resuming heating cycles.



Different Nozzle Types: Single Wall, Focused Heat, Top-Vented and Side-Vented Nozzles.

Removing Conformally-Coated Parts

Removing conformally coated parts can be one of the most frustrating procedures in rework. If not done correctly, either or both the component and the board can be damaged irreparably. Using the Sniper II and a little technique, you can safely remove conformally coated devices. The key word is patience; it is not only critical to melt the solder

connections, but to soften the coating enough to allow the component to be removed. In such cases, the Sniper II Flo-Master's vacuum pickup is not strong enough to lift the component off the board while it is held by the coating; probes (such as those in the SMD Tool Kit) must be used to free the component from the conformal coating first.

After heating has been applied long enough to melt the solder, use the probe #2 from the optional SMD Tool Kit (A.P.E. Part No.8100-1097) to apply slight positive pressure under the component to gently break the bond of the coating as the chip ramps up in temperature.

As the coating continues to soften, it will be possible to slide the probe completely under the chip. Loosen the chip gently, releasing it from the bond of the coating all around as shown. Be careful not to attempt to force the probe under the chip; as the coating softens, the probe will slide under the chip easily. Since the coating thickness may vary, the softening time may vary as well.

Once the chip is loosened completely, it can be lifted off the surface by the vacuum pickup.

While the board is still warm, use the probe #3 supplied with the SMD Tool Kit to scrape the coating from the center of the chip area.

Be sure to use the knife-edge side and take care not to damage the solderable pads. Then, use probe #1 to scrape the residual coating from between the pads, again, being careful not to damage the pads themselves.

Finally, use the Pad Prep supplied in the SMD Tool Kit to complete coating removal from the pads themselves by rubbing the pad prep on the pads themselves until all traces of coating material are removed. Now, you can hot air level the pads and replace the component, depending upon the requirements for your particular application. Refer to the rework specification for your particular part or operation for the other details.

9. Reflow Calibration:

The 8100-P300 Controller is initially calibrated at the factory and an "Input Ratio" entered in the "Engineering Set Up," (See Appendix A) which calculates the Thermocouple "Offset". This ratio may require recalculating should the "K" Thermocouple change it's position.

The "K" Type Thermocouple of the Reflow system is connected to the PID (Proportional Integral Derivative) 8100-P300 Reflow Controller. During Factory Set Up we ensure that the thermocouple is correctly positioned within the Nozzle Block of the Reflow Head, this assists in providing an accurate temperature reading from the Controller Display. In order to conduct a calibration check, it is helpful for the user to understand the standard that was used. In a Convection Hot Air environment there are several variables, which effect temperature measurement, not least of which is the open chamber that includes the nozzle. As nozzle sizes obviously vary, the chamber will alter within a few degrees. To standardize a mean average, a PLCC 44, 8100-0000-44, 0.80" x 0.80" (20.32mm x

20.32mm) Calibration Nozzle is provided with the system, and a circuit board placed 6-9mm under the nozzle. This environment matches the original calibration set up for the computerized registration of the PID Controller at the factory using Computer Profiling.

Calibration using Thermal Tracker. The APE Thermal Tracker or other Profiling System should be used providing an accurate independent track of air temperature. A Test Rig, should be constructed from a piece of FR4, approx. 100mm x 75mm suitably drilled with a 15mm square pattern of four (4) holes. Thermocouples (K Type) are placed clear through these holes, protruding 2mm on one side of the PCB. Tape the Thermocouples to the rear of the PCB using Kempton Tape. These Thermocouples will provide the feed back to the Thermal Tracker. The Test Rig should be mounted in the Board Holder and with the Thermocouples 6-9mm under the nozzle (Part No 8100-0000-44). The Test Rig is then used to create a graph of the profile as the Sniper II runs through a selected Profile Pattern Recipe (PPR), which enables the user to confirm that the Sniper II is functioning within specification.

Calibration Procedure.

1) Insert an 8100-0000-44 Calibration Nozzle (Supplied with the system).

2) Create a simple PPR holding a soak of 450 F (232 C) for 3 or 4 minutes to enable the test to be carried out.

3) Press "Run" and allow the temperature to rise to 450F and dwell, check the profile, which should be within 5% (F) of the Controller, due to the Peak-to-Peak Proportional differential tolerance.

4) Should the readings compare unfavorably, for example 450 F displayed on the Controller and 400 F monitored on the Thermal Profile System, the Input Ratio will need to be changed:

5) Calculate Ratio Differential: Actual Temperature/Set Point Temperature 400/450 = 0.89

6) Check PV Ratio (See Appendix A) Multiply the PV Ratio by the Ratio Differential.

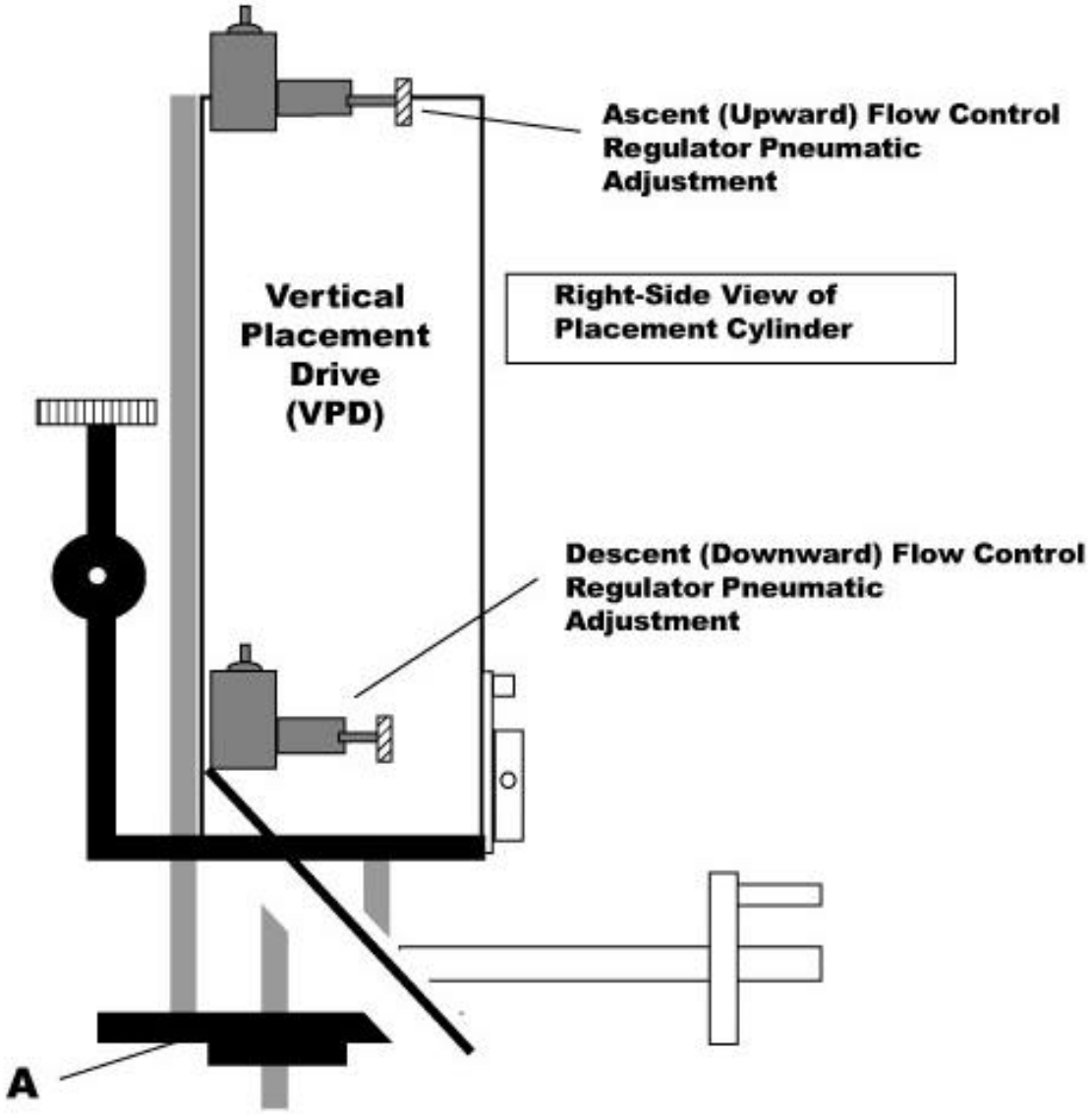
   Example: Controller PV = 0.85

   Ratio Differential = 0.89

   Enter new PV = 0.76

9. Procedure for correct Alignment of the VPD and Prism System

In addition to the pneumatic input controls on the rear of panel of the Sniper II, it is possible to tune the speed (pressure) of the DOWNWARD motion of the Vertical Placement Drive (VPD), by adjusting the Bottom DOWNWARD Release Valve as Fig below. The Top release Valve controls the UPWARD stroke, this is permanently Factory Set and it should not be necessary to be adjusted by the User.



