DEN-ON INSTRUMENTS

RD-500 II & RD-500S II
Area Array Rework System
Instruction Manual
Revision 1.4.3

RD-500Ⅱ

RD-500SⅡ

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SAFETY

The following are safety precautions that personnel must understand and follow when using or servicing DEN-ON products.

1. POTENTIAL SHOCK HAZARD **-** Repair procedures on DEN-ON products should be performed by Qualified Service Personnel only. Line voltage parts may be exposed when the equipment is disassembled. Service personnel must avoid contact with these parts when troubleshooting the product.
2. To prevent injury, adhere to safety guidelines in accordance with OSHA and other applicable safety standards for your country or region.
3. Always use DEN-ON systems in a well ventilated area.
4. Exercise proper precautions when using chemicals (e.g., solder paste). Refer to the Material Safety Data Sheet (MSDS) supplied with each chemical and adhere to all safety precautions recommended by the manufacturer.
5. Always follow the safety precautions as follows
   A. Be careful when using in places where there are combustible materials.
   B. Do not use in the presence of an explosive atmosphere.
   C. The heater assembly housing and any installed nozzle are hot when the system is being cycled and for a period of time thereafter.
   D. Do not touch either the heater assembly housing or the hot air nozzles. Also, be careful to keep hands and other body parts out of the direct heated air stream. Otherwise severe burns may result.

INTRODUCTION

Thank you for purchasing the RD-500 II or RD-500S II BGA/CSP Rework Station. Area array devices have increased with such popularity that rework and repair of printed circuit boards requires the use of a machine capable of handling these challenging components. These devices require an optical overlay vision system to ensure proper placement and high levels of process control during rework to ensure successful installation. The RD-500 II and RD-500S II has been specifically designed to rework these types of components and can also install and remove a variety of other SMT devices.

RD-500 II PACKING LIST

1.	RD-500 II Main Body (shipped as 2 separate parts)	1 each
2.	RD-500 II Board Holder	1 each
3.	Board Supports for Large Boards	2 each
4.	Board Support Bracket	1 each
5.	PC with Software and Video Card Installed	1 each
6.	Recovery Software CD-Rom Kit (Windows, RD-500, Drivers, etc.)	1 each
7.	Flat Panel Display	1 each
8.	RS232C Cables	2 each
9.	Mouse	1 each
10.	S-Video Cable	1 each
11.	Bottom Nozzles (Large and Small)	2 each
12.	Hand Held Vacuum Pick	1 each
13.	BP-500 Kit (less Stencil)	1 each
14.	Vacuum Pads – Large	3 each
15.	Vacuum Pads – Medium	3 each
16.	Vacuum Pads – Small	3 each
17.	Allen Wrench Set	1 each
18.	RD-500 II/RD-500S II Instruction Manual	1 each
19.	K-Type Thermocouples	5 each

RD-500S II PACKING LIST

1.	RD-500S II Main Body	1 each
2.	RD-500S II Board Holder	1 each
3.	PC with Software and Video Card Installed	1 each
4.	Recovery Software CD-Rom Kit (Windows, RD-500, Drivers, etc.)	1 each
5.	Flat Panel Display	1 each
6.	RS232C Cables	2 each
7.	Mouse	1 each
8.	S-Video Cable	1 each
9.	Bottom Nozzles (Large and Small)	2 each
10.	Optical Alignment Tool	1 each
11.	BP-500 Kit (less Stencil)	1 each
12.	Vacuum Pads – Large	3 each
13.	Vacuum Pads – Medium	3 each
14.	Vacuum Pads – Small	3 each
14.	Allen Wrench Set	1 each
15.	RD-500 II/RD-500S II Instruction Manual	1 each
16.	K-Type Thermocouples	5 each

FEATURES

1. HEATING SYSTEM – There are three Heater Sections in the RD-500 II and RD-500S II Systems. Two are hot air type to accurately heat the target component and circuit board from the top and bottom. The third is an area heater and is a series of either two or four infrared heaters, depending on the system you purchase. Please note that on the RD-500S II this area heater is a series of two infrared heaters and is an option. The area heater gradually heats the overall PCB from the bottom. This is used in order to prevent the circuit board from warping during the rework heating cycle. These heaters form the heart of the RD-500 II and RD-500S II and are the reason it can accurately and effectively produce nearly any profile for standard or lead free solders. They are also so effective that the performance of the unit is unaffected by heating or air conditioning vents.

2. 5-ZONE PROFILING – The reflow profile is separated to five zones. The two hot air heaters can be independently set at each zone. Because these have individual controls, the RD-500 II and RD-500S II profiles can be accurately adjusted to create the perfect profile for any board or component. The IR area heater is set at one temperature through out the heating cycle and is used for overall stable heating of the board through out the reflow cycle.

3. COOLING FAN – This is a fan that is initiated upon the command of the user when wanting to quickly cool the part. This has been recommended for certain alloys of lead-free solder. This effectively adds a 6^{th} zone to the rework profile

4. AUTO PROFILING – One of the primary features of the RD-500 II and RD-500S II is the Auto Profiling function in the software. Previously, this type of function was only available on the most expensive of machines. Now with the RD-500 II and RD-500S II, this time-saving function assists the user in creating a profile quickly and more accurately than ever. It is initiated in software and uses one thermocouple to gather data and automatically develop the profile.

5. TWO-POINT AUTO PROFILING – At times when a very low temperature difference is desired between the ball and the top of the component, the user can place a second thermocouple on the top of the component and connect it to the #5 sensor input. This will cause the Auto Profile function to automatically adjust the upper heater down and lower heater up in the Ramp 2 and Reflow phases in order to minimize this delta. As a safety precaution, this automatic adjustment will only take place when there is a difference between 0°C and 30°C. If the #5 sensor sees a difference of less than 0°C or more than 30°C this automated function will not occur. If there is no thermocouple plugged into Sensor 5 then the function will not occur.

6. SEMI-AUTOMATION – The handling of the components during removal and replacement is done via a semi-automated process. Since a vacuum pick is located inside the nozzle, the vacuum is automatically activated when the unit needs to pick-up or place the component during the either the removal or placement reflow heating cycle.

7. BOARD CAPABILITY – The RD-500 II is designed to hold a board with a maximum size of 500mm X 600mm. The RD-500S II is designed to hold a board with a maximum size of 400mm X 420mm.

8. LARGE AREA HEATING FLEXIBILITY

    a. RD-500 II – With this maximum board capability, the area heater also needs to accommodate and be moved into position since the target components can be located anywhere on the board. So the RD-500 II area heater has been placed on a slide in the X-Axis to accommodate varying component positions. Also, if smaller boards are to be reworked the two outer heaters can be simply and easily turned off at switches located at the right side of the machine. If no IR area heating is necessary, then all the area heaters can be turned off via the software set-up mode.

    b. RD-500S II – The RD-500S II has a similar system except that the area heater is an option. When it is attached the software automatically notes the presence of the heater and begins starts control. It is not permanently attached and can be slid from side to side in order to maximize the heating of the board.

9. 5 SENSOR TEMPERATURE MANAGEMENT – Profile management and operation are controlled via the Development and Operation tabs in the software. In the Development, profiles can be run and viewed through five temperature sensor inputs. These are K-type thermocouples and are supplied with the unit. These can be placed anywhere on the board and then when the profile is run, the RD-500 II and RD-500S II will capture and record the information sent from these thermocouples.

1. SET-UP

1.1. The follow is an explanation of how to set up the RD-500 II and RD-500S II for operation. The RD-500 II Base and Upper Control Units come separate and need to be attached electrically and mechanically. The RD-500S II comes assembled so you can skip to 1.2.2.

1.1.1. Assembling the Base and Upper Control Units. **Note: This step applies only to the RD-500 II.**

1.1.1.1. Reference Figures 1, 2, and 3.

1.1.1.2. Remove the Base and Upper Control Unit from the boxes and place the Upper Control Unit on the Base.

1.1.1.3. There are two plates that are used to connect these two parts. See Figure 1.

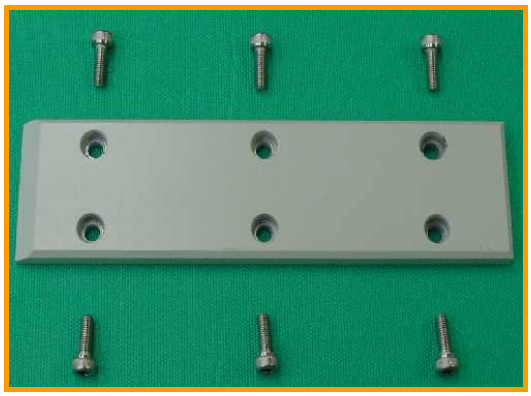


Figure 1

1.1.1.4. Using the screws provided, attach the Upper Control Unit to the Base. See Figures 2 and 3.

Figure 2

Figure 3

1.1.1.5. Reference Figure 4

1.1.1.6. Remove the rear cover on the Base Unit and make the electrical and air connections as seen in Figure 4.

Figure 4

1.1.2. Installing the Optional Area Heater for the RD-500 IIS

1.1.2.1. Remove the Bottom Nozzle and the Nozzle holder from the Bottom Hot Air Heater.

1.1.2.2. Set the Area Heater over the Bottom Hot Air Heater so that the heater comes up through the hole

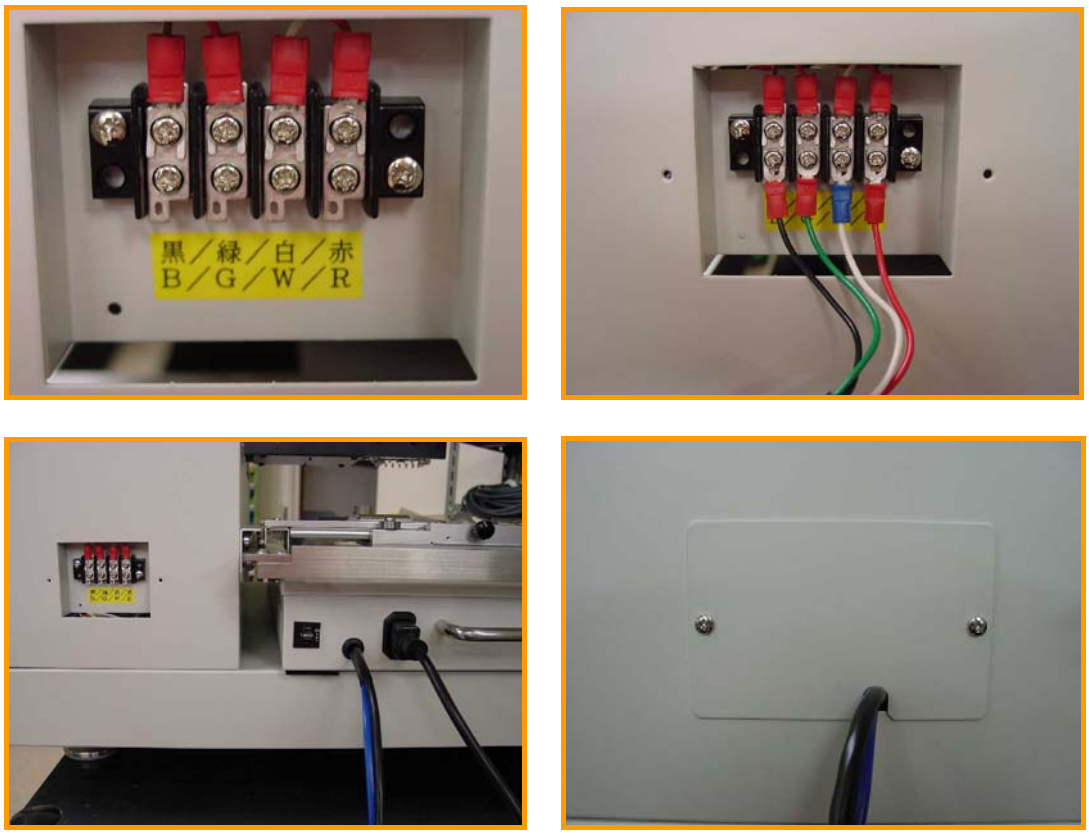
1.1.2.3. Remove the side cover plate on the left-hand side of the base unit.

1.1.2.4. Reference Figures 5.

1.1.2.5. Attach the wires from the area heater to the connectors exposed and held in the box.

1.1.2.6. Put the wires in the box so that only the main insulation is exposed and attach the cover plate.

1.1.2.7. Attach the main power cord to the unit.



Figures 5

1.1.3. Installing the Board Holder

1.1.3.1. Referring to Figures 6 and 7, insert the Rear Slide Plate into the Bearing Unit as shown in Figure 1. Next fasten the four screws of the front bearing as shown in Figure 6. Check to make sure the holder is square.

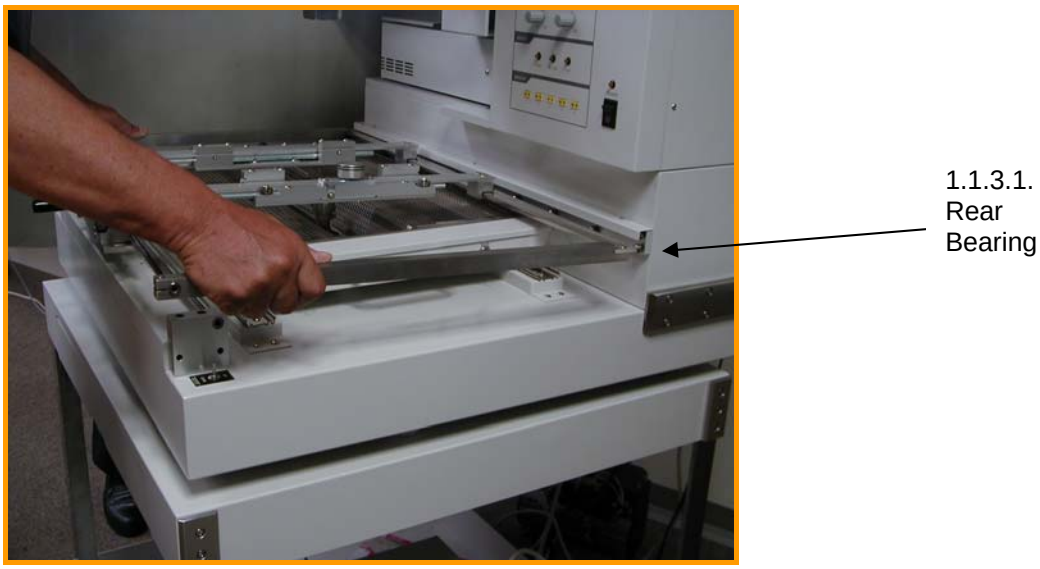


Figure 6

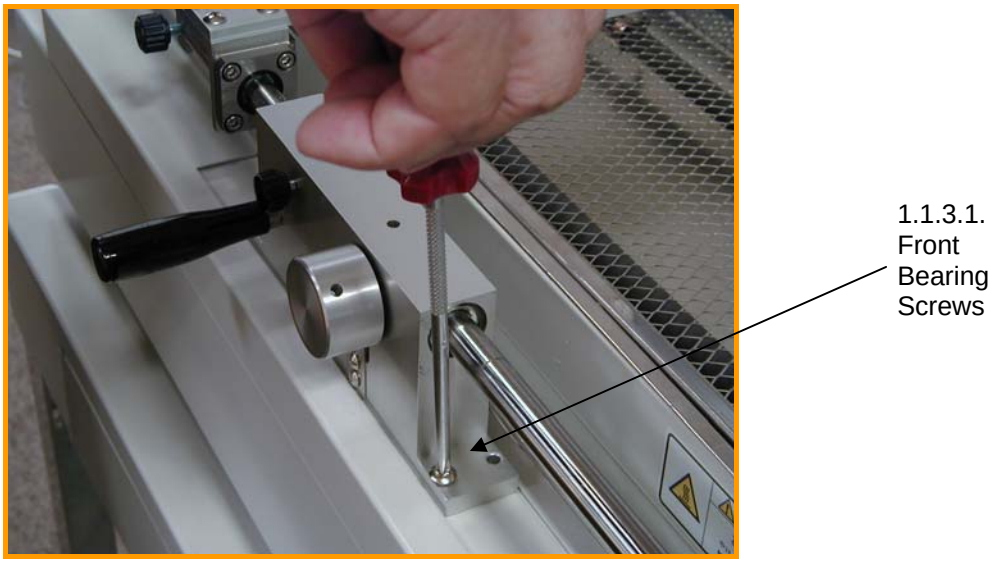


Figure 7

1.2. Installing the Flat Panel Display

1.2.1. Referring to Figure 8, using an appropriate size of Philips Screwdriver, attach the FPD plate to the rear of the FPD.

Figure 8

1.2.2. Referring to Figure 9, slide the support bracket onto the Support Shaft and tighten the Support Shaft Screw and the FPD Screw with the appropriate Allen wrench.

1.2.2.
FPD
Screw

Figure 9

1.3. Computer Interconnect Cables

1.3.1. Referring to Figure 10, make the connection between the base unit, the computer and the Flat Panel Display. If you have an RD-500S II with an Area Heater you will also need to make the connection between it and the Base Unit.

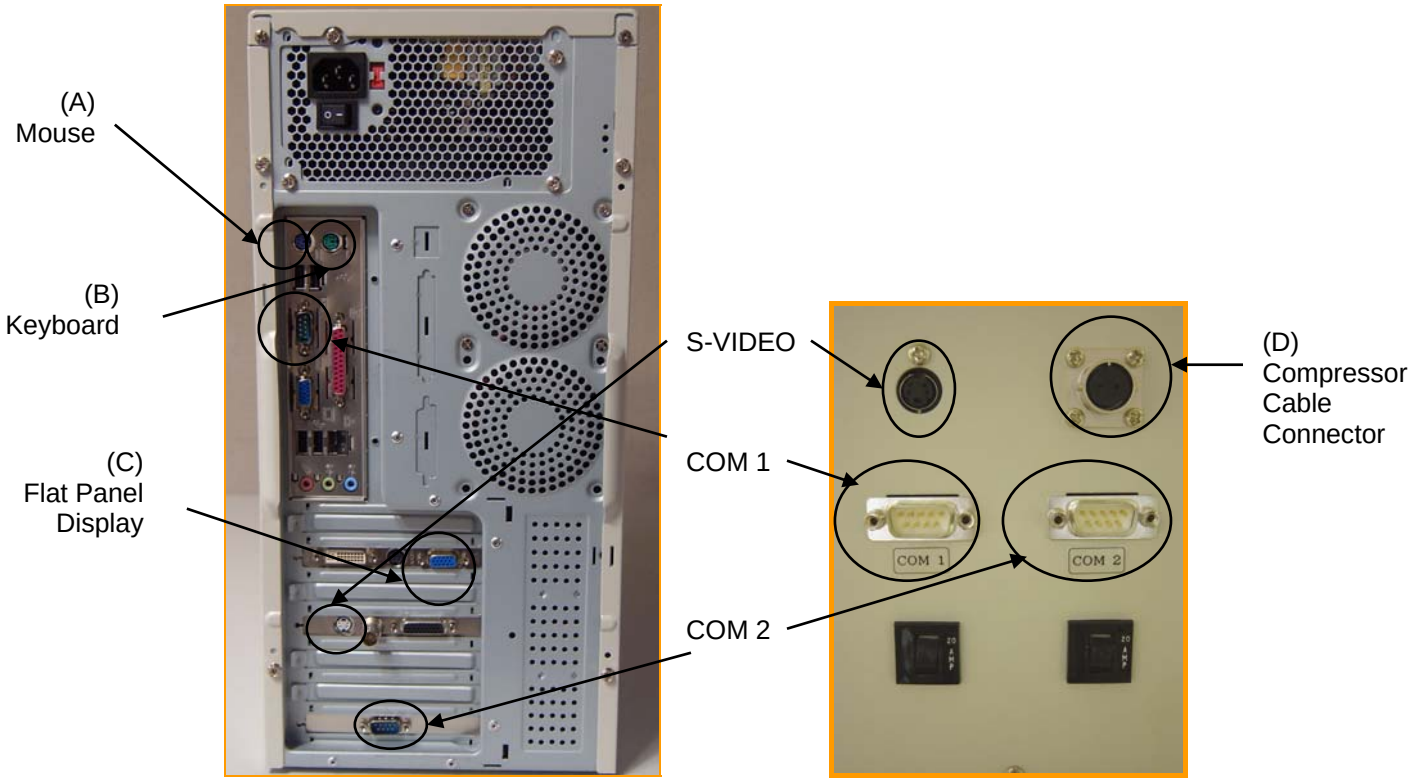


Figure 10

(A) Mouse
(B) Keyboard
(C) Flat Panel Display
(D) Compressor Cable (If optional Compressor is used. See section 4 below for air connection options.)
(E) Area Heater Controller (On the RD-500S II only, not shown in photograph)

1.4. Connection of Air - There are two ways to use air. One is to use the external shop air or nitrogen and the other is to use the optional Compressor.