Initial Mechanical Set Up:

A. Checking the VPD Alignment in the "Component View" position. (Note this is a factory set up Procedure and should not require adjusting).

1. A quick test is to use the Shipping Pin supplied with the system. Insert it into the right hand side of the Hood Assembly, so that it passes all the way through to the left side. The Pin should be tight, but able to be gently pushed through. Alternatively, check the Forward "Front Lock Nut" location, which sets the Right Angle square position from the front of the Hood Assembly to the base of the machine, an Engineers Square is used for this setting.

2. Also ensure that the Hood Return Stop (located at the very top of the system) is not interfering with the return of the Hood to its correct rest position and that the Hood is riding freely in its guide wheels.

B. Checking the VPD Alignment in the "Component Placement" position. (Note this is a factory set up Procedure and should not require adjusting).

1. Check the rear lead screw "Back Lock Nut" location, which sets the Right Angle square position of the VPD Cylinder Bracket to the base of the machine, an Engineers Square is used for this setting. Adjust if necessary

C. Checking the Cylinder Piston Height: (Note this is a factory set up Procedure and should not require adjusting).

1. With the VPD in the "Component Placement" position and a large Vacuum Barb fitted to the Vacuum Gantry, set the Vacuum Barb to the top left rear corner of the Board Holder. The Board Holder should be raised to its maximum height, by adjusting the "z" axis thumb wheels on each side of the Board Holder. Check that the correct height of the Board Holder is 105 – 106mm and that the Vacuum Barb comes to rest on the Board Holder at this height. Adjust if necessary by loosening four (4) screws, attaching the Cylinder to the cylinder Bracket. Allow the Vacuum Barb to rest on the Board Holder, so that it is perfectly level, check with feeler gauge, or paper. Then tighten all screws.

D. Checking the Vacuum Gantry position and Focal Adjust. (Note this is a factory set up Procedure and should not require adjusting).

1. Return the VPD to the component "Component View" position (without a component in place). View the Vacuum Gantry on the Monitor, adjust the camera zoom & focus so that the total Vacuum Gantry is in view. Check that the Vacuum Gantry is to the far right; this can be confirmed if the two Allen screws securing the bar are in the left most position. If needed. Adjust the gantry by removing the vacuum barb and loosening the two gantry screws with an Allen Key 7/64"and move the gantry until right adjusted. Do not over stress. Reinstall the barb.
2. With the Board Holder outside of the Placement area, depress the Alignment Switch so that the VPD with the Vacuum Barb attached travels down to the "Placement" position.

3. Check that the Focus Adjust Screw, located on the front of the Vacuum Gantry is adjusted, so that only four to five (4 - 5) threads are seen below the Gantry. This provides the correct prism focal distance for a QFP208 Alignment Procedure. At this stage the

initial mechanical Set Up is completed. The following details the procedure for aligning the Prism using a QFP208, which also acts as a procedure to ensure that BGA and CSP components are correctly placed.

E. QFP Alignment Procedure

a.) Ensure that 80 PSI is maintained throughout the Alignment procedure, otherwise the QFP might slip.

b.) Use a spirit level to ensure that the Sniper II base is level at all four corners

c.) Use the Alignment Kit comprising a QFP 208 and a Stencil Template with a 208 footprint.

d.) Install a large 0.512" Vacuum Barb.

e.) Mark center of QFP with scribe. A small "x" in the center will suffice. (This is helpful, but not essential).

f.) Move the Board Holder away from the VPD and adjust the two Z-axis thumb wheels on the Board Holder so that the Board Holder is at its lowest level.

g.) Place the Stencil Template into the top recess of the Board Holder and very carefully (manually), so as not to bend the delicate leads, place the QFP208 into the Stencil QFP208 footprint. This will exactly align the QFP208 into the Stencil footprint.

h.) Slide the Board Holder under the Vacuum Barb. Gently adjust the Board Holder using the Z-axis thumb wheel adjustment screws on each side of the Board Holder, so that the Vacuum Barb is just a fraction above the QFP208. Operate the VPD to ensure the Vacuum Barb does not apply any downward pressure on the QFP, so as to distort the leads.

i.) Without operating the vacuum switch raise the VPD to the "Component View" position. Now using the Monitor and camera, adjust zoom and focus, so that the entire component and Stencil footprint can be seen in the center of the screen, with the Vacuum Barb ghosted in the center of the component image

j.) Install the Diagonal Viewer (Mirror Splitter 7000-2500), between the Prism and the camera. Twist the Diagonal Viewer to obtain a correct perspective. Adjust zoom and focus to expand the view and adjust the mirror screws so that all four (4) corners of the chip and footprint are easily and clearly seen. It may be necessary to adjust the lighting aperture to remove the dark diagonal in the middle. Note that only a few of the leads on two (2) diagonal corners need be seen.

k.) Operate the VPD to bring the Vacuum Barb to the center "x" of the chip. Operate the vacuum switch and capture the component. Actuate the VPD to lift the

QFP208 from the Stencil. Then return the VPD again to the "Component Placement" position, turn off the vacuum and check that the chip did not fall, or was not pressed into the footprint and that all leads remain centered.

l.) Also check whether the chip is coplanar from the back to the front during placement. This can be seen as a difference in the placing of the chip, from the back to the front of the component. If a coplanar adjustment needs to be made use an 5/32"" Allen Wrench and loosen the lower screw on the right hand side of the Placement Cylinder. It is then possible to pivot, by gently pushing or pulling the Cylinder so that any coplanar issue is resolved. Tighten the screw securely after adjustment.

m.) If the chip is still aligned on the monitor, operate the VPD again and switch on the vacuum. Bring the component to the "Component View" position. The component should remain aligned on the monitor, if not then adjustment must be made.

n.) Remove four (4) screws retaining the Prism cover. With the Prism and adjusting screws exposed loosen the center knurled nut of the Rotary Adjust. With a 5/64 Allen Wrench inserted in the center hole, of the Rotator. Exert a little pressure left or right to adjust the vertical leads on the image. Then with an Allen Wrench adjust the Vertical Elevation screws on the right of the Prism. Adjust the screws to correct the horizontal leads on the image. (Do not over tension these screws as they can bite into the aluminum Prism Plate).

o.) Tighten the Rotary Adjust nut and finally check that all leads are aligned to the Stencil footprint. Operate the VPD to bring the component to the "Component Placement" position. Switch off the vacuum and ensure that the component settled evenly and check correct alignment by viewing the monitor. Place a few times to ensure accuracy.

p.) If the Alignment Procedure was successful, replace the Prism Cover Plate

q.) If there is difficulty in aligning the component to the Stencil footprint, it may be necessary to again check the Focus Adjust screw and either raise or lower the screw so that 1 more thread is seen under the Vacuum Gantry. An incorrect adjustment will be seen as a theta inaccuracy. If it is still not possible to achieve exact alignment, then the entire Prism mechanism base should be slackened (not removed) and a gradual adjustment should be made by tightening all screws supporting the prism mechanism.

Note: The QFP alignment procedure is correct only for the level (height) at which the component is aligned. If another level of component is required, the procedure should be checked again at the new level. This should only be a case of adjusting the Focal Adjust Screw.

For BGA & CSP applications the procedure for level (height) need not be so exact, as the view is two (2) dimensional and parallax is not an issue.

Footnote:

If the Stencil Template is not available, the procedure may be carried out on a Test PCB with a QFP208 footprint, as follows:

When at 7. of this procedure, align the chip on the QFP Test PCB footprint, this is tricky, but should be done accurately until all leads and pads are exactly centered. Look at the monitor, while lightly moving the component into position using a probe or the edge of your forefingers, take care not to bend the leads. Follow procedure there after.

11. Environmental Information:

The system is designed for operation within a modern assembly plant having control of relative Humidity of 60% and temperature of 10 Celsius to 35 Celsius.

Power:

High Voltage Power is used to power the Sniper II SMD-7007.
Systems are specifically designed for single phase:

- 100/120V
- 220/240V

Compressed Air 80-100PSA

Only dry compressed air should be used and it is recommended that a further regulator be installed prior to connection to the one supplied at the rear of the Sniper II SMD-7007.

Ventilation:

When in use the materials used in the mounting of components can emit uncomfortable solder fumes during the reflow or chip extraction operation. A flexible arm Fume Extractor is recommended, with a minimum bore of two (2) inches. The inlet should be located as close to the work as possible. The Fume Extractor should be finally exhausted through a filtration unit to a minimum standard of 99.9777% pure air.

Lighting:

The Sniper II SMD-7007, includes illumination for chip placement and a Halogen Light for Reflow attention, however it is recommended that the system be situated in an area of good and adequate lighting, which does not cast shadow.

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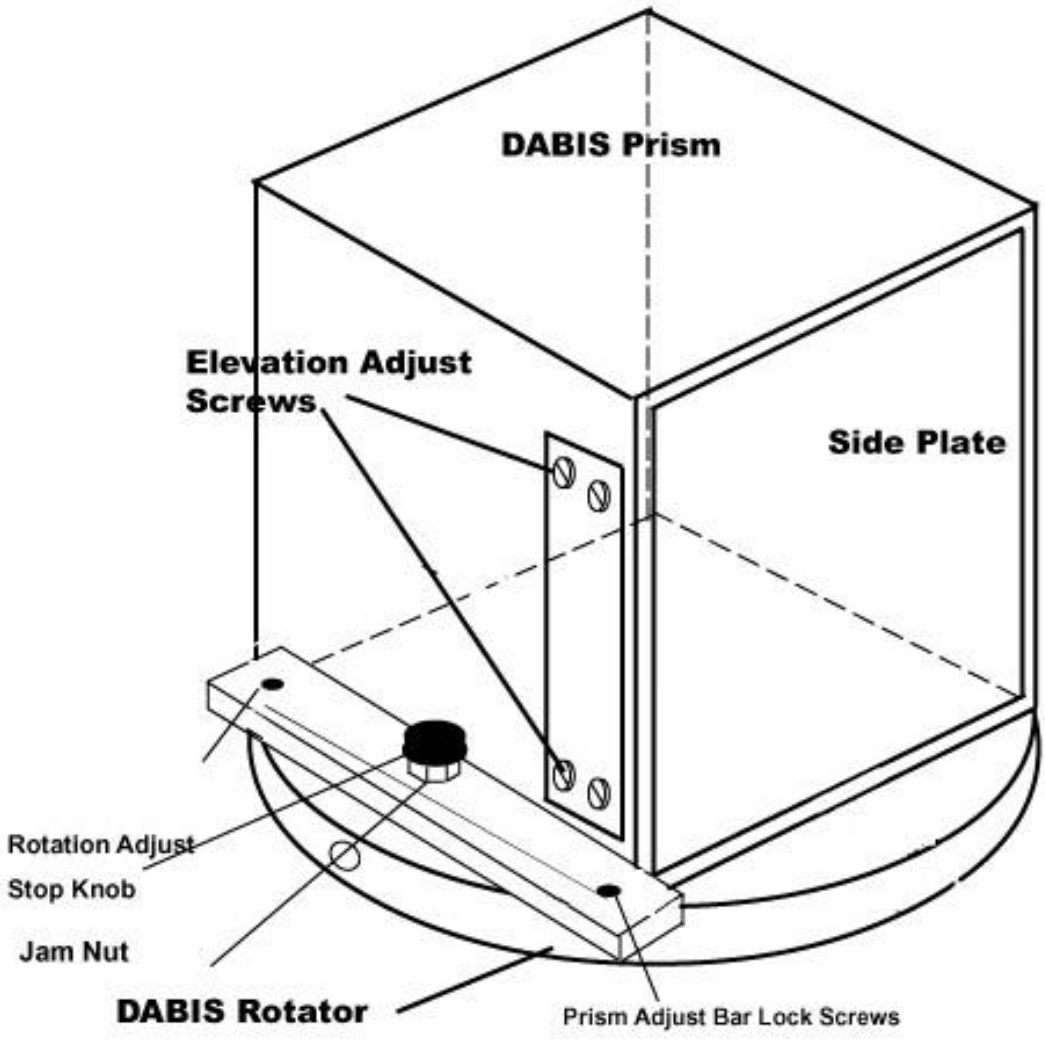


Electro Static Discharge (ESD) Precautions:
As the Sniper II has been designed to specifically rework modern PCB's and sensitive components, ESD precautions must be taken at all times. The Sniper II should be installed in an ESD safe environment with the necessary controls and grounding conditions. The Sniper II is grounded and being of an, all metal construction, does not support a static charge. However the operator must be grounded by a wrist strap of 1 meg ohm impedance connected through a common point ground connection. All ESD precautions and controls are the responsibility of the User.

12. Maintenance and Cleaning Instructions:

Cleaning: The base of the machine and the bottom of the Board Holder should be cleaned daily, either with alcohol or a proprietary cleaning product like "Armor-all", which will ensure a smooth surface for the Kevlar sliding base of the Board Holder. Use only a soft cloth to apply and polish. Nozzles and vacuum pickup suction cups should also be cleaned daily with alcohol to prevent flux buildup. Flux buildup on nozzles can burn and cause contamination of the circuit board. Any flux spillage or buildup, including on the Board Holder, should be removed daily with alcohol.

Lubrication: Occasionally, the Board Holder and Vacuum Pickup Assembly should be lubricated. Apply a drop of high temperature lubricating oil to the exposed part of the assembly above the heater head (under the spring) once every week or two, or whenever movement seems dry or tends to bind. Do not over-lubricate! Excess oil can run down and contaminate the circuit board.

Handling: The Sniper II is too heavy for normal lifting, excessive or indelicate handling could result in damage to the Vision Mechanism and Reflow heater elements. When transporting, pack the Sniper II in its original crate and packing material; cushion it well against any impact. Avoid contacting the area beneath the heater arms, or at the VPD and Vision area, always lift from the base. It is recommended that mechanical handling equipment be used in lifting and transporting the Sniper II.

Vacuum Cup Replacement: Vacuum pickup suction cups have a life of approximately 300 - 400 heating cycles (component removals or replacements), depending on temperature. The higher the Set Point the shorter the cup life. When they become cracked, replace them immediately.

Reflow Calibration: See Section 9.for procedure. Recommended check - every six (6) months

Prism Alignment Check: See Section 10. For procedure. Recommended check - every six- (6) months.

Changing Fluorescent and Halogen light bulbs:

a.) To replace the PCB Illumination (front) fluorescent bulb, actuate the VPD, so that the VPD is in the Component Placement position, switch off and then disconnect the power to the machine. This provides access under the VPD. Using a 5/64" Allen Wrench remove the two inner screws on the mounting bracket, which support the plastic molding of the bulb. Pull out the bulb and change. Replace the mounting bracket. Replace the connection to the machine and switch the power on. Wait a few seconds before bringing the VPD to the "Component View" position.

b.) To replace the component illumination fluorescent bulb, it is necessary to remove the two upper most rear panels of the machine. Switch off the power and

disconnect the supply cable. Remove the Rear Panel screws using a 5/64" Allen Wrench. The Fluorescent fitting will be clearly seen at the far end of the VPD. Remove the inner mounting bracket screws. Replace the bulb by pulling out and change. Replace the bracket and replace the covers. The power cord may now be connected.

c.) Halogen Light: Disconnect the power lead of the Halogen Light from the rear 120V outlet at the rear panel. Unscrew the Hood Shade of the lamp to expose the bulb, pull out the 2-pin fitting and change. Replace the Hood Shade and reconnect the power cord.

13. Technical Specification:

Physical:	**Imperial**	**Metric**
Dimensions:	21.75" x 29.12" x 29.0"	552.45 x 739.65 x 736.20mm
Weight:	160lbs	72.73 Kgms
Shipping Weight:	350lbs	159.00 Kgms
Shipping Dimension:	48" x 38" x 30"	121.9 x 96.5 x 76.2CM
Shipping Method	Heavy Duty Wooden Crate, secured with bolts on built in pallet	
Lifting Method	Pallet for Fork Lift	
System removal	Four (4) Hex bolts at base of pallet. Secured through to mounting feet screw threads on the machine base.	