1.4.1. Reference Figure 11

1.4.1.1. Using external shop air or nitrogen

1.4.1.1.1. Connect the external air with at least 0.20 Mpa to the IN side of the Regulator.

1.4.1.1.2. Connect the OUT side of Regulator to the IN port of air of RD-500 II.

1.4.1.1.3. Set the RD-500 II regulator between 0.15 and 0.20 Mpa using the knob located on the top**. Note: Do not**

set the regulator to more than 0.20Mpa. Doing so will not allow the Solenoid Valve to properly open.

1.4.1.1.4. Set the Top and Bottom Hot Air Flow Valves on the panel of RD-500 II to the maximum by turning them counter-clockwise.

1.4.1.2. Using the Optional Compressor

1.4.1.2.1. Connect the output of air of Compressor to the IN side of Regulator.

1.4.1.2.2. Open the Regulator Knob on the RD-500 II completely. Do this by turning the knob counter-clockwise. Since the Compressor is a low pressure type, the RD-500 II will need the full pressure it supplies.

1.4.1.2.3. Set the Top and Bottom Hot Air Flow Valves on the panel of RD-500 II to the maximum by turning them counter-clockwise.

1.4.1.2.4. Connect the control cable of the Compressor to Connector of RD-500 II.

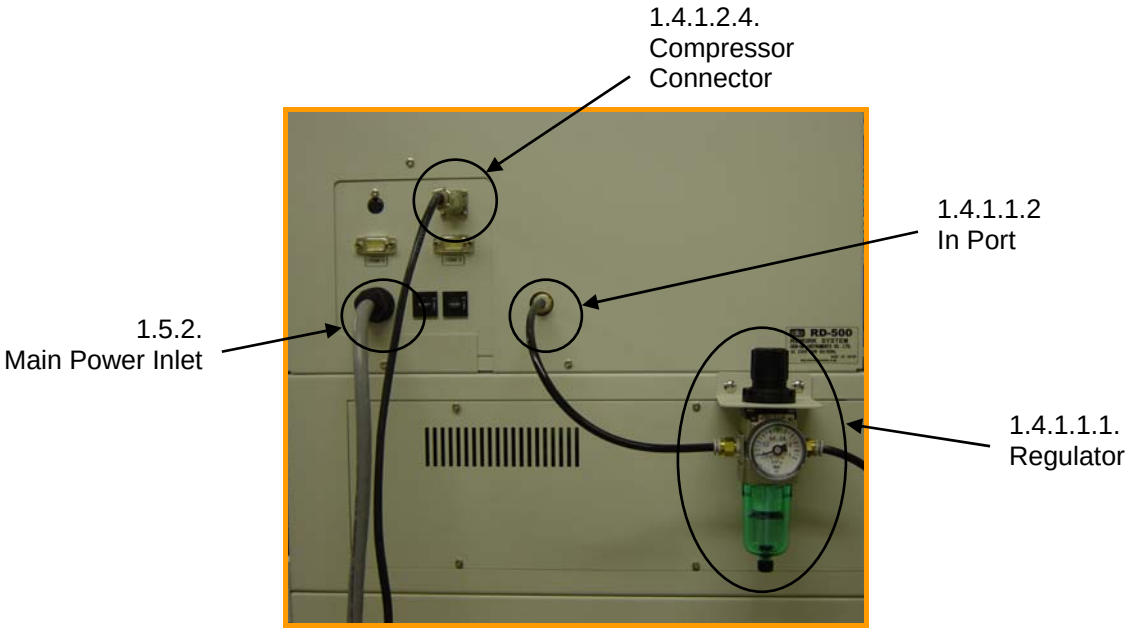


Figure 11

1.5. Connection of Power Source

1.5.1. The RD-500 II Main Body requires 200-230VAC at 3.0kw. The RD-500S II comes in either a 100-120VAC or 200-

230VAC at 1.4kw. If the optional Area Heater is installed it uses a total of 2.2kw.

1.5.2. Confirm that the power source is off. Attach an appropriate plug to the electrical cord in Figure 10. Next plug the unit into the power outlet.

1.5.3. The Computer is switchable and can be set to run on 100, 120, or 220 VAC. The Flat Panel Display is an auto-switching power supply and can run from 100-240VAC, 50-60 Hz. Note: Confirm these settings on the rear panels of these units before connecting them to the power source. The incorrect power can easily damage these units.

1.5.4. The Compressor is available in either 100 or 230 volt. Please confirm the power of the unit before connecting it to the power source.

1.6. Initial Power-Up

1.6.1. You can check to see if power is being properly supplied to the unit without starting the computer. Switch the Main Power into the “on” position. When this is done, there will be a clicking sound coming from the main body. This is the sound of a Solenoid Valve opening to let the compressed air into the RD-500 II as a system check. At this time the two flow meters will show that air is flowing through the RD-500 II. During this system check hot air will briefly flow from both the top and bottom hot air heaters. If this occurs then all connections have been properly made.

1.6.2. Next, switch off the Main Power of RD-500 II. And start up the PC. Then double click the icon of RD-500 II to star up the soft of RD-500 II. The message of “Initialization” will appear in the screen. At this point switch on the power source of RD-500 II Main Body again. After the initialization of RD-500 II Main Body is confirmed, the screen is switched to the image of the profile conduct. When all of the confirmations above are done, it is a sign that the set up is complete.

2. Function and Use of the RD-500 II Machine

2.1. Main Body

2.1.1.1. Reference Figures 12A for the RD-500 II and 12B for the RD-500S II

2.1.1.2. Main Power Switch – This switch provides power to the Main Body only. It does not control power to the Flat Panel Display, the computer, or the optional Compressor. This switch is also marked in with a yellow background as it also functions as the Emergency Cut-off Switch and will stop all functions of the Main Body in case of an emergency.

2.1.1.3. Top Heater Airflow Valve – This is the Top Heater Airflow Valve. To open the valve, turn them in a counter-clockwise direction. The air settings are determined by the size of component to be reworked. Below are the general guidelines:

30 l/min. for Device larger than the 25mm
25 l/min. for Device with the 15mm – 25 mm square
20 l/min. for Device smaller then the 15mm square

In the software there is also a reference to the airflow and nozzle selected. Please see section 4.2.1.9 for this software function.

2.1.1.4. Bottom Heater Airflow Valve – This is the Bottom Heater Airflow Valve. This can be kept constant at 25 l/min.

2.1.1.5. Heater Indicator LEDs – These are the LEDs that indicate power being supplied to the 3 heater systems. These are the Top Hot Air Heater, the Bottom Hot Air Heater, and the Area IR Heaters.

2.1.1.6. Device Lighting Adjustment Knob – This knob is used to adjust the lighting directed at the Device when the Optics Arm is deployed.

2.1.1.7. PCB Lighting Adjustment Knob – This knob is used to adjust the lighting directed at the PCB when the Optics Arm is deployed.

2.1.1.8. Device Theta Adjustment Knob – This is the knob that is used to adjust the theta alignment of the component during the placement process.

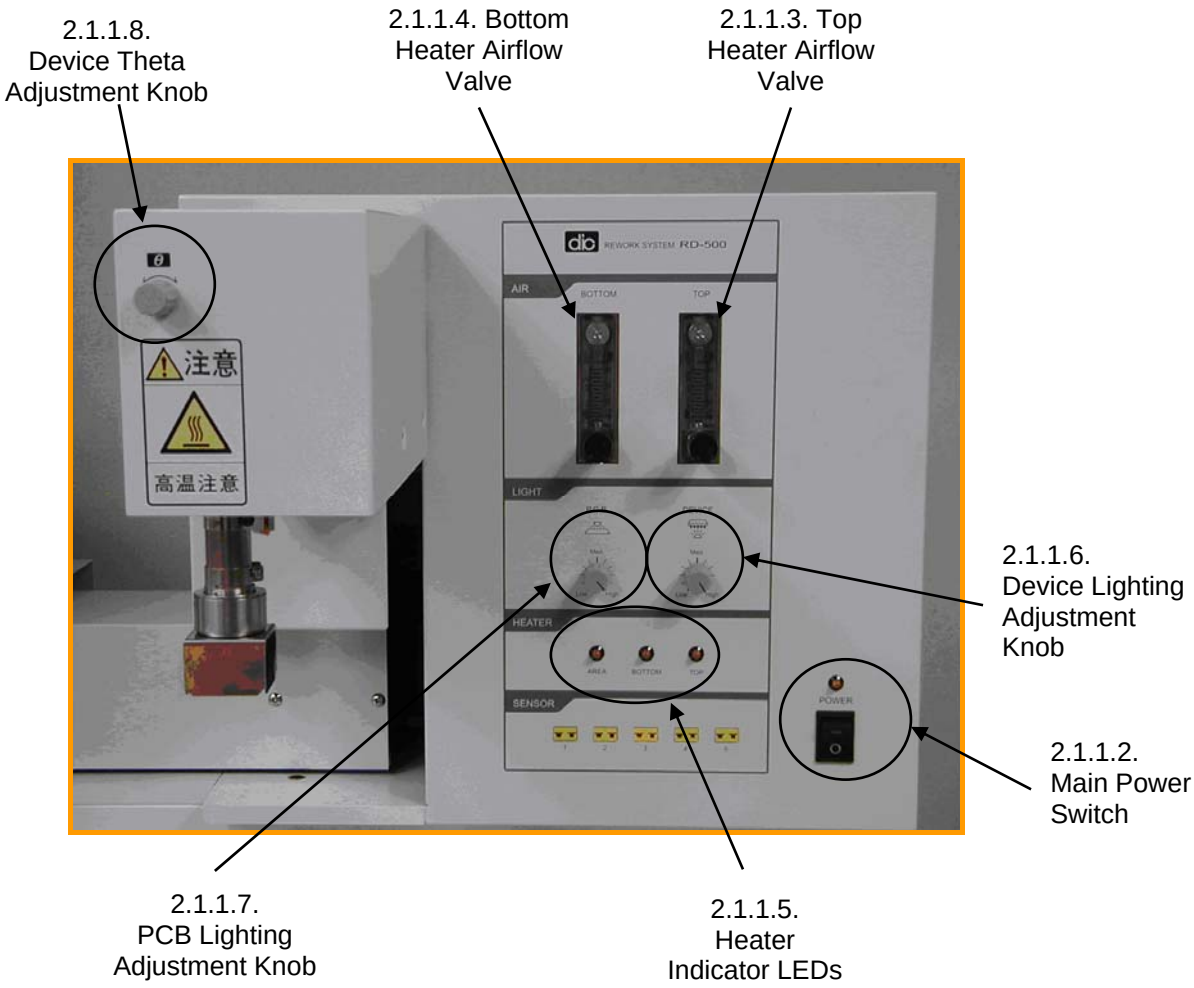


Figure 12A RD-500 II

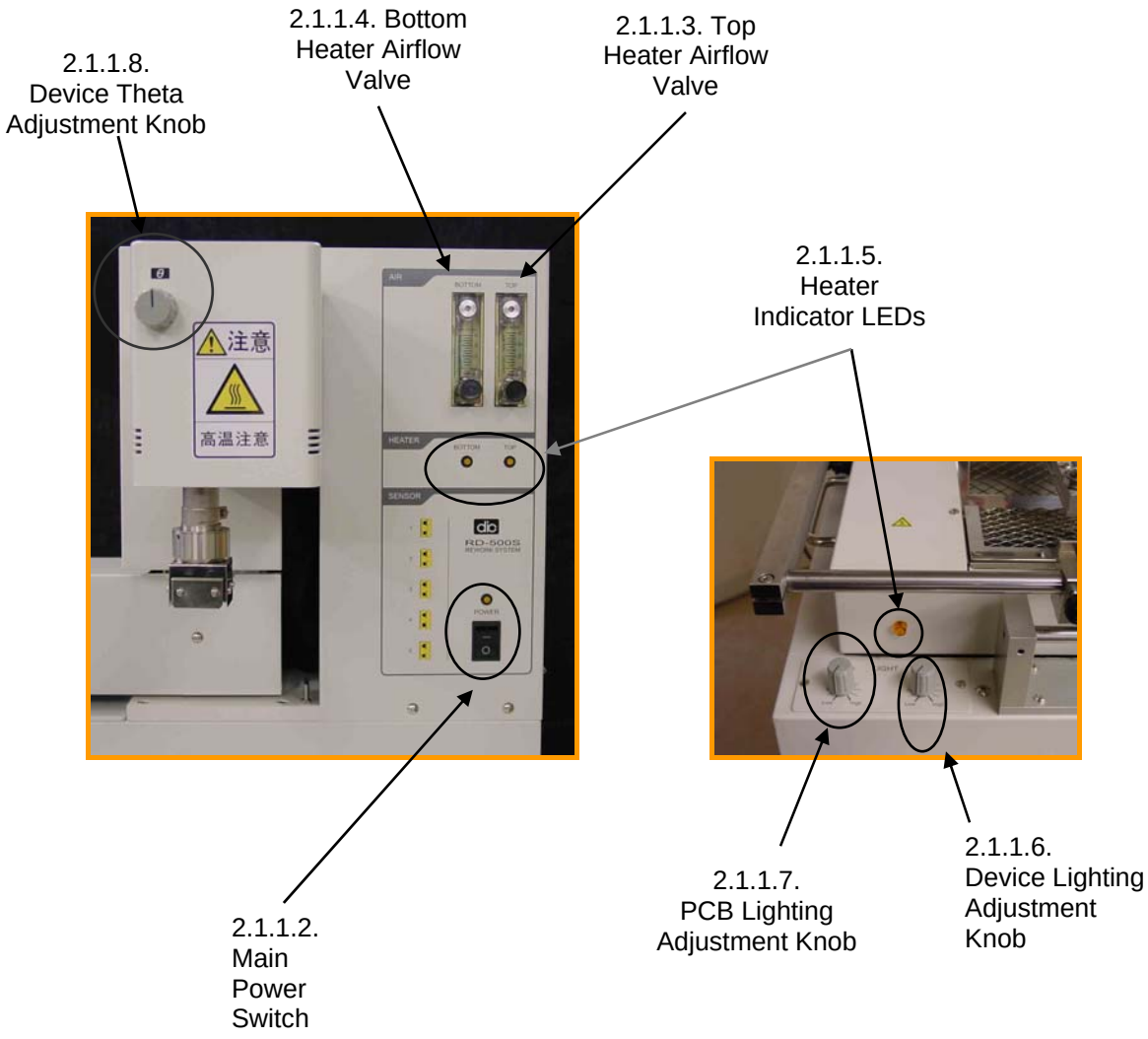


Figure 12B RD-500S II

2.1.2. Reference Figure 13

2.1.3. There is a small window on the side of the heater head. This is to view the location of the Theta adjustment mechanism. The RD-500 II and RD-500S II were designed to require only small amounts of theta adjustment. The mechanism can therefore only move 10 degrees or so in either direction. If this theta adjustment goes too far in one direction then the vacuum pick can sometimes get caught and not properly place and remove components. To ensure the proper location of this mechanism, a window is provided in the side of the heater head. Please check that the silver bar is in general alignment with the vacuum pick.

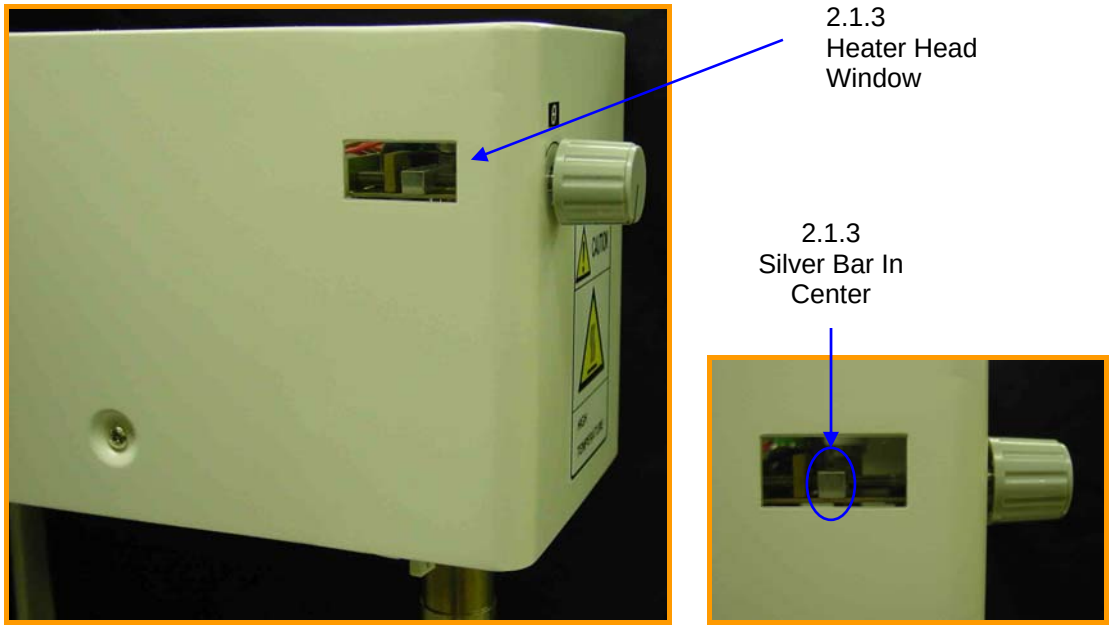


Figure 13

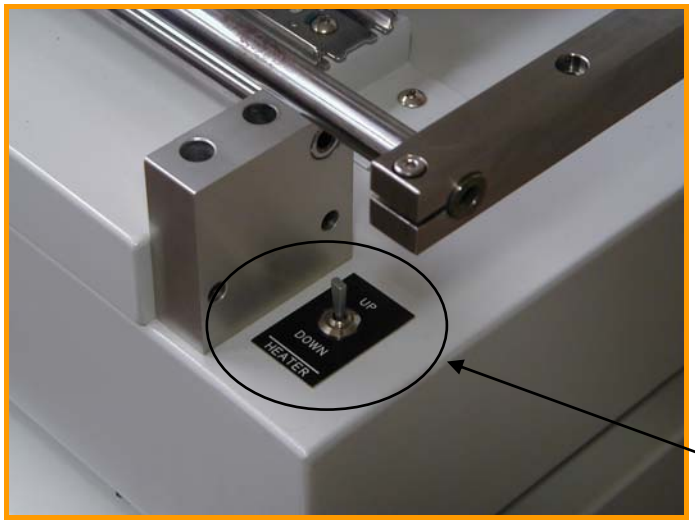
2.1.4. Reference Figure 14

2.1.5. Manual Up-Down Heater Head Switch – This switch has three purposes:

2.1.5.1. During the alignment process, components with different thicknesses will be aligned. Because they are held into place at the nozzle by the vacuum pick, the location of the bottom of the balls or columns will be different. This will cause them to be at a different focal length relative to the prism as the PCB. In order for the images of the device and the PCB to be the same size, they must be at the same focal length from the prism. If not their size on the screen will be different and they will never be aligned. Use this switch to adjust the focal length.