Supply Ratings:

Voltage:	100/120V dedicated system designated by code 7007-1000		
	220/240V dedicated system designated by code 7007-1002		
Power	2500 Watt		
Power Consumption:	100/120V	25/20.83	Amp
	220/240V	11.36/10.42	Amp

Fuse Panel:

Description	Rating
Main Power:	15 Amp x 1
Blower motors:	2 Amp x 2
Heater elements:	12 Amp x 2
Accessories:	5 Amp x 1

Interconnection Accessories 100/120V:

Location:	Bottom Rear Panel See page 14
Fuse Rating:	5 amps

Quantity:	Two (2) Outlets
Purpose:	Connect APE accessories, Halogen Lights and/or Monitor. (See Install Page 9 Sec. h)

Emergency Power: Located at Left front side of machine. Push "IN" for Power Off.

Digital Camera:

Signal Format:	NTSC
Power:	*DC10-12V*
Power Consumption:	250mA

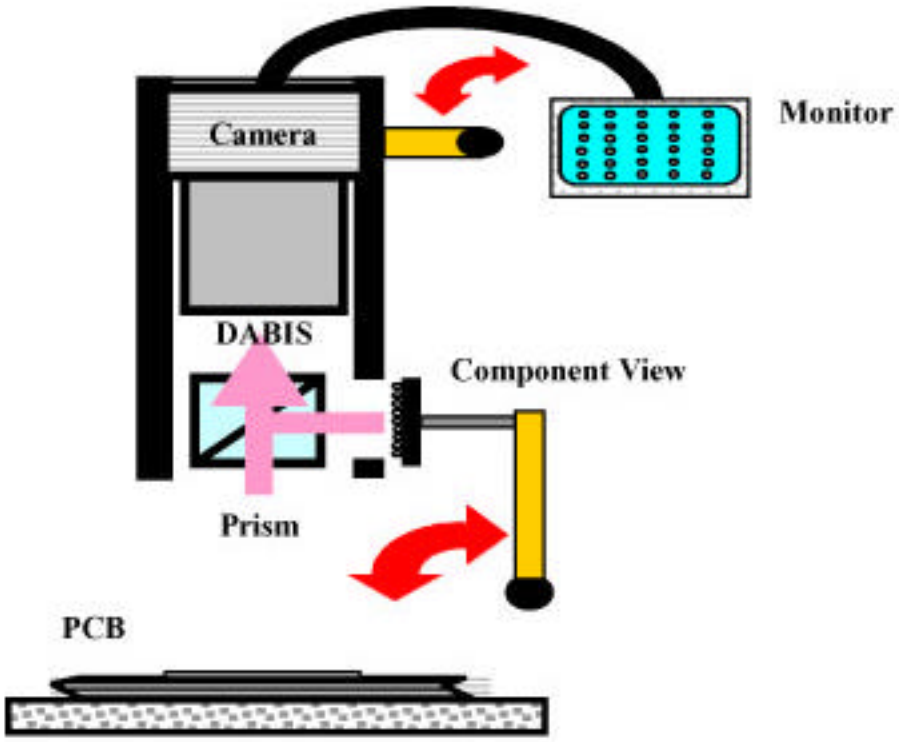
Illumination:

VPD Fluorescent	19V Transformer 120V/19V
Rating:	13 Watt
Halogen Goose Neck:	12V Transformer 120V/12V
Rating:	20 Watt

Compressed Air Operation

Supply:	100 PSI
Content:	Dry Filtered
Continuous Operation:	80 PSI
Consumption:	*0.50 Liters per actuation of the Main Cylinder* (Vacuum Generators Off)

Placement Illustration



14: Sniper II Computer Graphical Interface Program

For operation with Windows 95ä or Windows 98ä

SpecView APE User Guide

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2 Connecting the Sniper II to a Host Computer

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c. Running a PPR
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5 8100-P300 Sniper II Controller

1. Overview

1.a. The SpecView software is a multi purpose graphical interface for communicating with temperature control devices and data logging their events.

1.b. This document is a reduced instruction User Guide, which can be used with or without referral to the SpecView published manual, which is provided with the software.

1.c. This document will assist the User to construct a communication protocol with the 8100-P300 Controller installed in the Sniper II Split Vision Rework System and to Data Log the events in Adobe PDF files, which are auto saved on print.

1.d. Further CSV data logging is possible, should the User require this level of recording and reporting, however a PDF file is a more User friendly method of capture and logging in a graphical manner, which is easily readable and understood.

1.e. This document is not meant to detail or explain all the characteristics of the installed software and has been compiled to provide a simple, yet effective User Instruction, requiring limited computer skills.

1.f. Also, included with the Software is a "Start Up Configuration Disk", this is a User Graphical Presentation of all the information required to create and run a Profile Pattern Recipe, (PPR), formatted for APE Rework and provides a Start Up configuration file, which should remain unchanged as a back up.

1.g. The 8100-P300 Controller can be used to control the Sniper II with or without a computer interface. When used without SpecView all sixteen (16) Profile Pattern Recipe's (PPR) may be programmed and operated as required. Using SpecView any number of PPR's may be stored within the host computer, however only Profile Pattern Recipe (PPR) #1 of the 8100-P300 Controller will be recognized by the SpecView program.

2. Connecting the Sniper II to a host computer:

2.a. The SpecView Graphical Interface Program includes a Hardwired parallel Key, which when inserted in the parallel port of the computer enables the software to run in all modes. The key allows straight through connection for normal printer operation. The key should be inserted before loading the software disks.

2.b. Included is an RS422/RS432 interface connection, mounted on the inside rear panel of the Sniper II cabinet. The RS232 connector of this interface is seen mounted through the rear panel. A 25/9 Serial Connector cable is provided for connection to the 25pin connector and to the 9pin serial I/O, Com 1 or Com 2 of the computer.

2.c. The model 8100-P300 Controller is configured for RS422 working. This need not concern the User.

3. Installation:

- Adobe Installation
- Loading SpecView operation software
- Start Up Configuration Disk
- Run Mode
- Configuration Mode

3.a. Adobe Installation

3.a. a. Adobe 4.0 is not included with the SpecView and can be obtained from any authorized reseller. **Install Adobe 4.0 prior to installing the SpecView Software, first ensuring that you uninstall Adobe Acrobat 3.0 Reader, should it be present**. Adobe 4.0 should be set up as the Default Printer in the Printer Set Up window and the print path set correctly for automatic launch. Install Adobe prior to Spec view and ensure that the parallel key is NOT installed.

3.b. Loading SpecView

3.b.a. Two, (2) Application Disks, named Disk 1 and Disk 2 are included.

3.b.b. From the Start button, select "Run", insert Disk 1 and browse A:/. Click on the "Setup" in the display and follow the instructions, installing Disk 2 when requested. (**Ensure the "Key" is located in the parallel port before the computer is powered up**). Note the location where the SpecView program is saved. The default installation path is "C:\Specview

3.b.c. Once the program has loaded, Disk 2 may be removed and both Disks stored in a safe place. A Shortcut can also be placed on the Windows Desktop. (Refer to Windows 95/98 operation).

The Sniper II should be turned on at this stage.

3.b.d. Click on the shortcut and open the SpecView program. The first window seen is named "Configurations Found" at this point click on "Test Comms for NEW config". A request prompt will open, with the name for configuration as "Default". Accept this Default name and select OK to proceed.

3.b.e. The next window is "Ports & Protocols", selecting Com 1, under "Protocol" and using the drop down list, ensure that "RKC Inst" is displayed, if this is not recognized by SpecView try Com 2, again selecting "RKC Inst" under "Protocol". Leave Baud Rate set to "Auto".

3.b.f. Select "Start Scan", if communication is correctly established, within a few moments a graphical image (no values) of the 8100-P300 Controller will appear on the top left of the screen. Notice the "Auto Configure Status" information as having found the correct Com 1, (information status only). This completes the Com Set Up procedure and confirms that the communication protocol to the Controller is correctly configured.

3.b.g. Select "Stop." SpecView warning window opens as, "All Channels scanned. Press OK to continue." If the warning window does not open, then the Com port setting will need to be changed and the "RKC Inst" protocol set correctly.

3.b.h. It is now time to save the Default Configuration File. Select "File" from the Menu Bar and then select "Close ", from the drop down menu, a prompt will request that the changes be saved to SpecView 1, accept this request. The window "Save As" will return a prompt to accept the file name as SpecView.Gdw. Accept this file name and click OK. Now exit the program.

3.b.i. The path for this configuration file will be C:\Specview\Default\Specview.gdw.

3.b.j. With this Set Up completed, it is now possible to install the Start Up Configuration Disk.

3.c Start Up Configuration Disk

(Standard Set Up is supplied in Fahrenheit; Celsius can also be supplied upon request)

3.c.a. Insert the "Start UP Configuration Disk" into Drive A:/. Using "Explore" copy all files to the "C:\Specview\Default" sub directory in SpecView, responding with a "Yes to

all" when asked if you wish to overwrite. This will set up the APE configuration automatically.

3.c.b Remove the Start Up Configuration Disk from the A: Drive and store in a safe place.

3.c.c. The Start Up Configuration Disk presents a GDW (Graphical Display Window) comprising:

a. Real Time Graphical Presentation of the 8100-P300 Controller, presenting:
. Present Value
. Set Value
. Profile Pattern (1) and current segment (1-16)
. Time to run for each segment

b. Temperature PPR Chart with Set Value and Present Value pen tracers. Time "x"axis (Real Time) v. temperature "y" axis.
c. Two rows of eight (8) segments, left and right side of the GDW, totaling 16 segments.
d. Start (execution) program button.
e. Stop program button
f. Profile Pattern Recipe (PPR) information, Date and Time
g. Data Log (Path to Adobe print)
h. Timer - Start Timer - Stop Timer - Reset Timer.

3.c.d. Click on the SpecView (SV) Shortcut and open the SpecView program. The first Window provides information on "Configurations Found". Upon starting the program the "Default" will be seen, as configured by the Start Up Disk, confirm that you wish to go "On Line".

3.c.e. The next stage takes the user to the "Run Time Mode" window of the Start Up Configuration.

3.d. Run Time Mode

3.d.a Run Time Mode is the execution mode of the SpecView™ program and communicates the following instructions to the 8100-P300 Controller.

3.d.b. Recipe Management
- A program execution to Profile Pattern #1 on the Controller.
- Adobe Data Logging
- Adobe Print Out

3.e. Configuration Mode.

3.e.a. The Configuration Mode is a Graphical Creation Program, which was used to create the Start Up Configuration Disk. The program has many features to customize a

User Interface, these features can be found in the User Manual. However, it is recommended that the Start Up Configuration Disk is always maintained as a back up.

4. Developing a Process in Run Mode:

- Recalling a Profile Pattern Recipe (PPR)
- Creating a PPR
- Recording a PPR Name to include displayed inf. for future recall.
- Running a PPR
- Data Logging and Printing of a PPR record

4.a Recalling the initial "StartUp" (PPR) from the Start Up Configuration Disk

Select "Recipe" from Tool Bar
Select "Recipe Management"
Selecting "Recipe Management" will display the Recipe Window.

Select File Name "Startup," this will automatically load the PPR "Startup". Select "Send," at this command the parameters entered in the Start Up Configuration will be downloaded to the 8100-P300 Controller at Profile Pattern # 1. All 16 segments of the program will be entered. These are zero values. "Downloading P300-00.P1 Seg Level #" will be displayed until all segments have been downloaded. **Exit the Recipe Menu**. **DO NOT OVERWRITE THE "STARTUP" RECIPE**

4.b Creating a Profile Pattern Recipe.

Creating a new recipe is simply a case of changing an existing recipe and saving as a different PPR file name. We recommend the User use "Startup" as the standard PPR for change, which loads Zero Values and can be changed and saved as a new PPR file name, **without having to delete any values**. Proceed as follows:

Select "Recipe" from Tool Bar
Select "Recipe Management"

Selecting "Recipe Management" will display the Recipe Window. Select File Name "Startup," this will automatically load the PPR "Startup". Select "Send," at this command the parameters entered in the Start Up Configuration will be downloaded to the 8100-P300 Controller at Profile Pattern # 1. All 16 segments of the program will be entered. These are zero values. "Downloading P300-00.P1 Seg Level #" will be displayed until all segments have been downloaded. **Select "Exit "to exit the menu.**

Starting at the first segment, double click on the " Seg 1 Temp" value. A "Value Description" box will open. To change a value, erase the displayed value, by highlighting and selecting "Erase". Then using the keypad in the box, enter the new value. Select "Send" to transmit the new value to the Controller, and then select "Close" to exit.

Now, double click on the “”Seg 1 Timer” value and enter the required second part of the segment by erasing the displayed value, by highlighting and selecting “Erase”. Then using the keypad in the box, enter the new value. Select “Send” and then select “Close” to exit. Continue changing each value until the revised PPR is completed. Now proceed to save the new PPR: **Note: If a “Time Signal Output” (See Section 7) has been entered in the controller to manage a Pre Heat condition, the first Segment should be programmed at room temperature for the preheat period required.**

4.c Saving a new PPR and displaying information for recall.

When saving a new PPR name, part of the title can be written, such that it includes essential information that will be displayed on the GDW during “Runtime Mode” and which will, therefore be displayed on the PDF image for future recall. **DO NOT OVERWRITE THE “STARTUP” RECIPE**

Select “Recipe” from Tool Bar
Select “Recipe Management”
Select “ Current Value”
Select “Save As”
Enter the new PPR Name, which should include as much information for future recall.

Example: **Recipe Name - Job Name - Serial # - Operator Name**
(Use only enough characters as can be easily read on the GDW)

Note: That time and date do not need to be included, this inf. is automatically displayed.

Select OK to save.

Once this action is completed the User can download the new recipe to the 8100-P300 Controller by selecting the “Send” command. **Select “Exit” to exit the menu.**

4.d Running a Profile Pattern Recipe

First exit the Spec view GDW, then select “File” on the Tool Bar and select “Enter Runtime” mode. This will display the Spec view GDW again but will reset the time for a new PPR Run.

To run a recipe after selection, select the “Start” Button.

The Stop button serves two purposes, one (1) to interrupt the program; this feature is a computer adjunct to the “Emergency Stop” and two (2), to reset the 8100-P300 Controller at the end of sequence.

The “Start Timer” may be selected if desired and the “Stop Timer” selected when complete.

4.e Data Logging a PPR

Ensure that the Adobe™ print path was set up correctly upon the installation of the Adobe™ Acrobat Software. The Printer Default is "Acrobat PDF Writer" as Default, with Print path as the Acrobat path not LPT1.

Select "Data Log" on GDW. Wait until program activates. Save with Data Log File Name and print out if required.

15. Program Controller 8100-P300 for use with Sniper II

Specifications

The 8100-P300 Controller can store up to 16 Rework Thermal Profile Patterns, each with 16 temperature segments, for a precisely controlled temperature profile. APE, 8100-P300 controlled systems also include RS-485 interface connection for external computer control. An optional "Windows" software program, provides data logging and profile creation in "real time" or "off line" modes.

There is no limit to the number of profile patterns that can be stored using the PC option. Any APE adapted system can also be controlled from the computer or operated directly from the machine. APE uses Type "K" Thermocouple close loop control with the 8100-P300.

Input

Measured input (Universal input)

(1) Input	a) Thermocouple	K, J, R, S, B, E, T, N (JIS/IEC) PLII (NBS), U, L DIN W5Re/W26Re (ASTM) Pt - 40%Rh - Pt - 20%Rh
	b) R T D	PtlOO(JIS/IEC), JPtlOO(JIS)
	c) DC low voltage input group	0 to 10mV, 0 to 100mV, 0 to 1V, 0 to 5V 1 to 5V, -100 to 100mV, -1 to 1 V, -5 to 5V
	d) DC high voltage input group	0 to 10V, -10 to 10V
	a) DC current input group	0 to 20mA, 4 to 20mA

*Refer to Input, Range code.
*DC voltage / current type is with square-root extractor.