2.1.5.2. When the reflow cycle is started, sometimes the nozzle will not come down to the desired height. Use this switch to adjust the nozzle to the desired height.

2.1.5.3. When the nozzle is brought down for reflow, sometimes a component not seen in the alignment process will be in the path of the descending nozzle. Use this to move the nozzle up so that the head will not bang into these components.



2.1.5.1. Manual Up-Down Heater Head Switch

Figure 14

2.2. Board Holder

2.2.1. Reference Figures 15 and 16.

2.2.2. Looking at Figures 15 and 16, first loosen knobs 1 and 2 and adjust Holding Blocks 3 and 4 to be about 4-5 mm smaller than the board. Tighten these knobs. This will provide for a snug fit in the Holding Blocks.

2.2.3. Insert the board by squeezing plates 5 and 6. Fit the board into the grooves of Holding Blocks 3 and 4.

2.2.4. Next, Loosen knobs 7 and 8 then move the board holder so that the target component or area for the component are roughly in between the Top and Bottom Hot Air Heaters.

2.2.5. Tighten only Knob 7 at this time. This is the gross movement clamp.

2.2.6. With the RD-500 II, computer and Flat Panel Display powered up and in the Optics section of the software set, use knobs 8 and 11 to adjust the board into position.

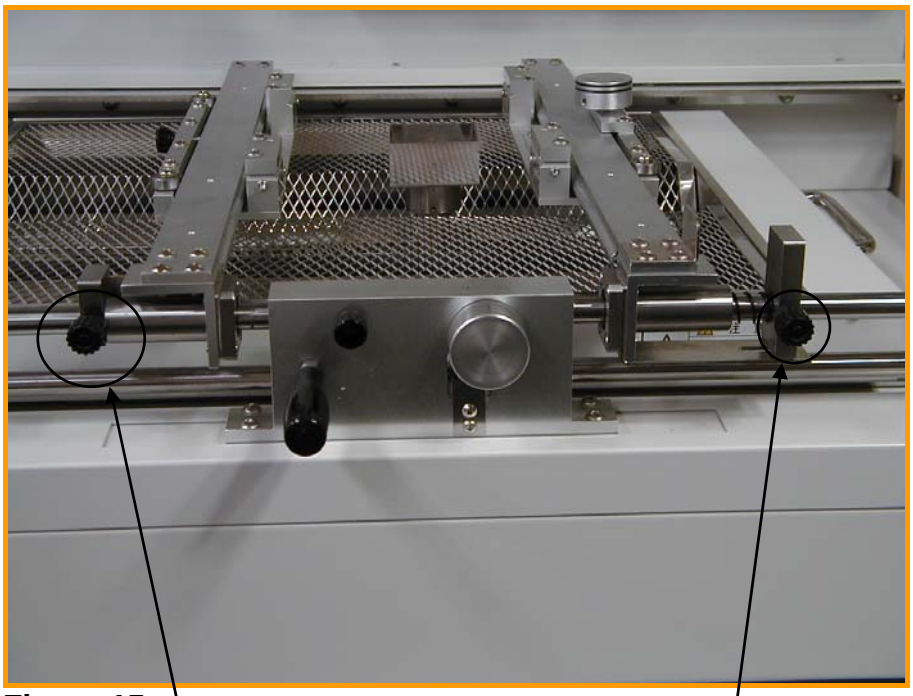


Figure 15

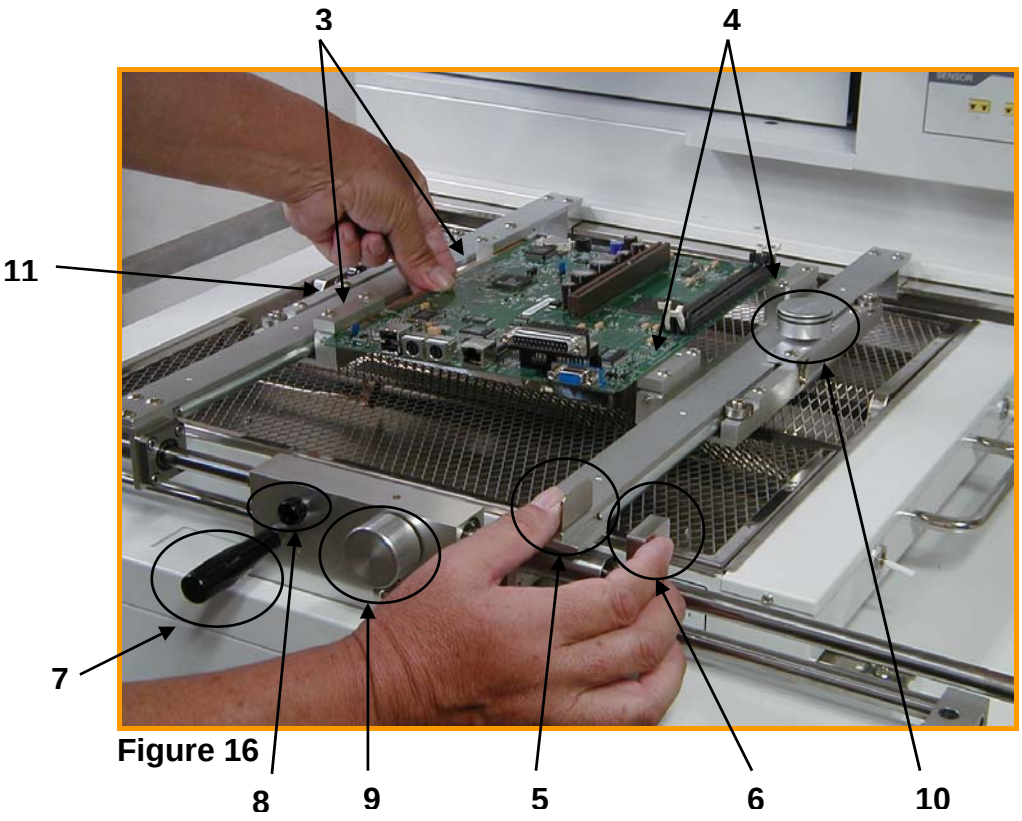


Figure 16

2.2.7. Reference Figure 17.

2.2.8. For smaller PCBs, remove the screws securing the Holding Blocks 5 and 6 and turn the blocks 90 degrees. This will allow the holder to grab a much smaller area and hold smaller and narrower PCBs firmly.

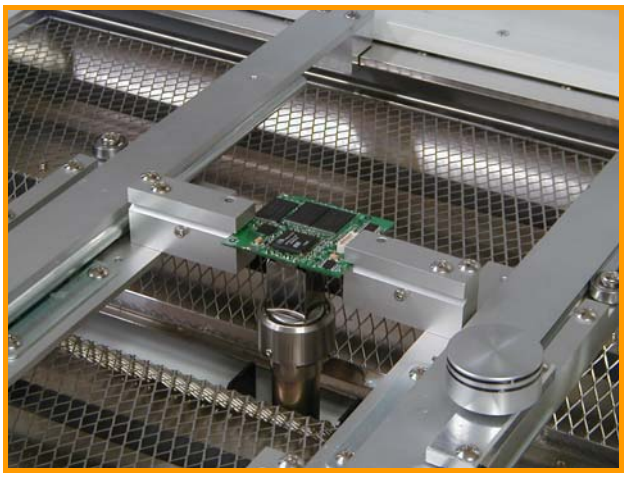


Figure 17

2.3. Top Heater

2.3.1. Reference Figure 18.

2.3.2. The Nozzle on the upper heater can be removed or replaced with a simple 30 degree turn. Note that inside the nozzle is a vacuum tube that has a silicon rubber pad and guide washer attached. Be sure not to force the nozzle out as it might get caught on this vacuum tube and pad.

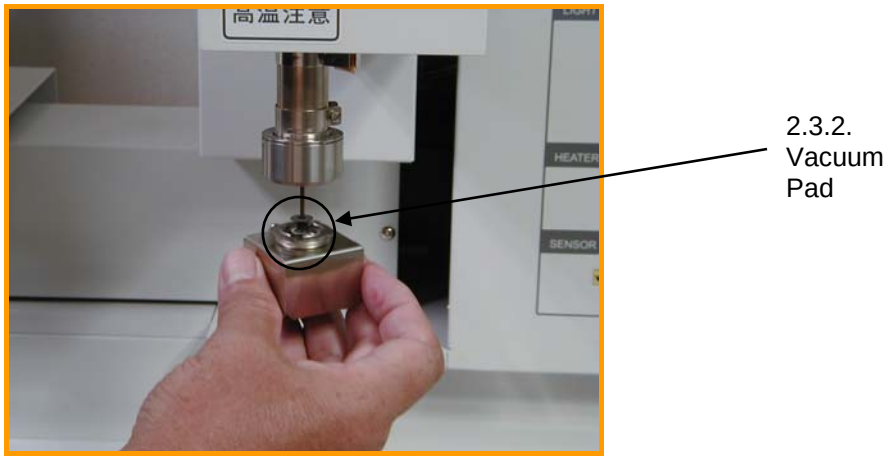


Figure 18

2.4. Bottom Heater

2.4.1. The removal and replacement of the lower nozzle is exactly the same as the upper nozzle. However, there is now vacuum pick in the lower nozzle so it is a bit easier. Also, 3 sizes of nozzles come standard with the RD-500 II. These are to approximately match the area and device to be reflowed.

2.5. Area Heater

2.5.1. The function of the Area Heater is to heat the overall board during the reflow cycle and prevent the PCB from warping due to uneven heating.

2.5.2. For the most safe and effective reflow during rework, it is usually suggested that the surface of the PCB be between 110 and 130 degrees Celsius at the peak time of the reflow. To obtain this condition, the Area heater should be set up to have a standby temperature of 350 degrees Celsius and a reflow temperature of 450 degrees Celsius. This temperature is set in the Setup Tab of the RD-500 Computer software. Please note that these temperatures indicate the temperature as measured on the surface of the IR heater rods. The actual temperature radiated to the PCB is much lower.

2.5.3. If the PCB size is smaller than the overall area under the Area Heater, then the two outer heaters can be turned off via the switches on the right-hand side of the Area Heater Box. Also, if the component to be reworked is located toward one of the edges of the PCB, then the Area heater can be shifted with the component. The overall length of movement is 230mm in the X direction.

2.6. Cooling Fan

2.6.1. The cooling fan comes standard to the RD-500 II and RD-500S II. A picture can be seen in Figure 19 below.

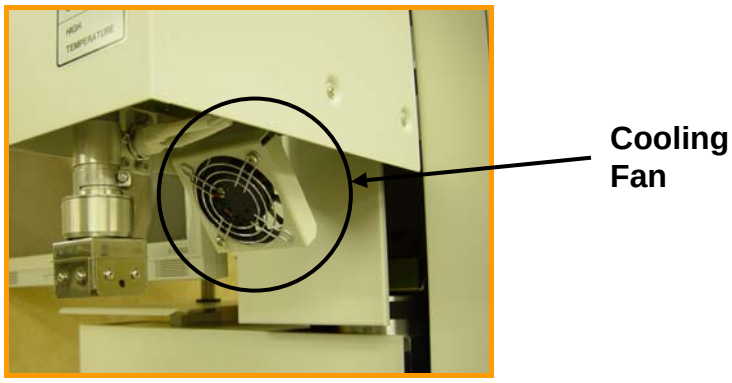
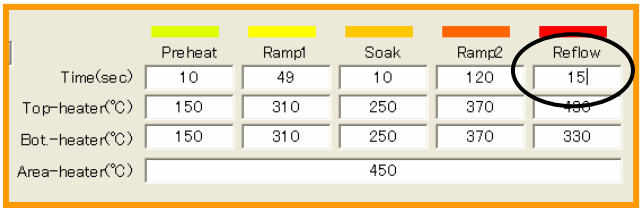


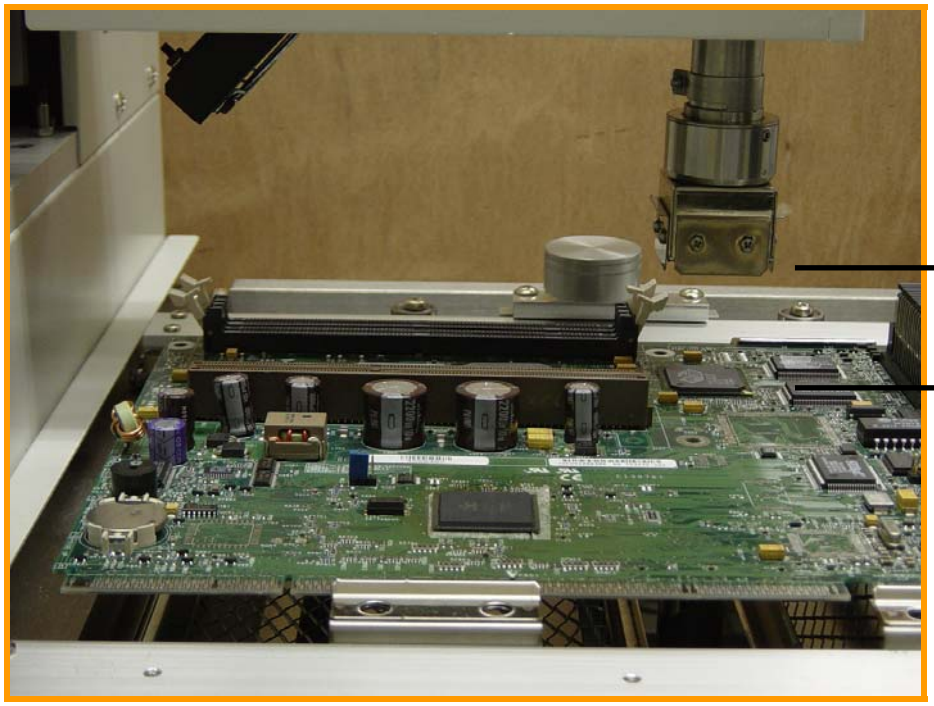
Figure 19

2.6.2. The cooling fan feature is initiated by a software command embedded in the Reflow Time. If the Reflow Time is an Even number then the Cooling Fan feature will be disengaged. If the Reflow Time is an odd number then the Cooling Fan feature will be engaged. For example, the screen below shows the Reflow time set at 15 seconds.



2.6.3. With this setting, the Heater Head will raise up 5 seconds before the end of the Reflow Time. So in this instance the Reflow Time will be 10 seconds and the cooling fan will run until the heater sensor in the heater head reaches a temperature of 150 degrees C.

2.6.4. The heater head will raise up approximately 15 centemeters above the board.



2.7. Board Supports (Standard with RD-500 II, option with RD-500S II)

2.7.1. Also, to prevent a large PCB from warping, Board Supports have been supplied as standard parts.

2.7.2. Figure 20 shows the board supports in place.

Figure 20

3. Function and Use of the RD-500 II Software

3.1. This section covers the function behind each section or tab in the software. For more a more detailed description of the full rework process using the RD-500 II and other tools, please see section 4 The Rework Process. When the RD-500 software is first activated it will open up to the Operation Tab. The Tabs are located at the top of the screen.

3.2. Operation Tab

3.2.1. Reference Figure 21

3.2.2. The main function of this screen is to operate the RD-500 II using profiles that have already been developed. First the board is aligned using the Optics screen, then the user would move to the Operation screen. Here they would find the profile that had already been developed. These profiles would be chosen from a list of names from the pull down menu in Profile Name.

3.2.3. Once the profile is chose, the data that was captured during the Auto Profiling or Development screen will be seen as both heater and time data in the upper boxes and as graphic data in the lower graph. This data cannot be changed from this screen.

3.2.4. Once the component has been aligned and the profile has been chosen, the Start button can be pressed. When this happens the Heater Head will come down over the component. The final height can be adjusted using the Manual Up-Down Heater Head Switch.

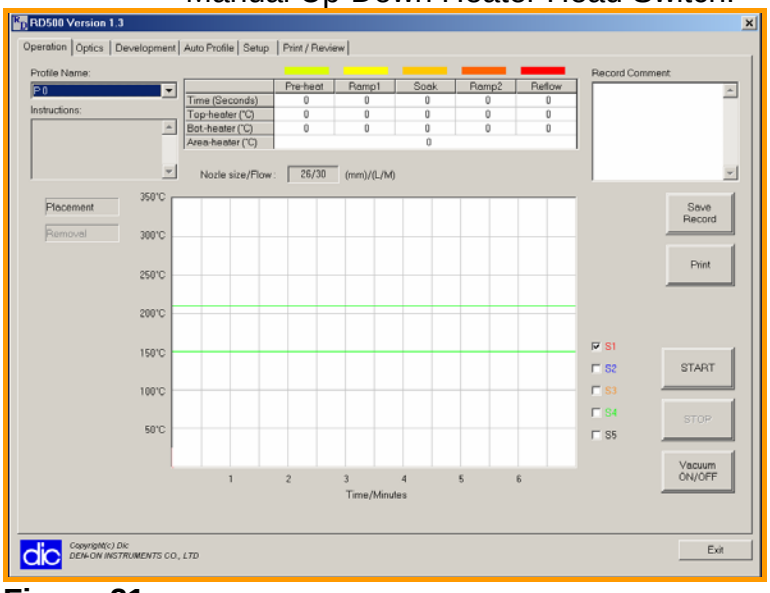


Figure 21

3.3. Optics Tab

3.3.1. Reference Figure 22.

3.3.2. This software function opens up the viewing screen for aligning component to the board.

3.3.3. When the Optics Tab is pressed, the Vacuum Pick-Up Pump is turned on. When the OPTICS ARM button is clicked the Optics Arm comes out between the Heater Head and the Board Holder. This head contains the prism that allows the look up/look down feature for aligning the nozzle and component to the lands or device on the board.

3.3.4. To allow for the clearest picture, adjust the Zoom Bar so that the target PCB fills the entire the screen. In most cases the Focus Bar does not need to be adjusted since the Auto-Focus feature built into the camera provides for a clear picture.

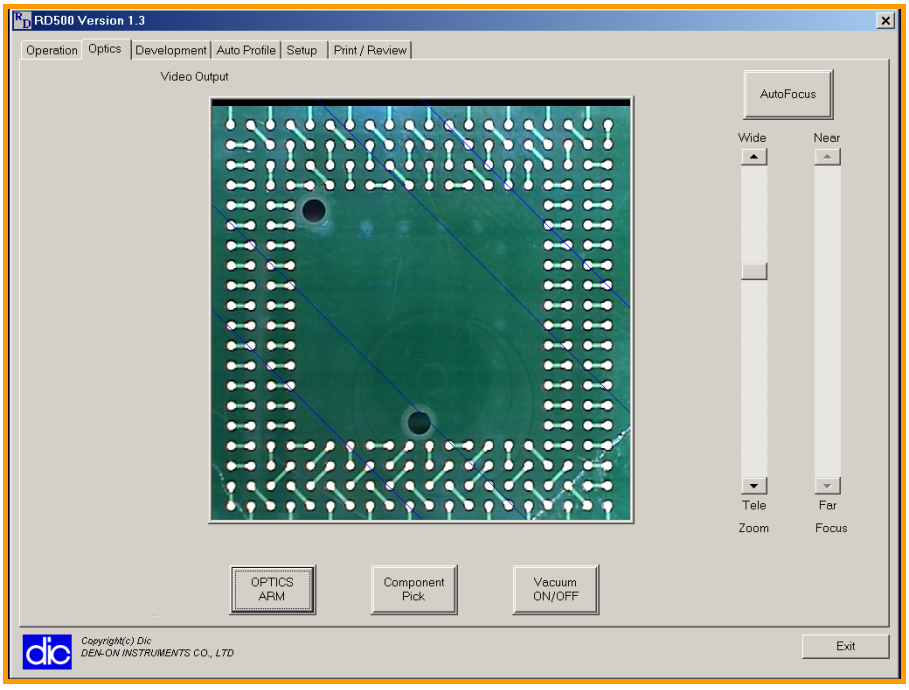


Figure 22

3.4. Development Tab

3.4.1. Reference Figure 23.

3.4.2. The Profile Development Tab is used to modify existing profiles or profiles just produced from the Auto-Profiling. For a detailed description on how to properly modify an existing profile, please see section 4.3. Modifying a Profile.