(2) Sampling time	0.1 sec	
(3) Input impedance	a) Thermocouple :	More than 1 M W
	b) DC low voltage :	More than 1 M W
	c) DC high voltage:	Approx. 1M W
	d) D C Current :	Approx 250 W

(4) Sensor current	300 µA (RTD)
(5) Resistance effect on input signal	Approx. 0.4m V/ W (TC)
(6) Effect of input resistance	Approx. less than 10 W per wire (RTD)
(7) Input break action	
a) Thermocouple	Up scale or down scale (selectable)
b) RTD	Upscale
c) DC low voltage	Down scale

d) DC high voltage	Indicate a value around zero
e) DC current	Down scale

(8) Allowable input voltage		Less than ±7V DC high voltage Less than ± 14V
(9) PV bias	a) Temperature input	-10.0 to 10.0 C (F)
	b) DC voltage, DC current	-10.0 to 1 0.0% of span
(10) PV ratio	0.001 to 9.999	

(1) Measuring Accuracy:

a) Thermocouple (0.1% of reading or1'C[F'] whichever s larger) ±l digit
Type Pt - 40%Rh-Pt - 20%Rh (0.1 % of reading or 10 μV, whichever is larger) ±l digit

For a thermocouple input, please note junction compensation error.

b) RTD (0.1 % of reading or 0.5C ['F] whichever is larger) ±l digit

c) DC voltage, DC current (0.1 % of span) ±l digit

(2) Cold Junction compensation error	Within ±0.5C (Between 0 to 50'C [32 to 122'F]) (As far as the measured value is above -100C. Below –100C, out
(3) Time Accuracy	of guarantee.) ±0.01 % of displayed value
(4) Insulation resistance	More than 20M Ω (500V DC) between input and ground More than 20M Ω (500V DC) between power and ground
(5) Dielectric strength	1000V AC for one minute between input and ground 1500V AC for one minute between power and ground

Program:

(1) Storage program profile patterns	Max. 16 profile patterns. (Max. 16 segments per profile.) Storage segments : Max. 256 segments. (16 segments 16 profiles.) (Possible linkage : Max.16 profiles)
(2) Segment time	00 hr 00 min to 99 hrs 59 min or 00 min 00 sec to 99 min 59 sec (Selectable by front key)
(3) Program repeat	1 to 1000 times or continuous. * If 1000 is set, the program is carried out endlessly.
(4) Wait Zone	-10.0 to 10.0'C ('F) (individual setting up and down side)

Control:

(1) Control method

a) PID action with autotuning, Direct/Reverse action (Selectable)
ON-OFF, P, Pi, PD action are available
b) Heat/Cool PID action with autotuning
c) Position proportioning action without feedback resistance

d) Proportional band Temperature input : 0.1 to span (C/'F) DC voltage, current input : 0.1 to 1 000.0% of span (ON/OFF action when 0 is set.

(2) Setting Range
Differential gap +/- l' C (F)
b) Integral time 1 to 3600 sec PD action when 0 is set
c) Derivative time 1 to 3600 sec PI action when 0 is set.
d) Proportional cycle 1 to 100 sec
e) Output time -5.0 to 105.0 % (Possible to set high and low output)
f) Anti-reset-windup: 1 to 100% of proportional band

(3) PID value storage 4 groups (Level PID)

(4) Output
a) Relay contact output 250V AC 3A (Resistive load)
b) Voltage pulse output 0/12V DC
(Load resistance More than 800 Ω)
c) Current output 0 to 20mA, 4 to 20mA DC
Load resistance Less than 600 Ω)
d) Continuous voltage output 0 to 5V, 0 to 1OV, 1 to 5V DC
Load resistance More than 1 k Ω)

External Control Input:

(1) Type
a) Standard function Reset, Run, Hold, Step
b) Optional function Profile No.set
(2) Input rating Non voltage contact input
a) OPEN : 500k Ω or more
b) CLOSE : 10 Ω or less

(2) Alarm types
Programmable
Deviation alarm (High limit, Low limit, High/low limit, Band)
Process alarm (High limit, Low limit)
Set value alarm (High limit, Low limit) FAIL
Hold function can be programmed.
Energized/de-energized alarm
(Selectable but FAIL alarm is only de-energized alarm)

(3) Differential gap
0.0 to 10.0'C ['F] (Temperature)
0.0 to 10.0% of span (Voltage/Current)

(4) Alarm delay 0 to 600 sec.

(5) Output Relay contact output, 250V AC 0.5A (Resistive load)

Profile Pattern End Output:

(1) Setting time	00 min 00 sec to 99 min 59 sec * When profile end output set 0 min 00 sec, keep on output until the power is OFF or reset.
	Open collector output
a)	Rating : Max. 24V DC 50mA b) ON voltage : Max. 24VDC 50 mA
b)	ON voltage : Max. 2V
c)	

Time Signal Output:

(1) Number of output	4 points or 8 points (Specify)
(2) Storage profile	16 profiles (16 times on/off per profile)
(3) Output	Open collector output

Alarm Output:

(1) Number of alarm	2 points

Auxiliary output (Option):

(1) Number of output	Max. 3 points When heat/cool control (released soon) or position proportioning control (released soon) is specified, 1 point (OUT2) is used for the control output. Thus the points available for use decreases. * When the analog output is specified which uses 1 point (OUT4), the available points decreases.
(2) Output types	Programmable optional types for each output types Process alarm (High limit, Low limit), Set value alarm (High limit, Low limit), Profile end status signal, Soak status signal, Hold status signal, RUN status signal
(3) Output	Relay contact output, 250V AC 0.5A (Resistive load)

Analog output (Option):

(1) Number of output	1 point
(2) Output signal	0 to l0mV, 0 to 100mV DC (Load resistance : More than 20kΩ) 0 to 1V, 0 to 5V, 0 to 10V, 1 to 5V DC (Load resistance : More than 1 k Ω) 0 to 20mA, 4 to 20mA DC (Load resistance :Less than 600 Ω)

	Programmable optional type for each output types Measured value (PV), Set value (SV), Deviation value (DEV) Manipulated value (MV), Segment time (TIME) (Outputs the segment time in percentage.)

High limit and low limit are available. * Manipulated value (MV) and segment time (TIME) are not scaling.

(3) Output Scaling	Scaling range is -19999 to 32000 digit
(4) Output accuracy	0. 1% of span 1
(5) Output resolution	1 bits or more

Digital Communication (Option):

(1) Communication method	RS-485 (2-wire), RS-422A (4-wire), RS-232C (2-wire)
(2) Synchronous method	Asynchronous method
(3) Communication speed	1200, 2400, 4800, 9600, 19200 BPS
(4) Bit configuration	Start bit : 1, Data bit : 7 or 8 Parity bit : "with'" or "without", even or odd in case of "with' parity Stop bit : 1 or 2
(5) Max. connection	31 sets, But I set, in case of RS-232C

General Specifications:

(1) Power supply voltage :	90 to 264V AC including power voltage fluctuation (1 00 to 240V AC rating) 50/60 Hz selectable by front key
(2) Power consumption	Less than 17 VA (at 240V AC)
(3) Momentary power failure	Not affected by power failure shorter than 50 msec.
(4) Memory backup	EEP-ROM and Non-volatile RAM(Approx. 10 years)
(5) Ambient temperature	5 to 40'C (41 to 1 04'F)
(6) Ambient humidity	20 to 80% RH
(7) Net weight	Approx. 500g
(8) External dimensions	96X96Xl00 mm (HXWXD)
(9) Environment	Should be free from corrosive and flammable gas and dust.
(10) Other conditions	Free from external noise, vibration, shock and exposure to direct sunlight.