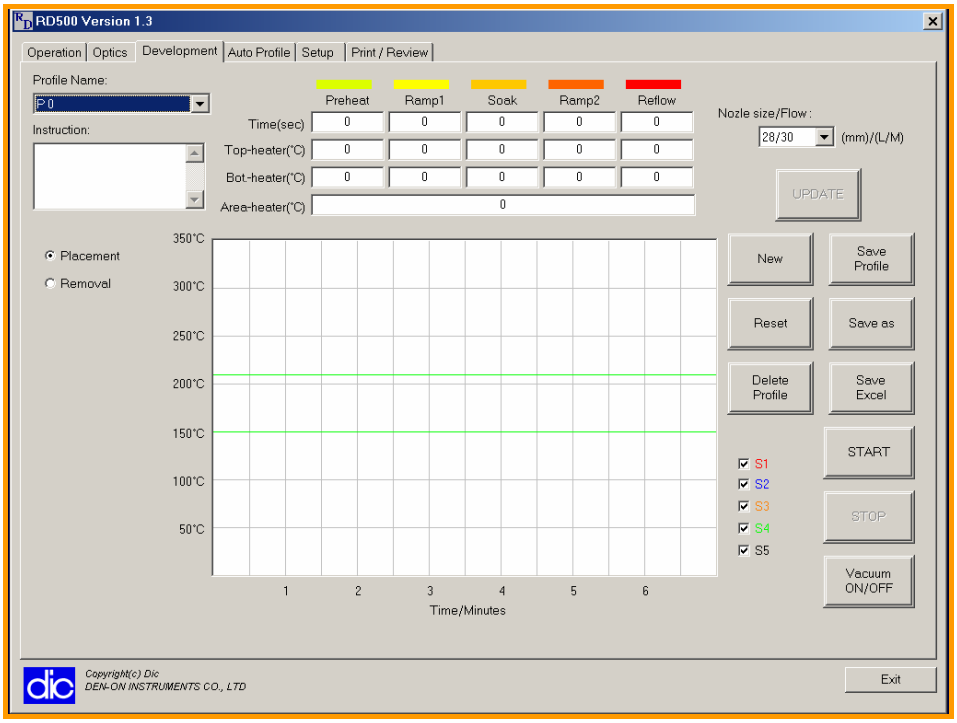


Figure 23

3.5. Auto Profile Tab

3.5.1. Reference Figure 24

3.5.2. The Auto Profile Tab is used to develop profiles for boards and devices via feedback from one K type thermocouple sensor. Please see section 4.2. Creating and Confirming a Profiles.

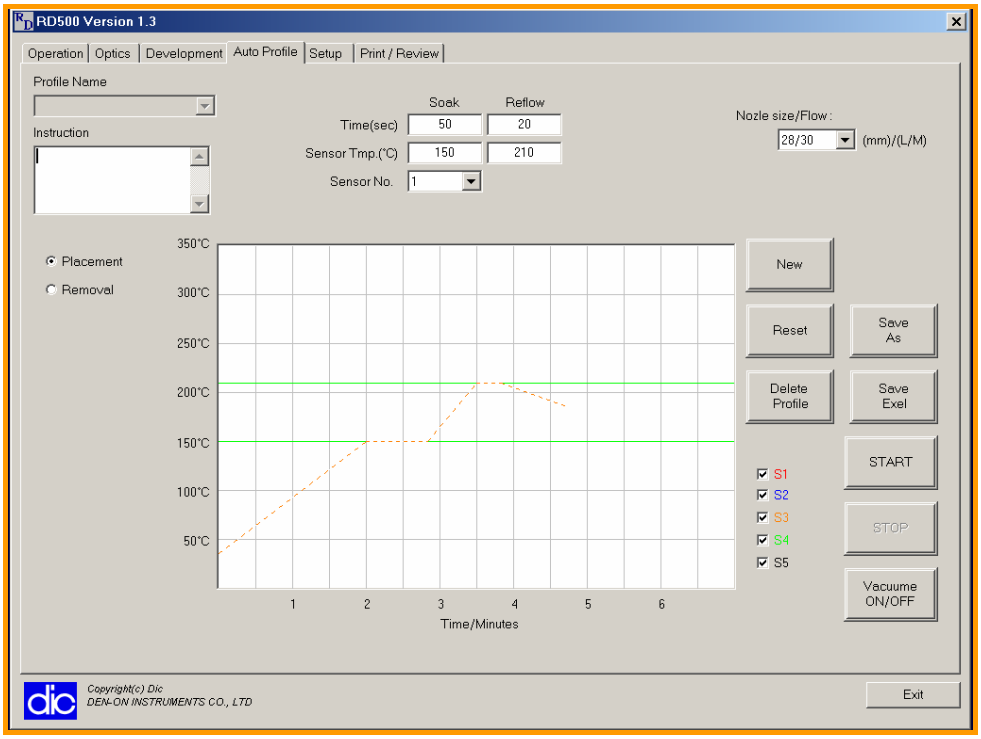


Figure 24

3.6. Setup Tab

3.6.1. Reference Figure 25.

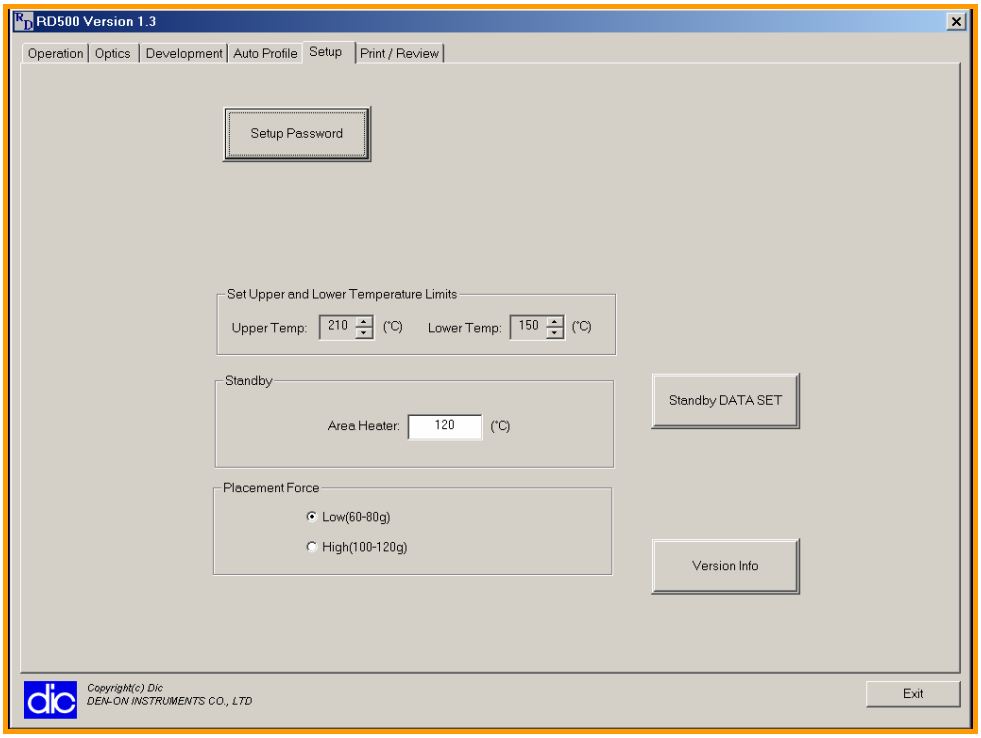


Figure 25

3.6.2. Setup Password

3.6.2.1. The RD-500 II can have password protection that will allow only authorized personnel to create or modify profiles. The following explains how to set up and maintain the Password feature.

3.6.2.1.1. Entering a Password

3.6.2.1.1.1. Click on the Setup Password button.

3.6.2.1.1.2. In the space provided, enter a password with letters or numbers. The Password is case sensitive

3.6.2.1.1.3. Click a button of OK. When operating the Profile Development Tab, this password number will now be required

3.6.2.1.2. Canceling the Password

3.6.2.1.2.1. Click on the Setup Password button.

3.6.2.1.2.2. Enter the old password.

3.6.2.1.2.3. To remove the password, leave the second two spaces blank and click OK

3.6.2.1.2.4. To enter a new password, enter it once in each section and click OK.

3.6.2.1.3. Universal Password

3.6.2.1.3.1. There are occasions when you might not know a password that has been entered. We can provide you with a universal password that can be used to release an unknown password. Please contact Denon or your nearest Authorized Denon Distributor if this is needed.

3.6.3. Set Upper and Lower Temperature Limits

3.6.3.1. These are reference lines (not true limits) that will be visible in the Operation, Development and Auto Profile screens on the graph area. They appear as green lines.

3.6.3.1.1. To set these limits, simply scroll then numbers up or down to the desired figure. To eliminate them set both to zero.

3.6.4. Standby Temperature

3.6.4.1. The Standby temperature is the idle temperature as measured on the surface of the Area Heater. If the RD-500 II goes for a period without use, this will allow for quicker set-up time because the Area Heaters will already be up to temperature.

3.6.4.1.1. To change the Standby Temperature, simply enter a new number and then click on the Standby DATA SET button.

3.6.5. Placement Force

3.6.5.1. The placement force for the device is controlled by a friction setting in the Upper Heater Head. There are two settings to the force: Low in a range of 60-80 grams and High in a range of 100-120 grams of force. The following is recommended:

Low for Components of 40mm square or less
High for Components of 40mm square or greater

3.7. Print/Review Tab

3.7.1. Reference Figure 26.

3.7.2. In this screen existing profiles can be called up, overlay with other profiles, review for printing (if a printer is installed) and printed (if a printer is installed). This function is primarily for keeping of hard records of profile data. The data here shows the differences between a standard Eutectic profile (in red) and a Lead-free profile (in black).

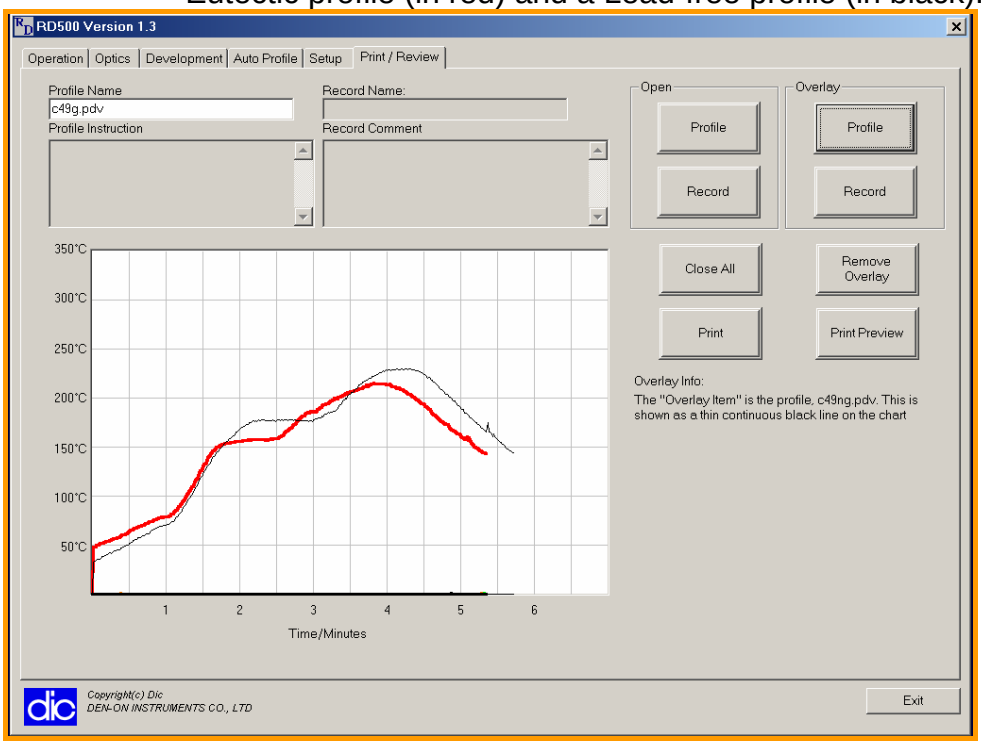


Figure 26

3.8. Inspection Tab

3.8.1. Reference Figure 27A and 27B.

3.8.2. The Inspection Tab allows the user to input known profile parameters, save them under a name, and then pull up any profile to see if the profile meets the criteria of the given profile parameters.

3.8.3. In the portion marked 1, the user can input the profile parameters. They are

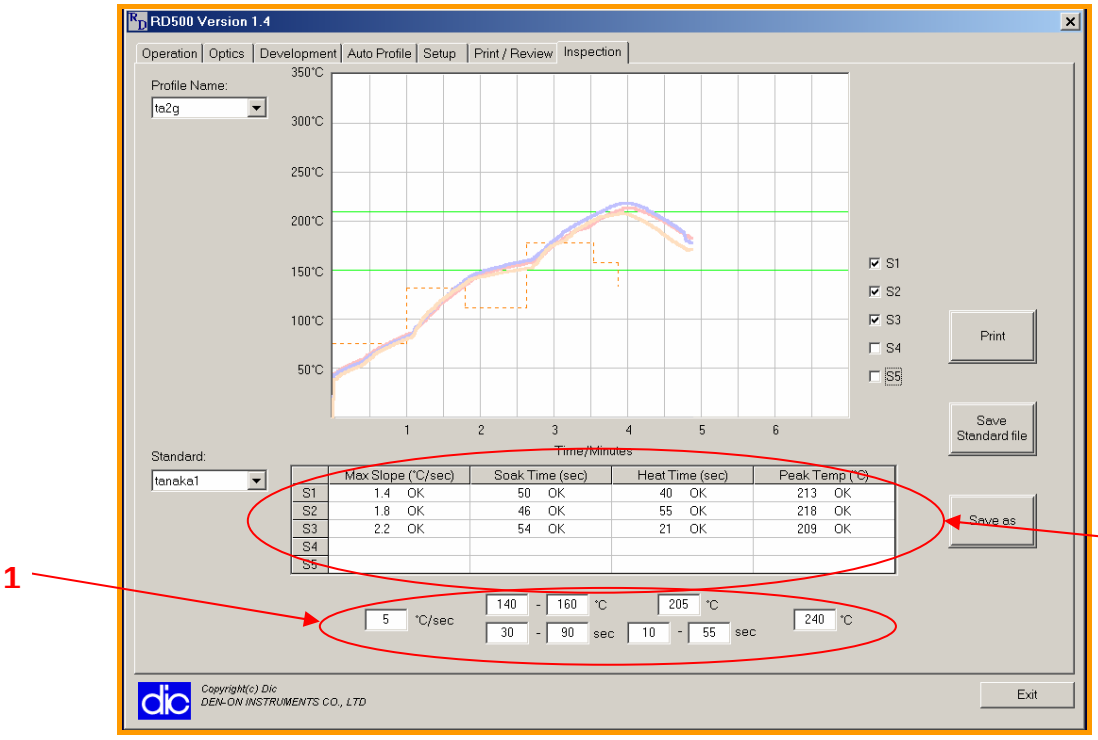
3.8.3.1. Max Ramp Rate – In Figure 26A, if any ramp or slope in the profile exceeds 5°C/sec. then the Max Slope column for the S (sensor) input will be marked in Red. In this case all the Max Slopes are below the setting so they all pass.

3.8.3.2. Soak Time Temperature and Time Ranges – In Figure 26A, the Soak Temperature Range is set between 140-160°C for a range of 30-90 seconds. All three sensors were within the temperature range for 50, 46 and 54 seconds respectively so they all passed.

3.8.3.3. Heat (or Reflow) Minimum Temperature Setting and the Time Range – In Figure 26A, the Minimum Heat Temperature is set for 205°C and the time range is set between 10 and 55 seconds. The actual time that all the sensors were above 205°C was 40, 55, and 21 seconds so they all passed.

In order to show how this section works, the same profile was inspected against a different set of parameters. Here we changed the Heat Minimum Temperature setting and kept the Time Range the same. By doing this the first two sensors now show the Red background Fail mode since these two sensors were above 200°C for over the allotted time of 50 seconds. Sensor 1 was 55 seconds and Sensor 2 was 69 seconds.

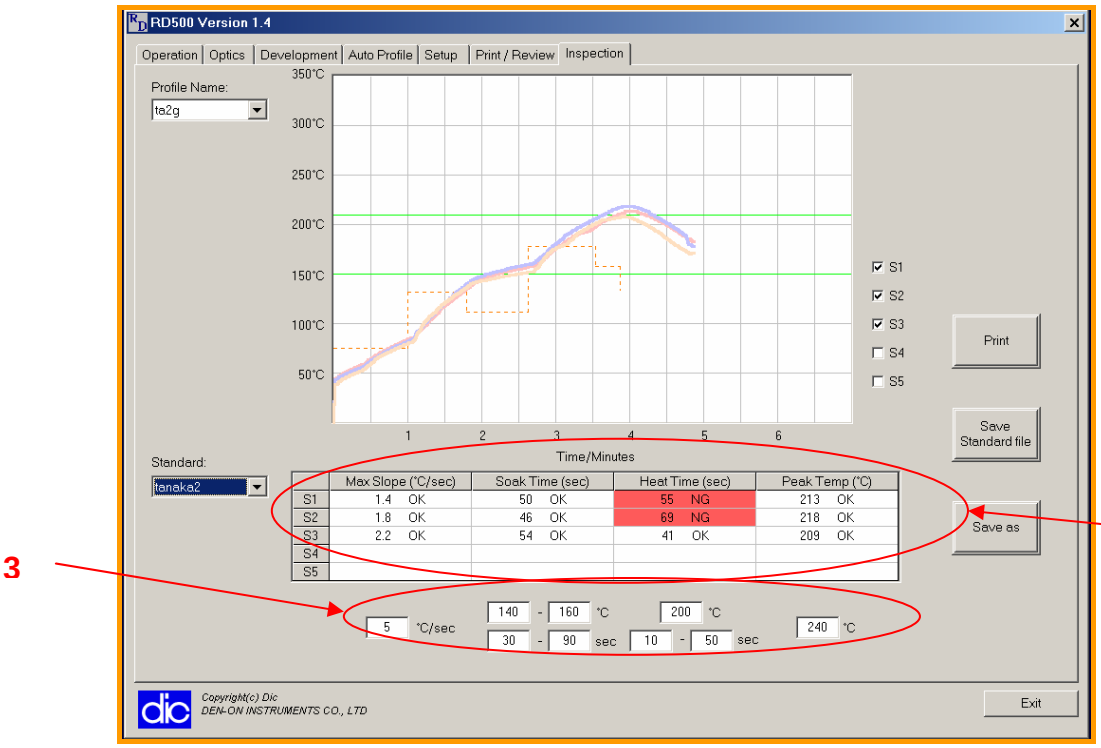
3.8.3.4. Peak Temperature – This setting allows the user to check the maximum recorded temperature for all the data collected by the sensors. This is used primarily to check the maximum temperature of the package but can also be used for testing the maximum temperature of the solder joints. In Figure 26A the Peak Temperature was set as 240°C and so all sensors passed.