16. Appendix A

SETUP setting: (Press "SET" & "MODE" key together to enter SETUP. Use "SET" key to step through fields)

Input type	INP	2 for F, 0 for Celsius	Contact input pattern

Scale high-limit	SCH	600 F or 400 C	Start mode selection	PD	0
Scale low-limit	SCL	0.0	Auto-tuning (AT)		
Decimal point position			differential gap	ATHS	2
Device address	ADD	0	Power frequency	PFRY	
1=60Hz, 0=50Hz					
SV at program start	SVST	1	Action selection at		
Control state selection			burnout occurrence	bOS	1
at program end	ENDP	1	Action selection for		
Control output value			abnormal PV input	AOVE	1
During reset	RSV	-5.0	Selection of Use/Non use		
			of square root extraction		
			function Setting time unit		
			selection	RIS	1

Engineer Settings for 8100-P300 Reflow Controller **(Press "SET" key for two (2) seconds to enter)**

Parameter Group PG 10 (Use "SET" key to step through fields, use "Up" arrow to move to Parameter Group)

SV in fixed set-point control	0.0

Parameter Group 20	**PG 20**
Pb bias	0
Pr Ratio	Unique to each machine. (A label with the Pr Ratio, can be found at the rear of the Sniper II.
Level PID setting 1 PIDV1	200 F or 93 C for Celsius set up
Level PID setting 2 PIDV2	300 F or 149 C for Celsius set up
Level PID setting 3 PIDV3	400 F or 204 C for Celsius set up
Digital Filter	0
Low level cut-off point	0.0

Parameter Group 30-31		**PG 30**	**PG 31**	
		1st Alarm	2nd Alarm	
Alarm setting	AL1	475 F or 246 C	AL2	-50
Alarm action selection	AS1	5	AS2	6
Alarm differential gap	AH1	2.0	AH2	2.0
Alarm timer	ALT1	0	ALT2	0
Energized de-energized selection	EGC1	0	EGC2	0

Parameter group 40-43	**PG40**	**PG41**	**PG42**	**PG43**
PID #	P1	P2	P3	P4
Proportional Band	187/85	91/33	67/19	36/2
Integral Time	12	8	4	4
Derivative Time	3	2	1	1
Anti-Resaet	100	100	100	100
Fuzzy	On	On	On	On

Parameter group 50		**PG50**
Output cycle %	CY1	2
Output limit, High Limit %	OLH	105
Output limit, Low Limit %	OLL	-5.0
Direct (Reverse action selection)	OS	1

Parameter group 60	PG60 (option)
Communication Speed	bPs 3
Data configuration	bIr 0

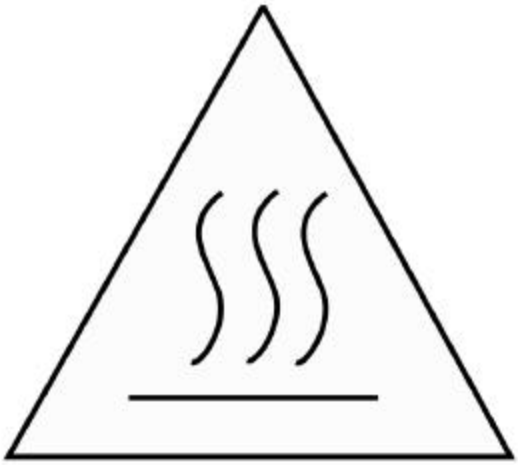
17. Hot Surface Symbol:

A Hot Surface symbol is installed on the front guard of the Nozzle Block assembly. Situated above the hot air exhaust.

This inner symbol is standardized in ISO 7000-0535 “Transfer of heat general”

This symbol is an important warning that caution should be exercised when the User is in the vicinity of the hot air components, including Guard, Heater, Nozzle Block and Nozzle. The User should avoid touching any part of this assembly, while in operation.

All components should be allowed to cool to room temperature before having any contact with these parts.



Graphical symbol: Caution, hot surface 417 - IEC – 5041

18: Engineer Test Procedures

1. Introduction:

This Section contains information, which is helpful to qualified personnel in trouble shooting potential problems with the Sniper II. It details initial Factory Set Up sequences that can be checked and followed to isolate and correct a problem area.

It is not meant as an Installation Procedure, nor need these procedures be followed as a matter of course, should a problem develop, as all procedures have been correctly implemented at the Factory. For Prism Alignment see Section 10 of this manual and for Reflow Calibration, see Section 9.

Only a qualified APE, Service Engineer or APE representative should carry out the following checks and procedures.

Caution: Some tests require the removal of panels exposing Mains voltage.

Caution: Non-qualified personnel making entry to the Sniper will invalidate Warranty conditions.

2. Hoses & Connections:

With the Power disconnected from the Mains Power, check all internal connections, including air hoses. Test each electrical crimp connections with a pull test of 15 lbs at crimp contact.

3. Rotary Table Adjustment:

1. Check level of Rotary Table with the Sniper work surface, ensuring that the Board Holder transfers from painted surface to the rotational table smoothly without interference.
2. If the level requires adjustment, proceed as follows:
3. Remove bottom panel, by carefully laying the Sniper on its left side. Be careful not to damage the “Emergency Stop Switch” Loosen the “set screw” of the large drag wheel and slacken until it doesn’t drag at all.
4. Using the, outside four (4) Height Adjust screws, raise or lower the Rotary Table so that it is level with the work surface, check level by sliding the board holder across the top and adjust again if necessary.

5. 4 Tighten the 4 lock nuts on each Height Adjust screw to secure.

6. Set the drag wheel to a light drag so that the Rotation Knob turns easily, tighten the “set screw” in the side of the wheel to secure.

4. Main Cylinder Test Without Power or Air turned on:

In this test the Main Cylinder Stop Lock Nuts are checked and adjusted using a “Carpenters Square”, and Shipping Pin. Two Lock Nuts sets are located at the front and the rear of the Threaded Rod. These determine the Stop settings of the Alignment and Placement positions, which must be set to a right angle to the base of the Sniper. Therefore this test is conducted after leveling of the Rotary Table.

5. A. Checking the VPD Alignment in the “Component View” position. (Hood Down)

A quick test is to use the Shipping Pin supplied with the system. Insert it into the right hand side of the Hood Assembly, so that it passes all the way through to the left side. The Pin should be tight, but able to be gently pushed through. If the Shipping Pin cannot be inserted, the following procedure should be followed:

1. Loosen the top Hood Stop Lock Nut, (located at the very top of the system), so that the Hood is not stopped by the Hood Stop.

2. Check the Forward “Front Lock Nut” location, on the threaded rod, which sets the Right Angle square position from the front of the Hood Assembly to the base of the machine, an Engineers Square is used for this setting. Adjust so that the Shipping Pin can be inserted and tighten the “Front Lock Nut”.

3. Adjust Hood Stop lock Nut, so that it just makes contact with the Hood. Connecting the Monitor and watching for the point where the image movement begins to be effected by the Hood Stop can also check the correct position of the lock nut.

4. The Hood Assembly should ride freely in its guide wheels.

5.B. Checking the VPD Alignment in the "Component Placement" position (Hood Up)

1. Manually lift the Hood and pull the VPD out and down to its "Placement" position

2. Check the rear lead screw "Back Lock Nut" location, which sets the Right Angle square position of the VPD Cylinder Bracket to the base of the machine, an Engineers Square is used for this setting. Adjust if necessary and tighten the Lock Nut.

6. Checking the Cylinder Piston Height

1. With the VPD in the "Component Placement" position and a large Vacuum Barb fitted to the Vacuum Gantry, set the Vacuum Barb to the top left rear corner of the Board Holder. The Board Holder should be raised to its maximum height, by adjusting the "z" Axis Thumb Wheels on each side of the Board Holder.

2. Check that the correct height of the Board Holder is 105 – 106mm and that the Vacuum Barb comes to rest on the Board Holder at this height. Adjust if necessary by loosening four (4) screws, attaching the Cylinder to the Cylinder Bracket. Allow the Vacuum Barb to rest on the Board Holder, so that it is perfectly level, check with feeler gauge, or paper. Then tighten all screws. Note: Prism Alignment will be required if the Cylinder position is adjusted in the Cylinder Bracket.

7. Ring Light Position Adjustment:

Ensure bottom PCB illumination ring light is set, so that it clears the acrylic shield, when the VPD is raised. To adjust, loosen the four (4) screws, at the sides of the Hood Cover and adjust the light.

8. Power Test WITHOUT air:

1. Disconnect Main Power Off

2. Carefully remove the two rear panels, so that all control valves are exposed.

3. Make sure all switches are in the off position.

4. Position "Alignment/Placement" switch in "Placement" position.

5. Manually pull out the VPD placement arm to rest in its "Placement" position.

6. Without connecting the air, connect Mains Power and turn on the machine.

7. At the rear right of the horizontal mounting panel of the Sniper, check the three Single Flow Control Valve rear lights on the horizontal Vacuum Manifold. These drive the Vacuum Generators.

8. Turn "On" the three Vacuum switches:

    a. Component "Alignment/Placement" Pick Up Vacuum

    b. Component Reflow Pick Up Vacuum

    c. Table Lock Vacuum

Ensure all lights come on when all switches are turned on.

9. The Alignment/Placement switch will affect a dual set of Double Flow Control Valves situated to the left of the Vacuum Manifold, containing the three valves. The Flow Control Valve on the right of the dual set is for the Main Cylinder and the one to the left is for the VPD.