1

2

Figure 27A



3

4

Figure 27B

4. The Rework Process

4.1. Thermocoupling a PCB and Device

4.1.1. Obtain a sample board and component. The component should already be attached to the circuit board.

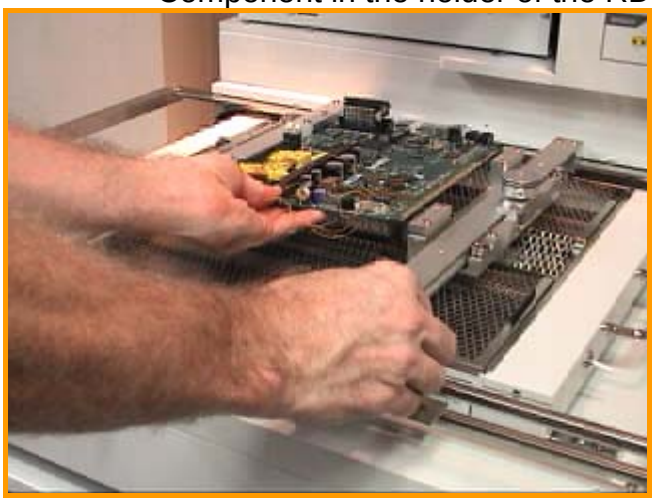
4.1.2. Next, slide a thermocouple underneath the component as far as possible and secure the wire with Kapton or other high temperature tape.

4.1.3. If you wish to use the board and component for multiple profile runs, it is suggested to secure the component corners using a High Temperature adhesive.

4.2. Creating and Confirming a Profiles

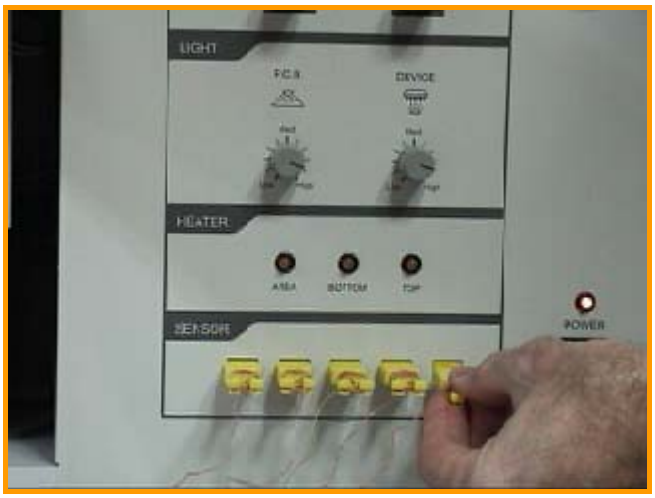
4.2.1. Creating the profile

4.2.1.1. Place the Thermocoupled Board and Component in the holder of the RD-500 II.

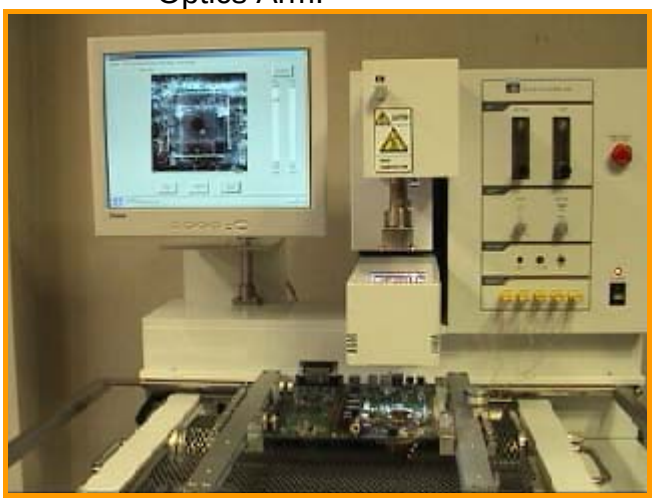


4.2.1.2. Select an appropriate nozzle for the rework and place it into the upper nozzle holder. Make sure that there is an appropriate vacuum cup on the vacuum tube coming out from the heater.

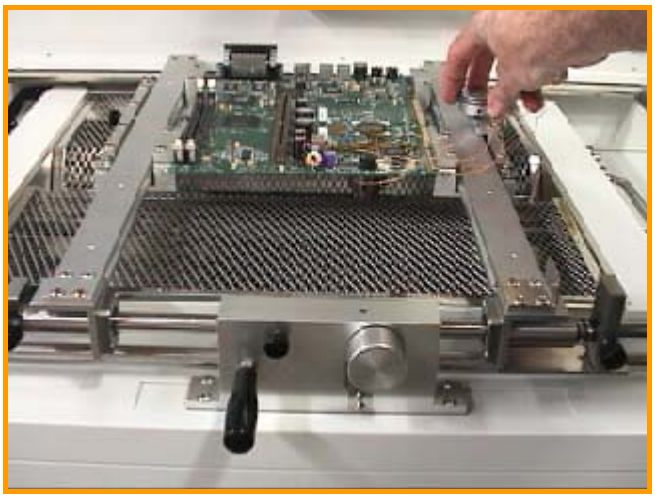
4.2.1.3. Insert the thermocouples from the board into the receptacles in the RD-500 II front panel. In the software you can choose either 1,2, or 3 as the thermocouple which will determine the profile. Make sure to insert your desired thermocouple on the board to coordinate with the one chosen in the software.



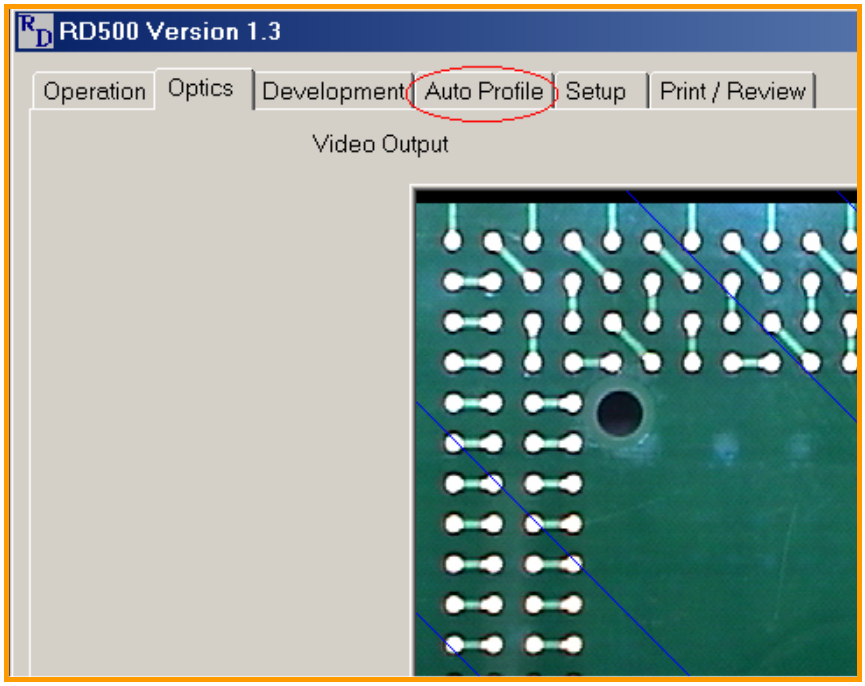
4.2.1.4. Click on the Optics Tab and then click on the Optics Arm button. This will bring out the Optics Arm.



Align the board so that the component will be covered by the nozzle when it is brought down into position.



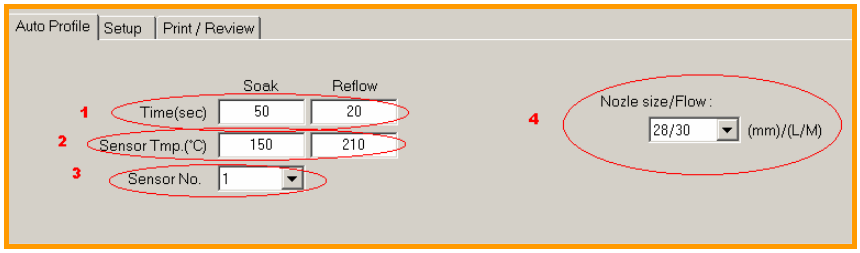
4.2.1.5. Click the Auto Profile Tab.



4.2.1.6. As shown below, enter the desired soak and reflow times. This is shown in circle 1.

4.2.1.7. Next enter the desired soak and reflow temperatures. This is shown in circle 2.

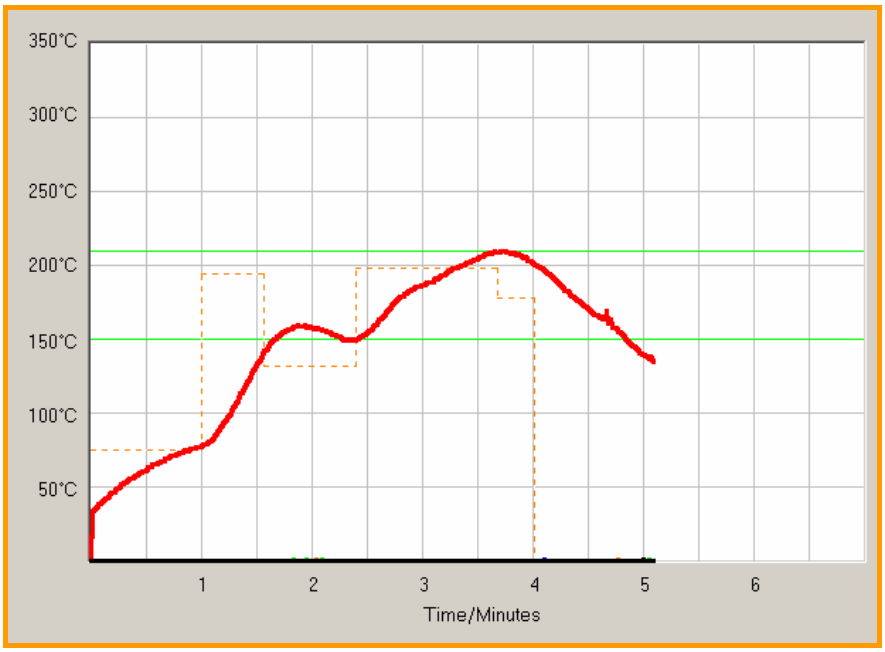
4.2.1.8. Next enter the thermocouple sensor input that will be used to control the auto-profiling.



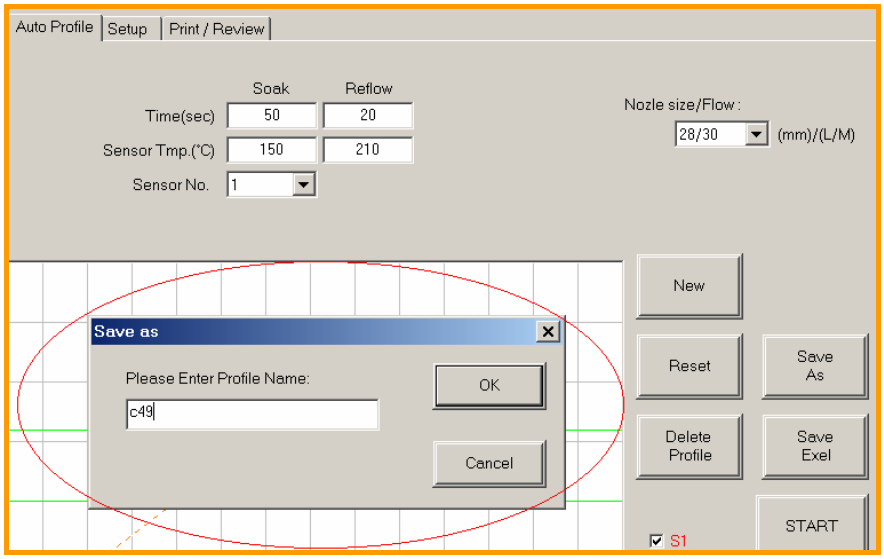
4.2.1.9. Select the nozzle size/flow for the component. Below you will see a chart that shows three different groups of nozzles. In the auto-profiling software, the assumption is made that smaller components will absorb heat much quicker than larger components. The auto-profiling therefore has three different ramp rate calculations that are used. If you find that the nozzle/flow setting you are using is too slow or two fast you can alter the ramp rate by choosing either a higher or lower ramp rate. The slowest ramp rate is the Group 1 Nozzles and the fastest ramp rate is the Group 3 Nozzles. If you have purchased a custom nozzle please use the nozzle size that is closest to the nearest standard nozzle.

Group 1 Nozzles	Group 2 Nozzles	Group 3 Nozzles
BNZ-7	BNZ-20	BNZ-28
BNZ-9	BNZ-22	BNZ-30
BNZ-13	BNZ-24	BNZ-32
BNZ-15	BNZ-26	BNZ-35
BNZ-18	-	BNZ-37
-	-	BNZ-39
-	-	BNZ-44
-	-	BNZ-49
-	-	BNZ-52

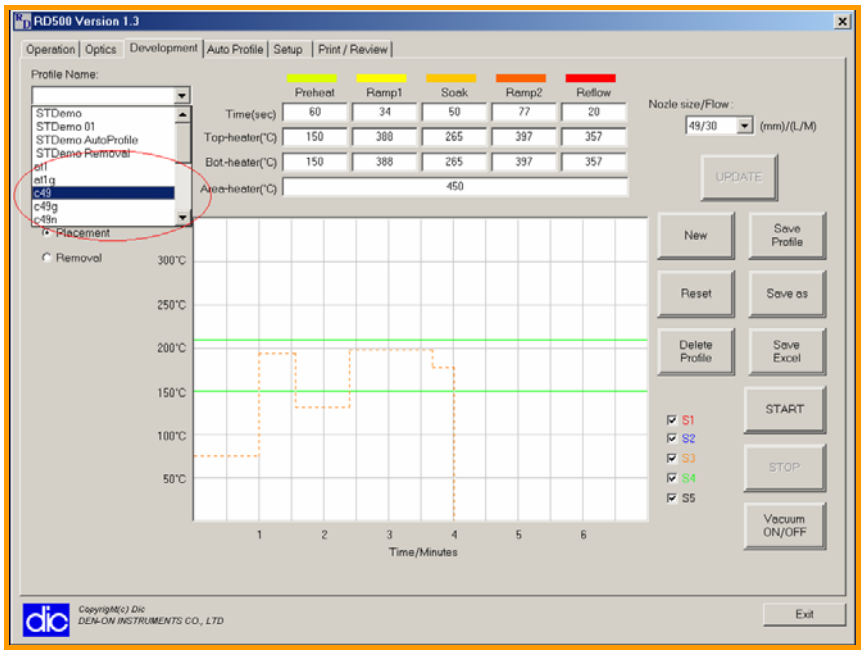
4.2.1.10. Click on the Start button on the right-hand side. Once the Auto Profile run is complete you will see a graph that shows some overshoot. (See Graph Below). This is normal and the RD-500 software will correct for this overshoot automatically. When you run a confirmation profile you will see that the profile has been corrected.

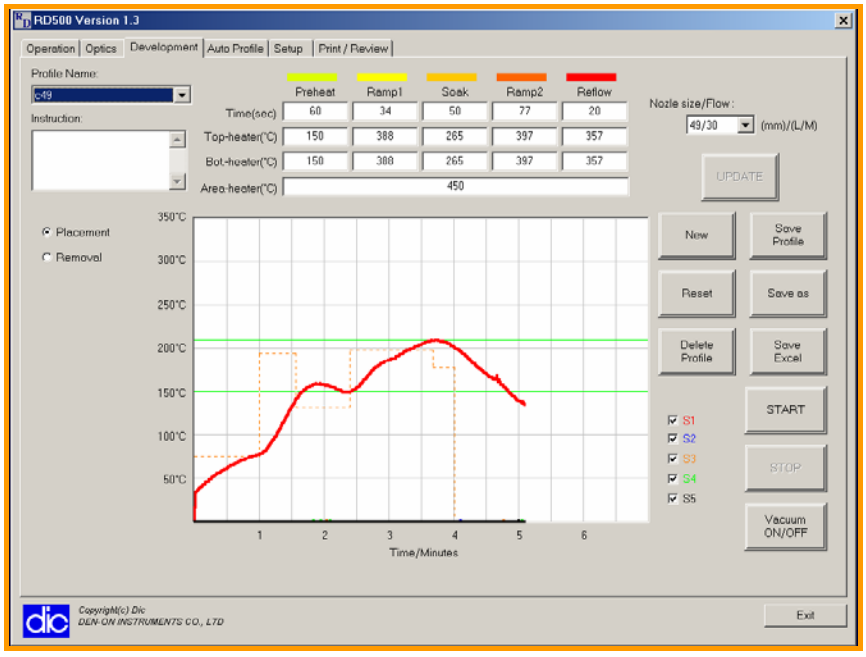


4.2.1.11. Next, click the “Save As” button on the right hand side and give the file a unique name in the dialog box.



4.2.1.12. Click on the Development Tab and then find your file in the Profile Name drop-down menu. You will then see the previous graph and a chart with heater information and times. Looking at the chart, you will see the actual heater temperatures (Top and Bottom) that were measured at the exit point of the heater. These are the corrected numbers needed to produce a good profile.



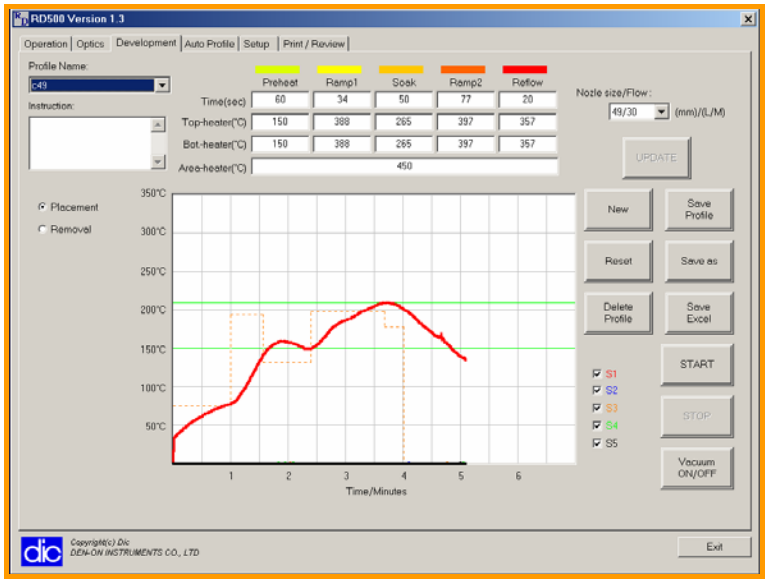


4.2.2. Confirming the profile

4.2.2.1. To confirm the profile, let the Thermocoupled board cool to room temperature.

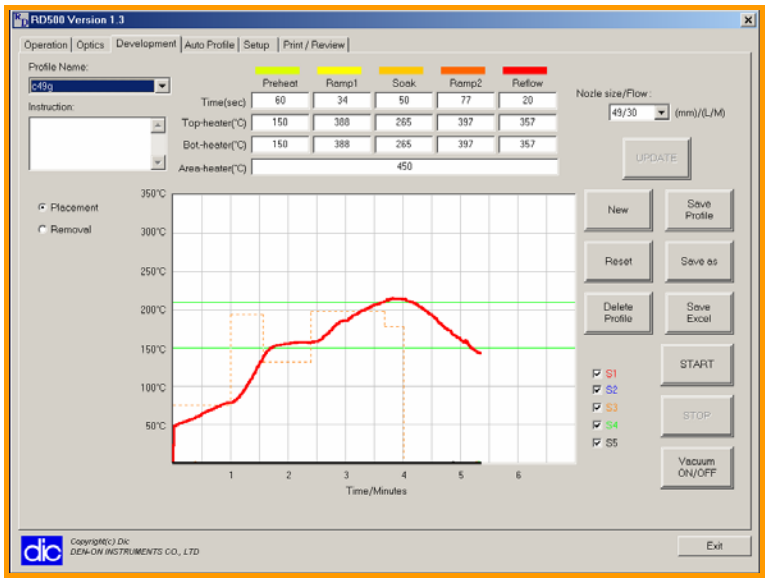
4.2.2.2. Next, put the board in place and align the Nozzle to the component.

4.2.2.3. Go to the Development Tab and choose the desired profile that still has the raw data from the initial Auto Profile run.



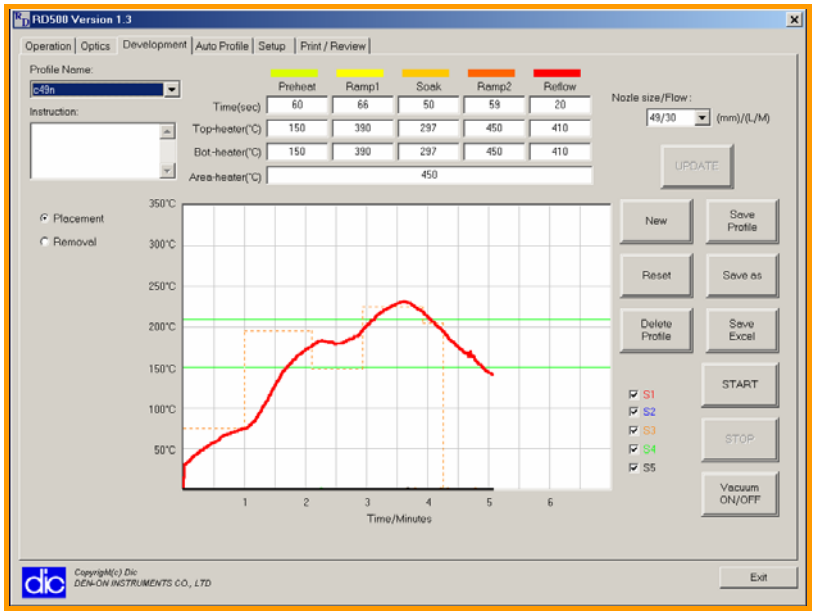
4.2.2.4. Make sure the thermocouples are plugged in and click the start button.

4.2.2.5. Once you run the confirmation you will see a graph such as the one below. The profile can be modified in a variety of ways. See section 4.3. Modifying a Profile as a reference for making changes.

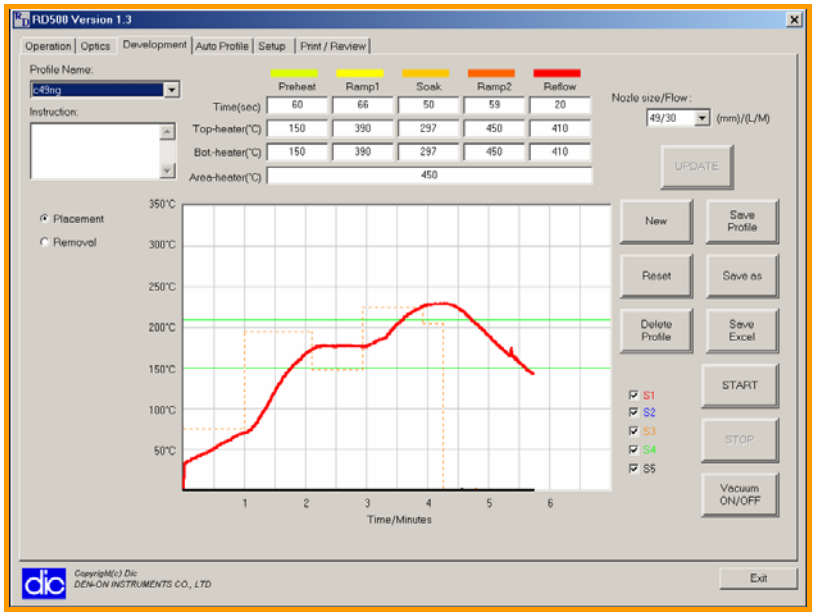


4.2.3. Creating a Lead Free Profile

4.2.3.1. Creating the Lead-free profile is easy using the RD-500 II or RD-500S II auto-profiling software. The only difference is on the input temperatures for the Soak and Reflow. Generally speaking, the Soak temperature is usually set at 180°C and the Reflow temperature is usually set at 230°C. Once this is done, all the other steps are the same. Below you can see the results of a profile developed for a lead free solder.



Lead Free Profile Auto-profile Run.

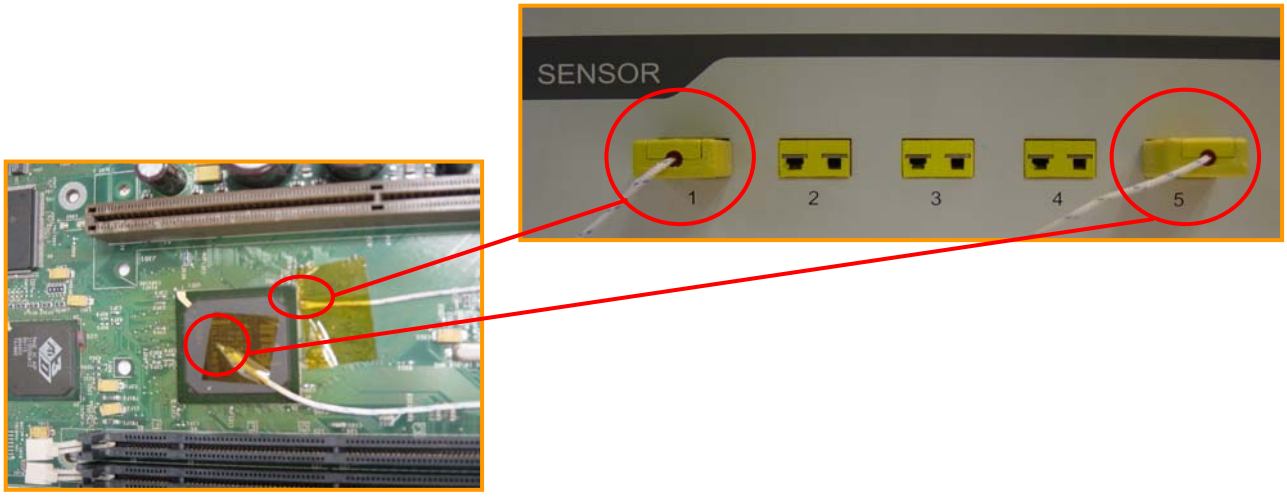


Lead-Free Profile Confirmation Run Note the elevated Soak and Reflow Temperatures.

4.2.4. Creating a Two-Point Auto Profile

4.2.4.1. A Two Point Auto Profile run is the same the same as a single point Auto Profile run except that a second point data point is used. In this instance, the RD-500 II uses the data from a thermocouple that is attached from the top of the component and connected to Sensor 5 input. See Figure Below.

4.2.4.2. As the Auto Profile is run, the RD-500 software will monitor the difference in temperature between the thermocouple attached to the ball and the thermocouple attached to the top of the component.



4.2.4.3. During the Ramp 2 and the Reflow, if a difference in temperature between 0-30°C occurs, the RD-500 II will apply more heat from the bottom air heater and less heat from the top air heater.

4.2.4.4. If the thermocouple were to see more than a 30°C difference, it will stop the change from occurring. This is for safety reasons. If the thermocouple unattached from the component, then it would see a greater temperature because it would reading the heat from the hot air and not the component. Normally, we do not expect to see a greater than 30°C difference.

4.2.4.5. If the thermocouple were to see a lower temperature difference (for instance, if it were attached to the PCB some distance from the

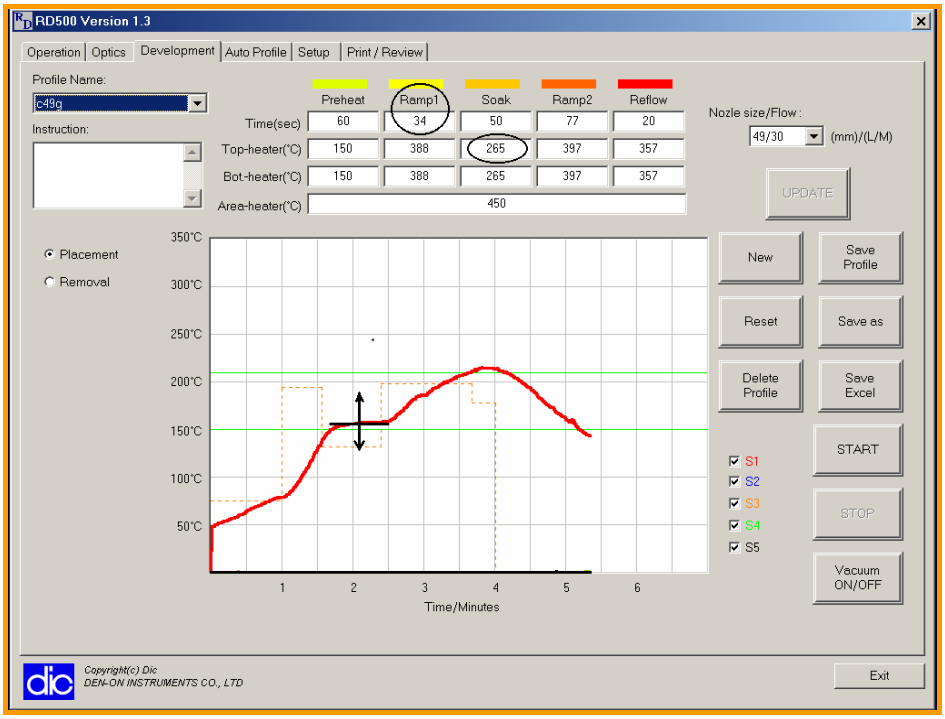
heater), then there would be no reason to change the Auto Profiling action from normal.

4.2.4.6. If there is no thermocouple attached to Sensor 5, then this feature will be disabled.

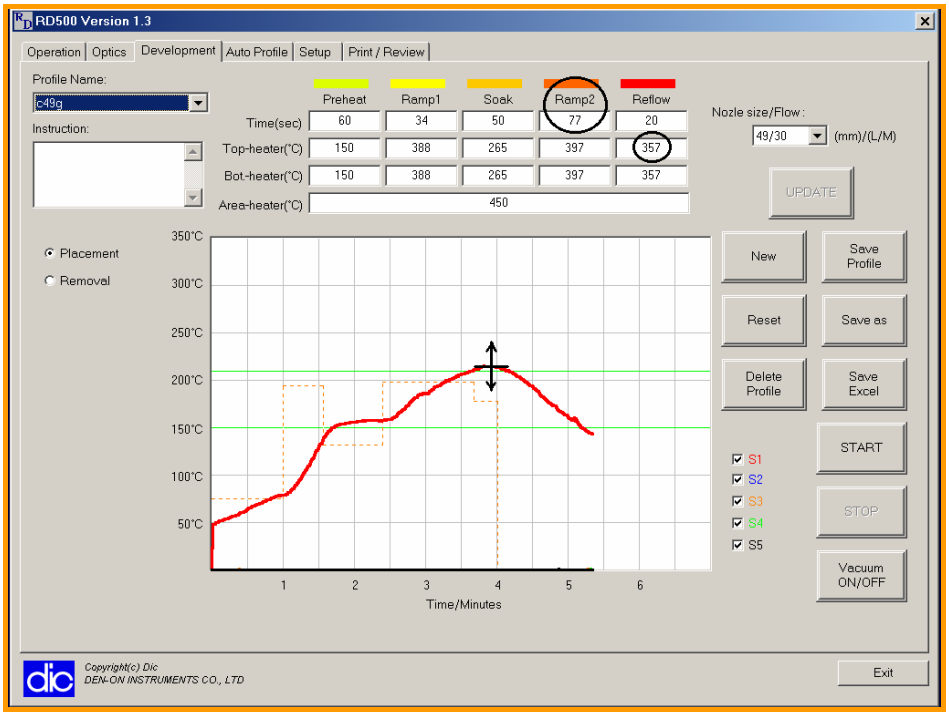
4.3. Modifying a Profile

4.3.1. To increase or decrease the overall Soak or Reflow time increase or decrease the Soak and/or Reflow Times respectively. (No Diagram)

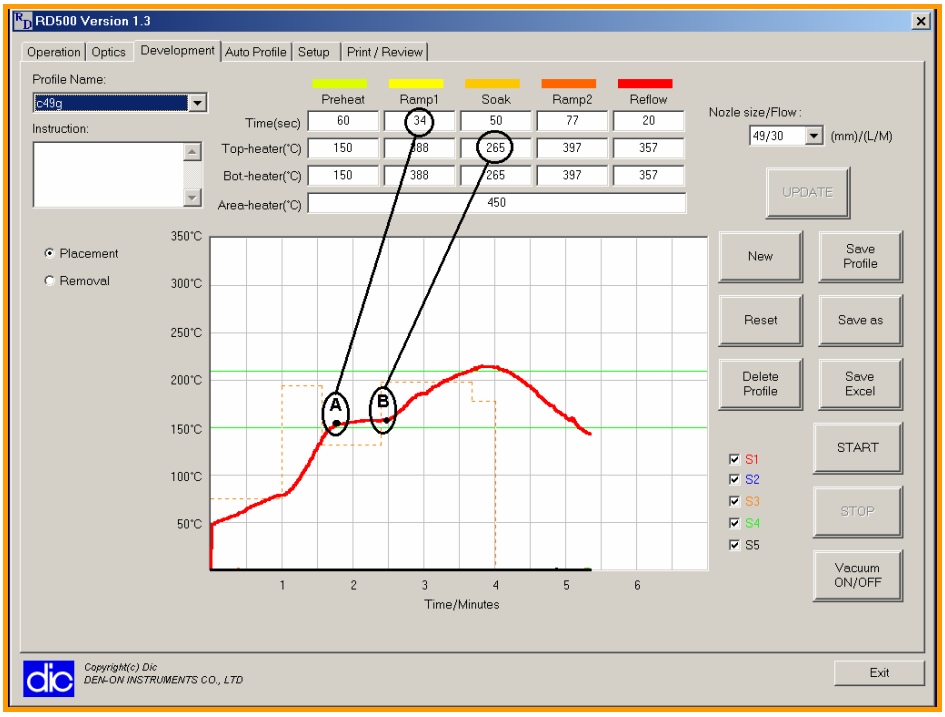
4.3.2. To raise the overall Soak temperature, raise both the Ramp1 Time and the Soak Top-heater(°C). To lower the overall Soak temperature, lower both the Ramp1 Time and Soak Top-heater(°C).



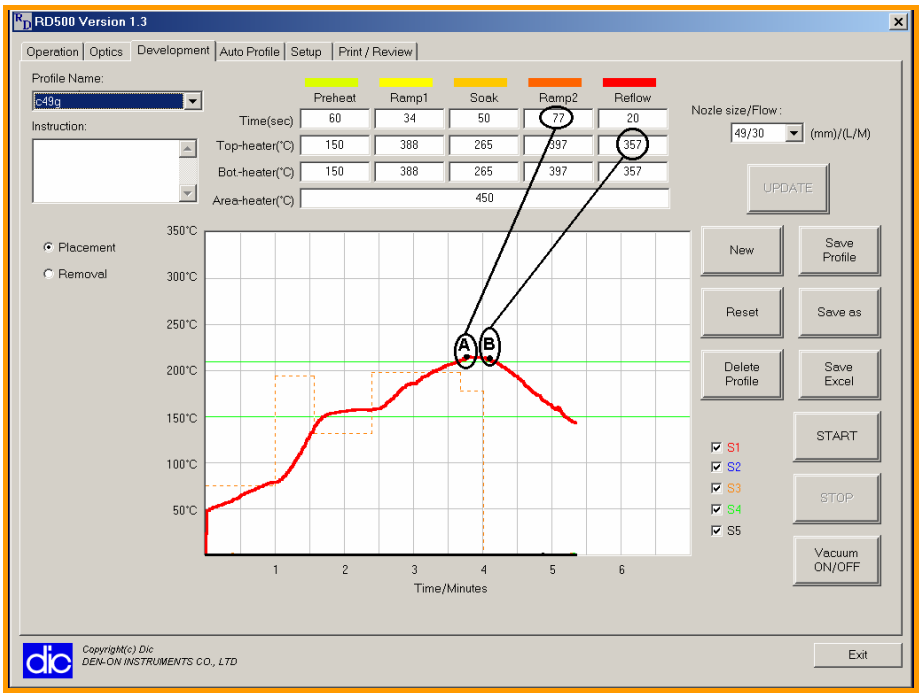
4.3.3. To raise the overall Reflow temperature, raise both the Ramp2 Time (sec) and the Reflow Top-heater (°C). To lower the overall Reflow temperature, lower both the Ramp2 Time (sec) and the Reflow Top-heater (°C).



4.3.4. If the Soak portion of the profile is not flat then either point A or point B can be adjusted. To raise or lower point A on the profile, raise or lower the Ramp1 Time(sec.) To raise or lower point B on the profile, raise or lower the Soak Top-heater(°C).



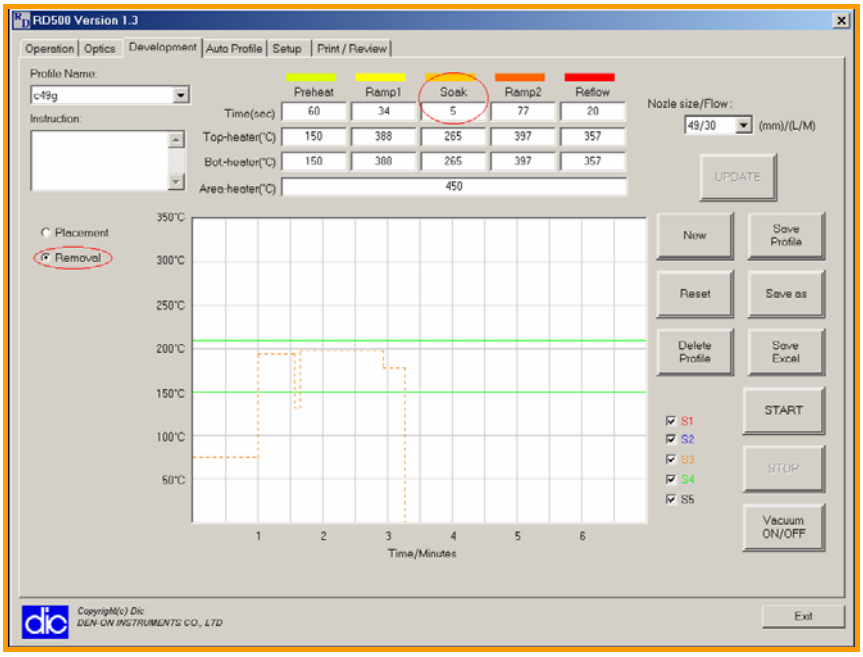
4.3.5. If the Reflow portion of the profile is not flat then either point A or point B can be adjusted. To raise or lower point A on the profile, raise or lower the Ramp1 Time(sec.) To raise or lower point B on the profile, raise or lower the Reflow Top-heater(°C).