10. In the "Placement" position the Main Cylinder Flow Control Valve rear light should illuminate. The rear light of the VPD Flow Control Valve should also be illuminated.

11. If the VPD rear light is not illuminated, check the magnetic switch on the Main Cylinder to ensure that it engages correctly and adjust for correct position, as follows:

12. The Main Cylinder Magnetic Switch should be set to engage (be illuminated) ¼" from the very end of its motion (Placement position).

13. To check the "Alignment" position, manually move the VPD up and push the Main Cylinder all the way back to the "Alignment" position. The Main Cylinder Flow Control Valve front light and the VPD Flow Control Valve front light should illuminate and the rear lights extinguish.

14. If the Main Cylinder front light does not illuminate, check adjustment of the VPD Magnetic Switch location and if necessary adjust by relocating its position, such that the light illuminates at the top of the VPD stroke (top most position).

9. Cylinder Flow Control Settings:

Cylinder Flow Controls are located at:

- Reflow Z Axis Cylinder: Two (2), Flow Controls.
- VPD Cylinder: Two (2), Flow controls.
- VPD Flow Control Valve (on the rear Horizontal Panel): One (1) Flow Control.

All the above Flow Controls are adjusted 1-1/2 turns out from all the way in. (approx 40 PSI)

The Main Cylinder contains two (2) Flow Controls, which are adjusted one (1) turn out from all the way in. (80 PSI)

10. Mini Air Regulators (located on bottom rear panel)

Close the Mini Air Regulators by turning, all the way, counter clockwise. (Note: The Mini Air Regulator adjustment is an opposite convention to a Cylinder Flow Control)

11. Soft Start Adjustment

1. Disconnect the Main Power.
2. Set the Primary Soft Start adjustment to off position (full clockwise). The Primary Soft Start Adjustment is accessed through a ¾" hole in the rear panel. Use a 3/8" screwdriver for the adjustment.
3. Ensure all hoses and wires move freely, and are not stressed throughout their range of motion.
4. Ensure the Main Air Regulator on the back panel is closed.
5. Set machine in "Initial Test" position. Main cylinder extended to "Placement" position and the VPD stroke in the "Up" position (not extended).
6. Switch the Alignment/ Placement switch to "Placement".
7. Connect the Air Line to the rear panel Main Air Regulator, (the panel will be unsecured from the machine, so be careful not to stress)
8. Open the Main Air Regulator to 80 PSI.

At this stage the power test with air can be conducted as follows:

9. Connect and turn Main Power "On."

10. Listen for any obvious air leaks.

(If leaks are detected, check Flow Control Valve gaskets are set correctly and hoses are firmly secured n fittings. Once found and corrected, switch off the machine and wait one minute before switching on.)

11. Ensure that the Primary Soft Start is full clockwise

12. If no leaks are detected, use a 3/8" flat screwdriver to adjust the Primary Soft Start counter clockwise slowly until you hear an audible "click", this allows air to flow through to the Secondary Soft Start.

The Secondary Soft Start has two (2) screw adjusters, marked "Pressure" and "Speed" which are factory set as follows:

- Speed Set (Right Side) fixed position **(do not adjust)**
- Secondary Stage Air Pressure screw (Left Side) adjusted to slowly reach initial pressure of 40 PSI

Adjustment will require an inline Pressure Gauge, inserted at the output of the Secondary Soft Start manifold. Adjust the "Pressure" only, left hand screw, until 40 PSI is reached over 15 seconds, the valve will then open to 80PSI. after this is reached.

13. Turn off Main Power.

12. Mini Pressure Regulator and VPD Flow Control Regulator Adjustment

1. Set "Alignment/Placement" switch to "Placement" position

2. Turn on Main Power.

3. Once the Soft-Start System is adjusted, the VPD Mini Pressure Regulator located on the rear panel (The Bottom of the two) can be adjusted until the VPD is seen to descend.

4. Adjustment can now be made to the VPD Cylinder Flow Controls. The top Flow Control adjusts the "Up Speed" of the VPD. The bottom Flow Control adjusts the "Down Speed" of the VPD.

5. Adjust the Flow Control until the VPD Cylinder is running smoothly.

6. Next switch to alignment (**NOTE: If the VPD rises too slow, set the switch back to placement before the VPD reaches the top, or the unit will slam back**.) the unit will move through its motion, adjust speeds as necessary.

13. Main Cylinder Speed:

The Flow Control at the rear of the Main Cylinder (towards the rear panel) adjusts the speed of the Cylinder as it retracts ("Alignment").

The Flow Control at the front of the Main Cylinder adjusts the speed of the extension ("Placement") motion.

14. Mini Pressure Regulator and Reflow Z axis Flow Control Adjustment

1. Set the Reflow "Z" Axis switch, located on the bottom front panel to the up position. Then turn the Reflow "Z," Mini Pressure Regulator (the top Mini Pressure Regulator on the rear panel) until you see it rise to the top of its motion. Adjust its pressure and Cylinder Flow Controls (top & bottom) until you get the Reflow Arm to rise smoothly and not jerk when the switch is operated.

2. Once these adjustments are completed and the machine is working smoothly, lock all the Flow Controls. Also ensure the Main Cylinder Lock Nut Stops are tight, and that the Shipping Pin can be inserted easily.

15. Emergency Stop

Turn the machine on and off with the "Emergency Stop" switch. Make sure it stays off when depressed, and releases when turned.

16. Controller Power

Turn on controller power switches on Front Panel, ensure that the top and bottom controllers and blowers for each turn on separately. Controller protocol and operation is covered within the sections of this Manual.

19. Appendix B

Sniper Bottom Heater 600W Replacement Procedure

1st. Work to be carried out at the rear of the Sniper:

1. Check that the power is disconnected from the rear of the Sniper.
2. Remove the two Rear Panels of the Sniper to expose the systems wiring.
3. Disconnect one leg (live) of the Heater Coil wiring from the Solid State Relay. Noting the terminal and the correct wire for the new Heater.
4. Disconnect the other wire (Neutral) from the Terminal Block, again noting the location and the correct wire for reassembly of the new part.

1st. Work to be carried out at the front of the Sniper:

5. Remove Black Heat Guard, by removing the five fixing screws.
6. Remove the Nozzle (round) Guard at the front of the Heater Assembly. Only two screws need to be removed to take out the Guard.
7. Carefully pull out the Thermocouple from the front of the Heater Assembly. Do not unduly bend or stress the Thermocouple.
8. Loosen the three supporting screws on the Heater Assembly Mounting Block.
9. Carefully remove the Heater Tube.

10. Remove the old Heater Coil, ensuring that the wires are free to pull out without snagging, note the feed aperture where the wires feed into the Sniper.
11. Install a new heater feeding the wires into the aperture.
12. Slide the Heater Tube over the Heater Coil and ensure that the coil mica supports are perpendicular and horizontal. (Not laid in an X)
13. Tighten the three (3) supporting screws evenly, fixing the Tube.
14. Reinstall the Guard.

2nd Work to be carried out at the rear of the Sniper:

15. Re-connect the two wires, ensuring Live connects to the Solid State Relay and the Neutral connects to the Terminal Block.
16. Replace the Rear Panels.

2nd Work to be carried out at the front of the Sniper:

17. If the Silicone Grommet was removed with the Thermocouple, carefully slide it off the Thermocouple and insert it into the hole where the Thermocouple will enter the Heater Assembly.
18. With great care, so as not to damage the Thermocouple sensor wires, insert the Thermocouple through the Grommet. The Grommet will insulate the Thermocouple through the Heater Assembly.
19. Reconnect the Power Cable and switch on the Sniper.
20. It is now necessary to recalibrate the Bottom Heater using the APE Thermal Trace system. During the calibration procedure, the Round Nozzle Guard should be in place at each reading. Only two (2) screws need to be in place during the tests to easily locate the Nozzle Guard and the Calibration Nozzle 8100-0000-44.
    After calibration the four Nozzle Guard Fixing screws should be adjusted so that a Bottom Heat nozzle can easily be installed without vibration

Sniper Top Heater 1200W Replacement Procedure

The procedure for the Top Heater is identical to the procedure above; except that there is no Nozzle Guard in the front of the heater assembly. (The front of the Heater Assembly for the Top Heater is referred to as the Nozzle Block).