4.4. Creating a Removal Profile

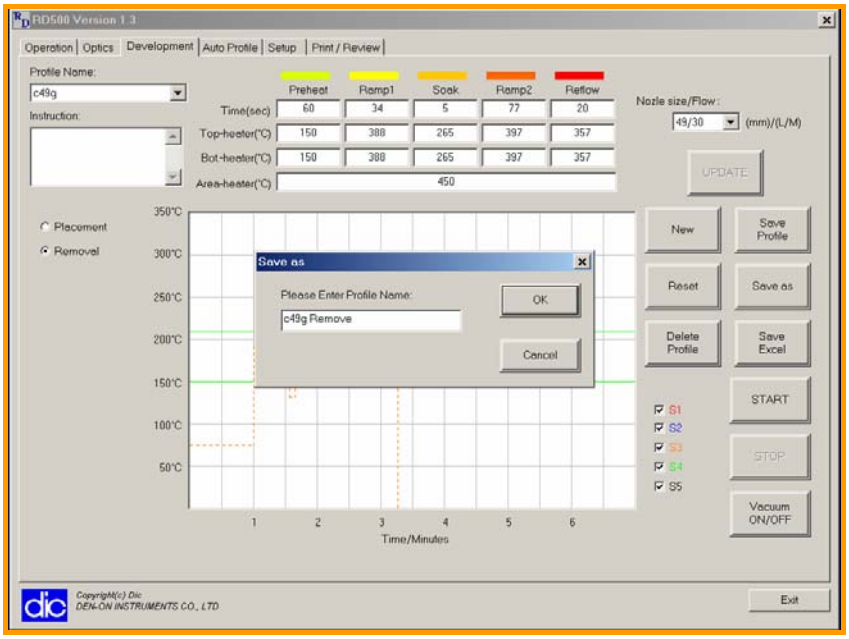
4.4.1. Creating the Removal Profile

4.4.2. Click on the Development Tab and then select the Placement profile for the component you wish to remove.



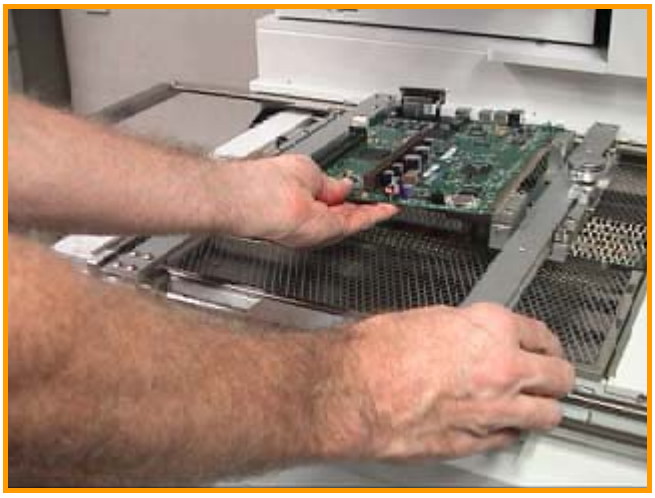
4.4.3. First change the setting from Placement to Removal on the left-hand side of the screen. Next, change the Soak Time (sec) to 5.

4.4.4. Finally, in the Profile Name area, give the profile an appropriate name.

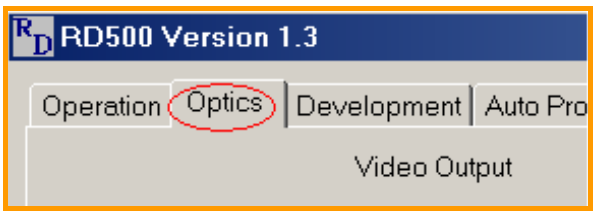


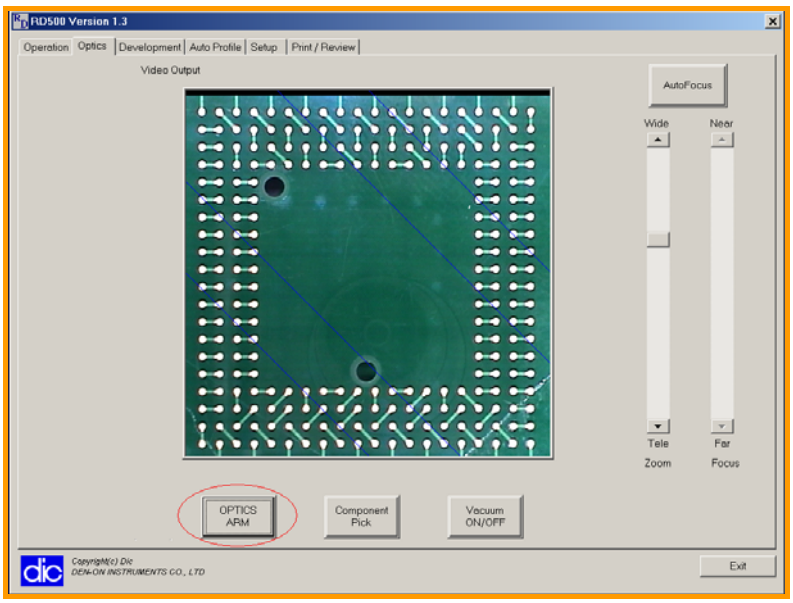
4.5. Removing the Component

4.5.1. Place the board in the RD-500 II holder.

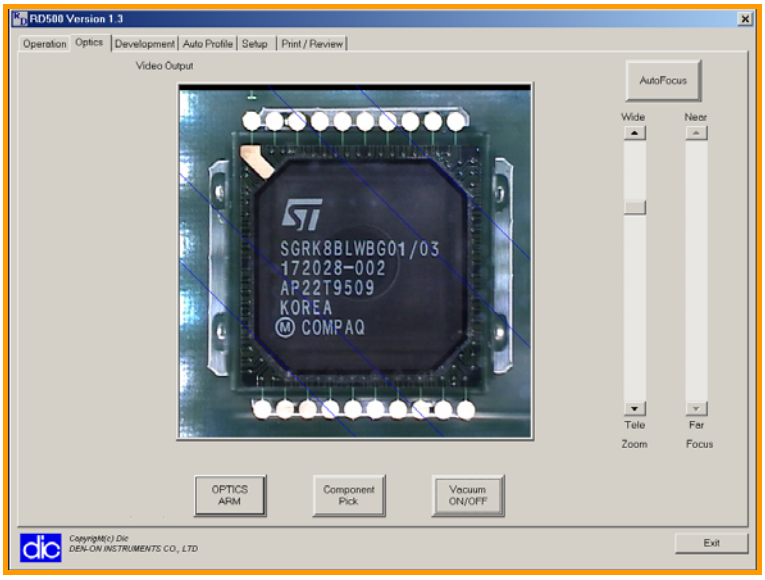


4.5.2. Click on the Optics Tab and then click on the Optics Arm button.

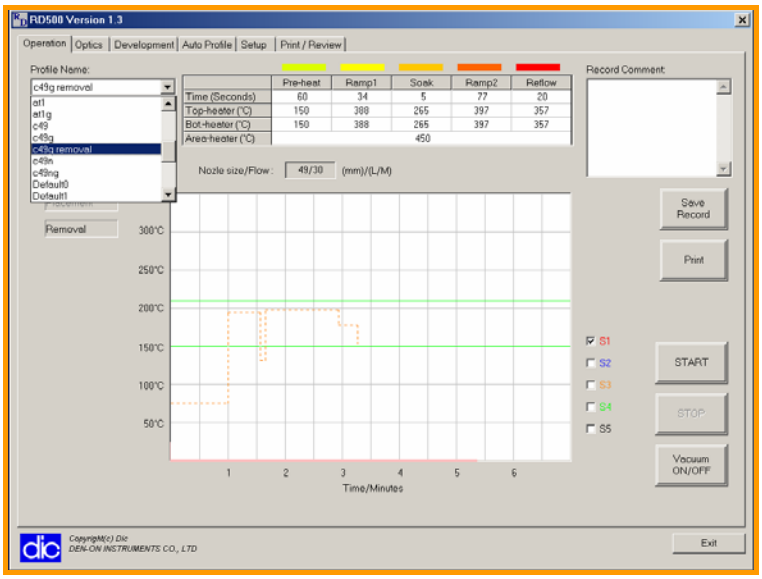




4.5.3. Adjust the board so that the component is aligned under the nozzle.



4.5.4. Choose the Removal Profile and click on the Start button on the right-hand side.

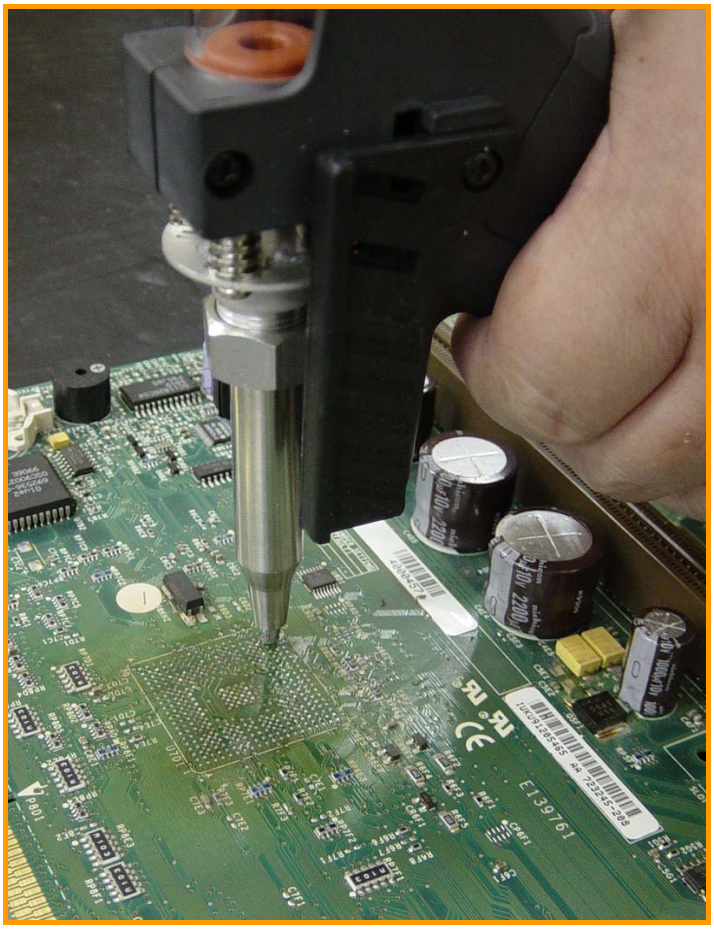


4.5.5. The RD-500 II will automatically reflow and then pick up the component when the cycle is complete.

4.6. Cleaning PCB Lands Using SC-200 or SC-300 Solder Cleaner

4.6.1. The ideal time to clean up the excess solder from the PCB is just after removing the component when the solder and PCB are still at an elevated temperature.

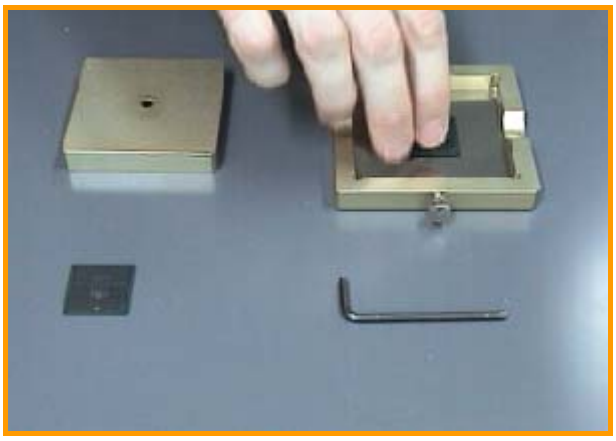
4.6.2. While the board is still in the RD-500 II board holder, use the SC-200 or SC-300 to remove the excess solder. **CAUTION: The Nozzle in the RD-500 II will still be very hot. Use caution when working in this area. If you prefer to remove the PCB before removing the excess solder, be sure to use gloves as the PCB will be hot after the rework cycle.**



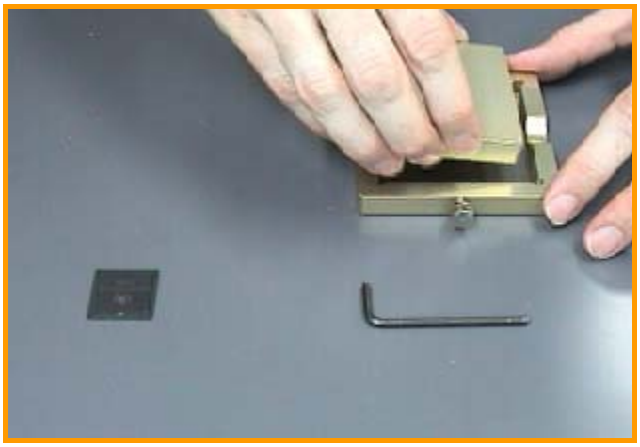
4.7. Applying Paste

4.7.1. Place the stencil in the BP-500 Base with the Component Etch-mark facing up toward the opening of the jig.

4.7.2. Place the component so that the balls of the component are inside the holes of the stencil.

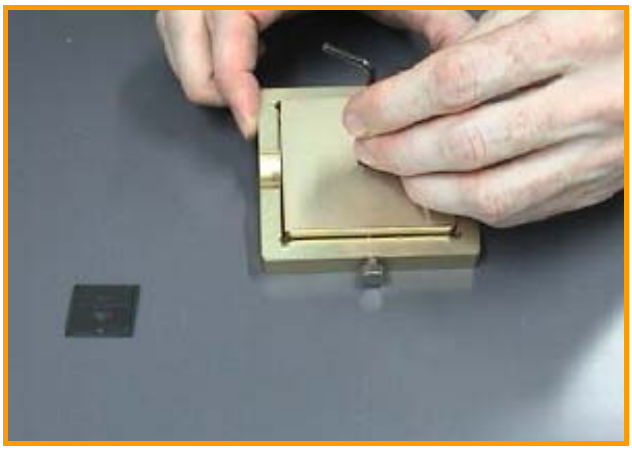


4.7.3. With the Holding Screw backed away flush to the Universal Cover, place the cover over the component.



4.7.4. Tighten the Base Clamp Screw.

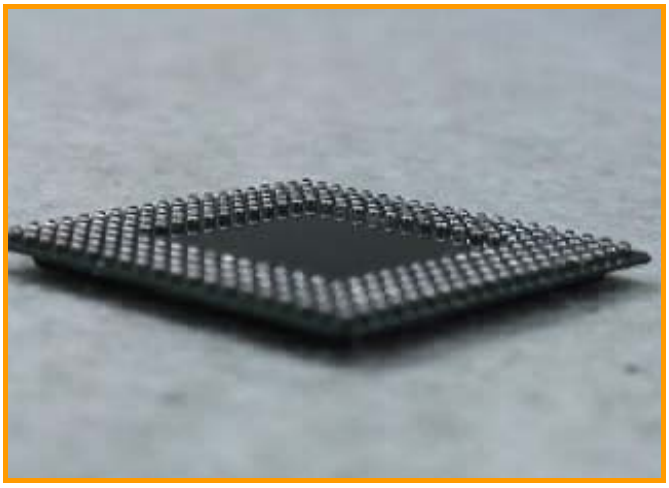
4.7.5. Next slowly tighten the Holding Screw until resistance is felt from it pushing on the component.

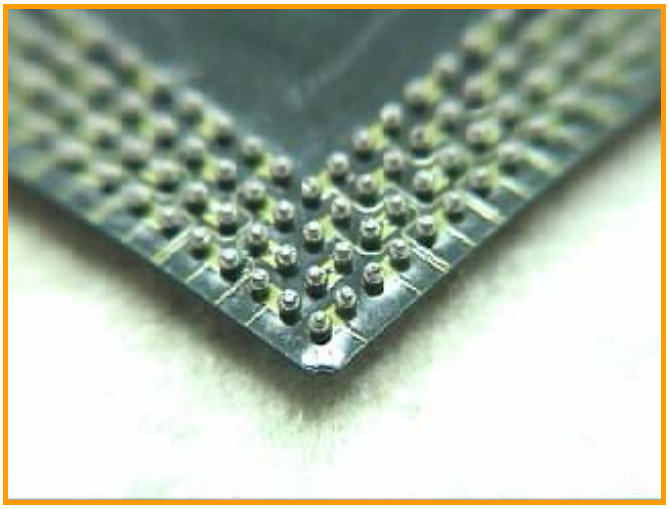


4.7.6. Prepare the paste for application.

4.7.7. Apply solder paste to the stencil parallel to one row of balls. Then with the Application Tool wipe the paste across the ball openings. Use a minimal amount of pressure and try to limit the number of wipes to less than 3. Apply too much pressure or wiping too many times will apply too much solder and force it under the stencil.

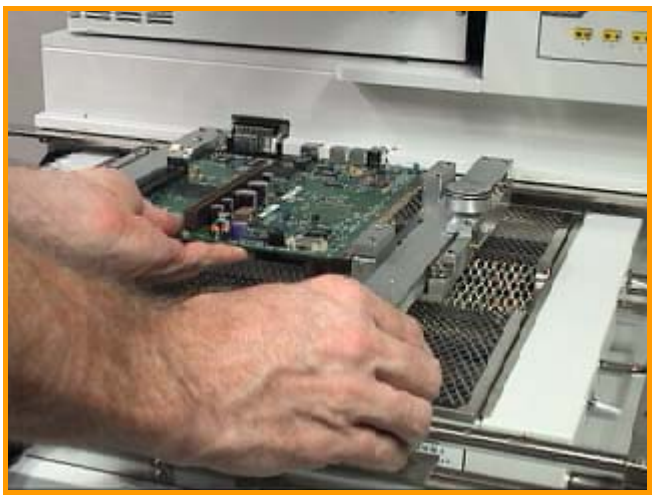
4.7.8. Results



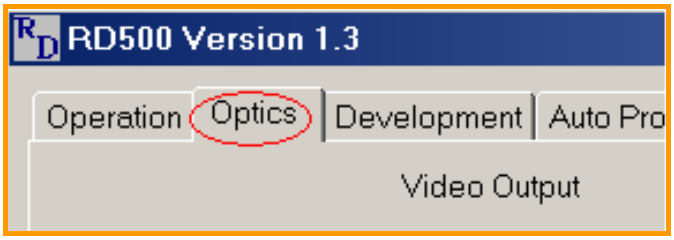


4.8. Component Alignment, Placement and Reflow

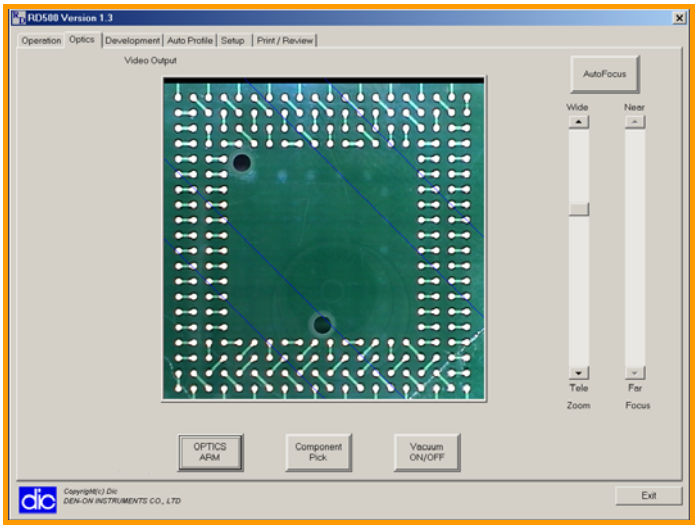
4.8.1. Place the prepared board in the holder of the RD-500 II.



4.8.2. Click on the Optics Tab and then click on the Optics Arm button on the bottom, left-hand side of the screen.

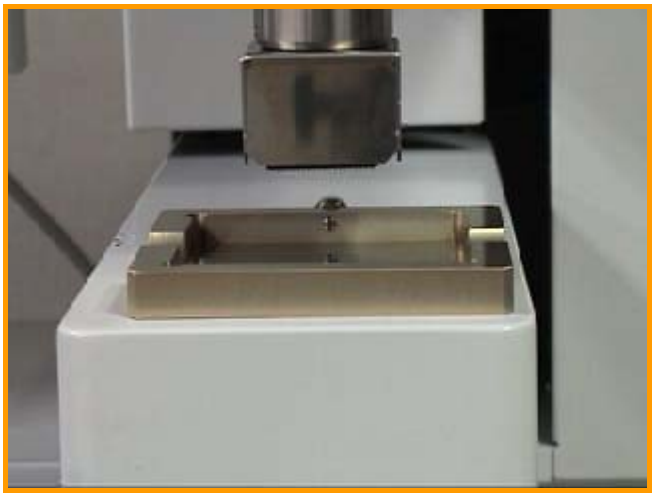


4.8.3. Move the board holder so that lands of the target site are in the center of the Optics screen. Increase the zoom on the camera so that the lands fill as much of the screen as possible.

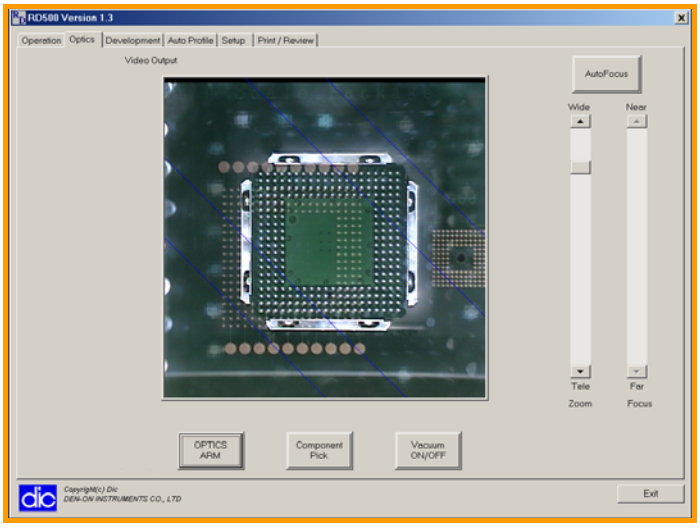


4.8.4. Place the BP-500 with the prepared component in the Optics Arm receptacle.

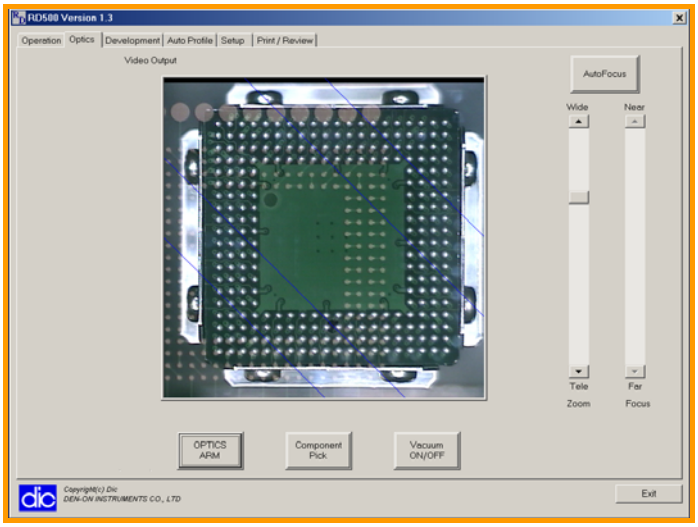
4.8.5. Click on the Component Pick button and the RD-500 II will pick up the component**.**



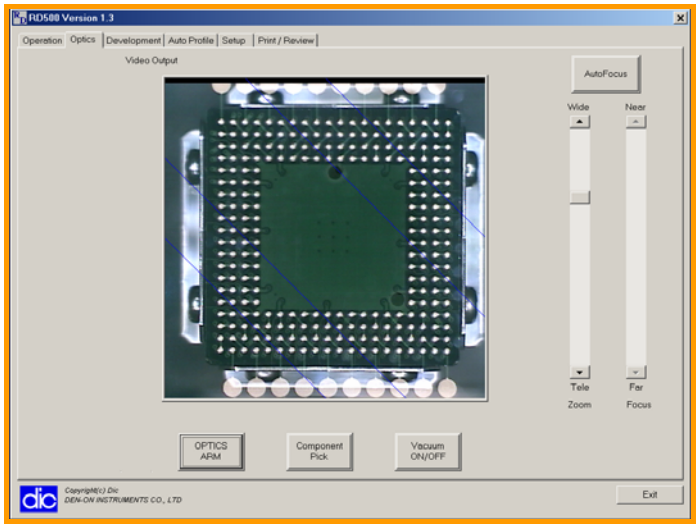
4.8.6. Adjust the P.C.B. and Device lights so that both the lands and the balls are clearly in view.



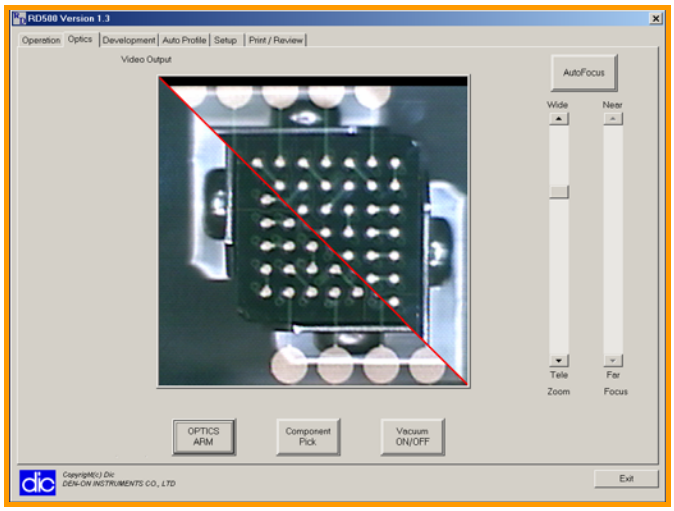
4.8.7. Move the Zoom button so that the nozzle and device fill the screen area.

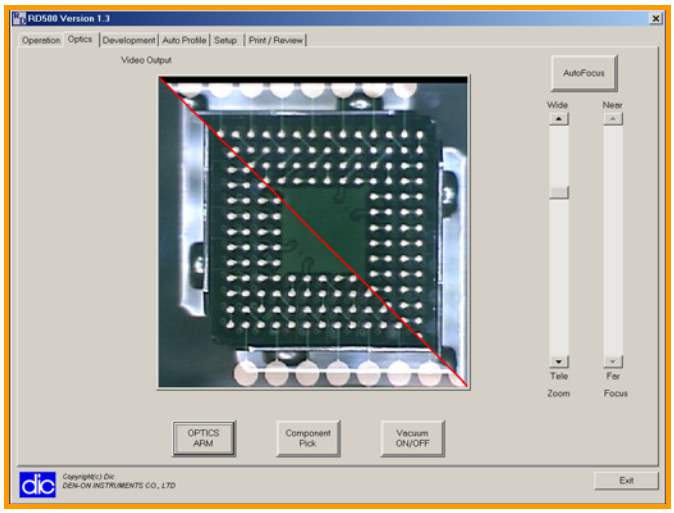


4.8.8. Move the X and Y axis adjustments of the board holder to align the component. If necessary adjust the theta using the knob on the upper head. **Note**: Due to varying component thickness, it may seem like the overall size of the PCB screen and the Device screen are different and the component will never properly align. This can be solved by moving the heater head up or down with the toggle switch on the front right-hand side of the machine.

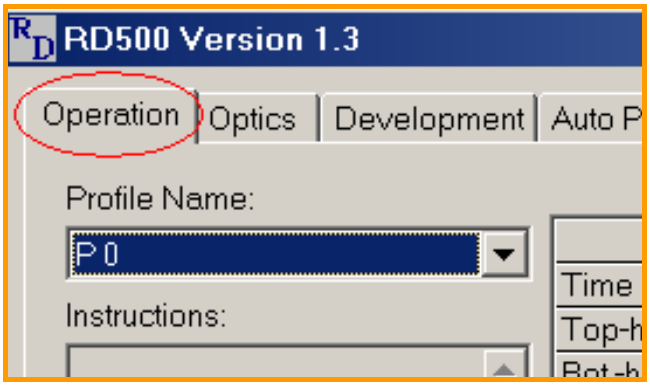


4.8.9. The alignment can be confirmed further by clicking in the areas of the screen that are marked off by the blue line.

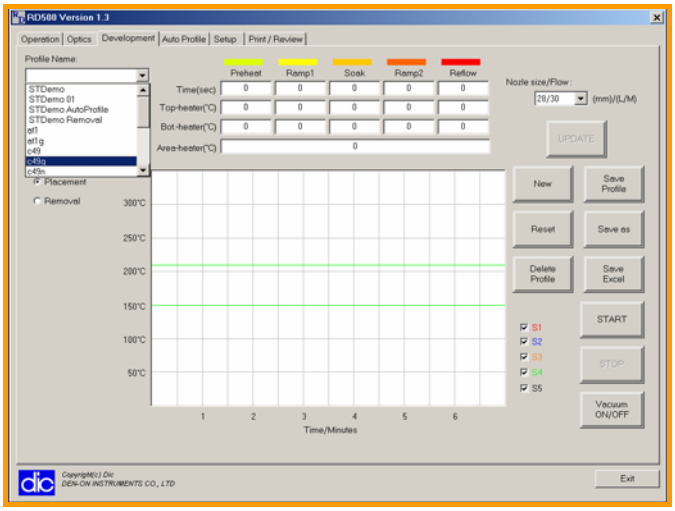




4.8.10. When the component has been aligned, click the Operation Tab on the top of the screen. At this point the Optics Arm will automatically move back into its original position.



4.8.11. Choose the appropriate Profile Name for the target component and board.



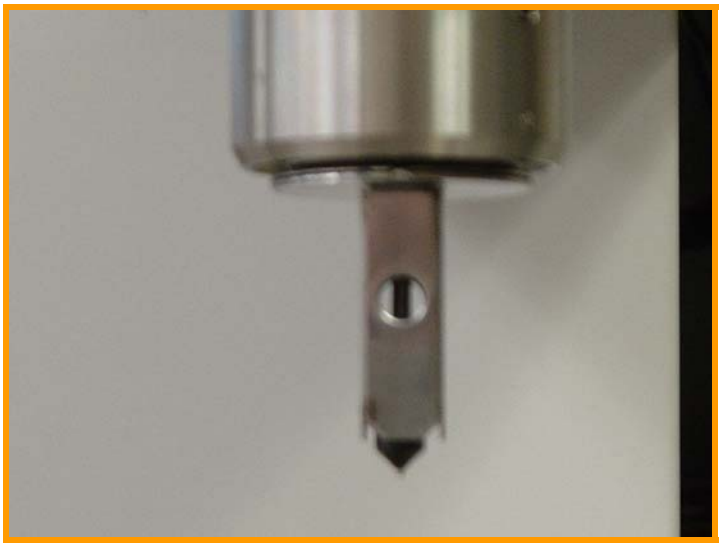
4.8.12. Click the START button on the lower right-hand side of the screen and the RD-500 II will place the component and begin reflow once it senses that the component has been placed on the board. **Note:** Due to varying component heights, it will sometimes it will be necessary to adjust the height of the nozzle at the beginning of the reflow cycle. To do this use the toggle switch on the front right hand side of the machine. This is the same switch that is mentioned in step 8.

4.8.13. When the reflow cycle is complete the reflow head will automatically lift from the board.

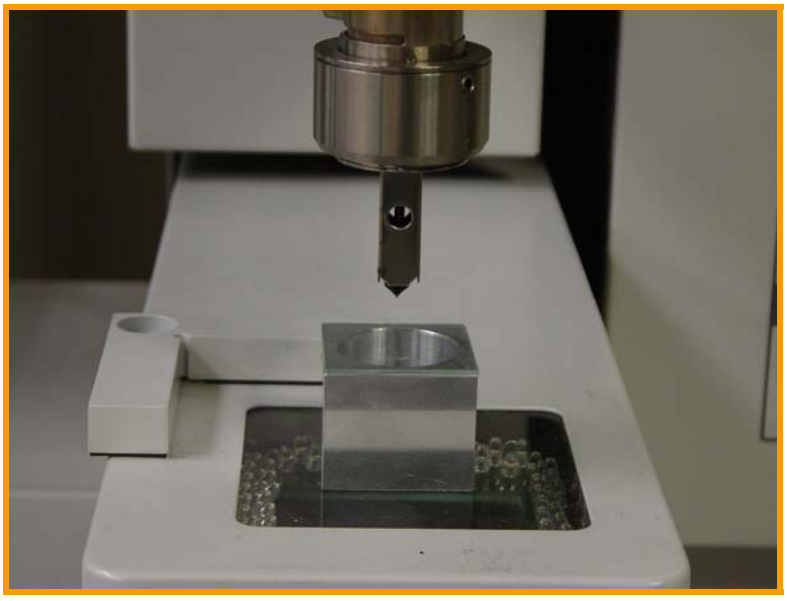
4.9. Reworking Micro Components

4.9.1. Attach the Vacuum Cup With SS Pipe to the Vacuum Tube of the RD-500 II or RD-500S II.

4.9.2. Attach the 7mm x 7mm nozzle to the nozzle holder and adjust the Vacuum Cup with SS Pipe so that the SS Pipe and the angle of the vacuum cup can be seen extended from the nozzle.



4.9.3. Go to the Optics Screen and deploy the Optics Arm. Place the Pick Up Jig on the glass of the Optics Arm with the glass side up.

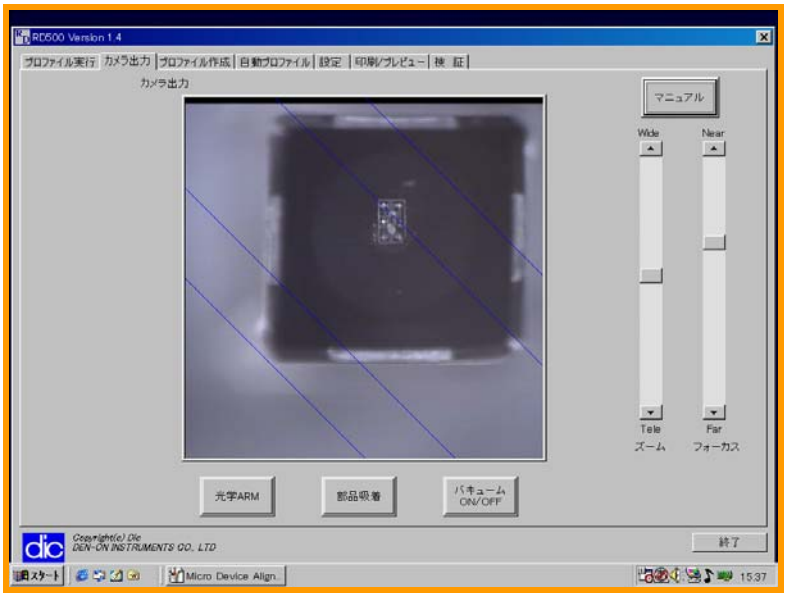


4.9.4. Place the target component on the glass and using the optics be certain that the component has the correct orientation.

4.9.5. Lower the Heater Head using the Heater Head Switch. Do not use the pick up button in the software since the component will need to be aligned manually once the Heater Head is close to the Optics Arm.

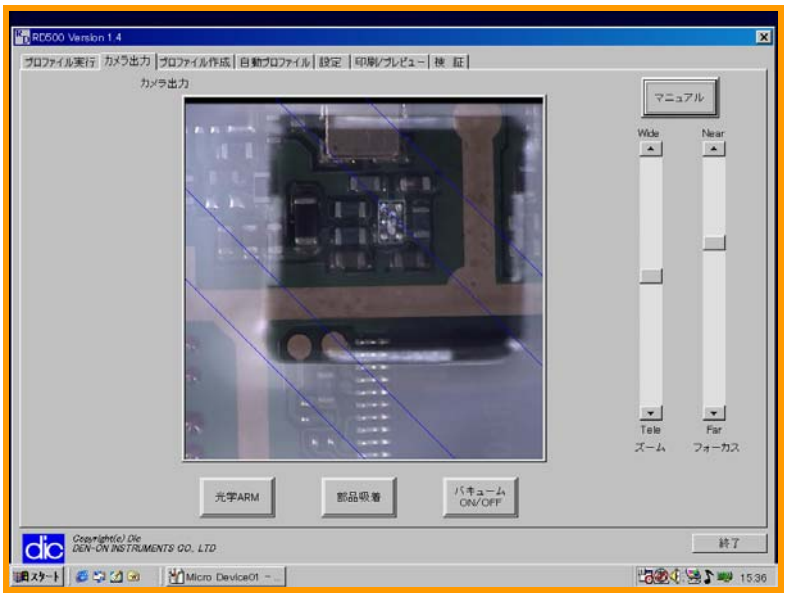
4.9.6. When the SS Pick-Up Pipe is close to the component, turn on the vacuum and pick up the component. Then raise up the Heater Head manually to the upper position.

4.9.7. Bring out the Optics Arm and turn up the Component Lights. Enlarge the image so that the component is visible. Turn off the Auto Focus and manually focus the component using the Heater Head Height Manual Adjustment Switch.

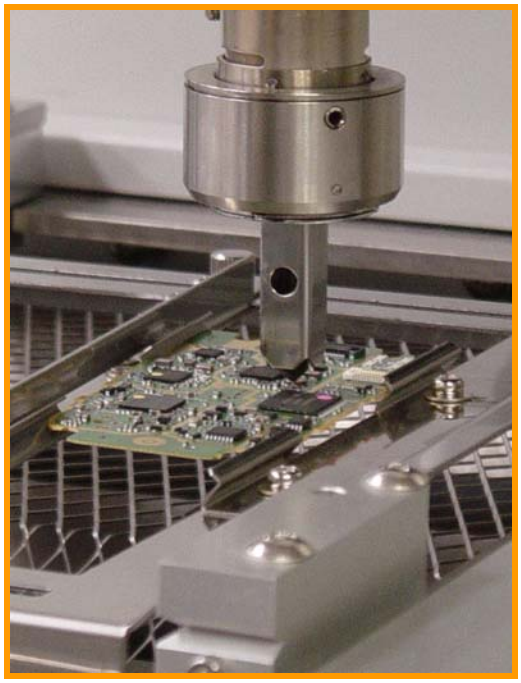


4.9.8. Place the board in the holder and turn off the Manual Focus and turn up the PCB Lights. This should allow the PCB and Component to be in focus.

4.9.9. Align the component. As seen in the photo below the image will sometime appear off center from the screen. This is because the vision system is slightly off-set. However this does not affect the PCB-Component alignment as this off-set is a function of the prism-camera position under the component. In this case it is only off by about 1 mm.

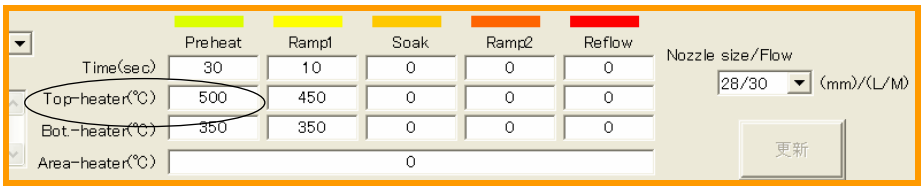


4.9.10. Apply tacky flux to the board and run the profile as normal. The tacky flux is needed in order to help release the component from the SS Vacuum Pick Up Tube.



4.10. Using the Reworkable Underfill Profile Feature

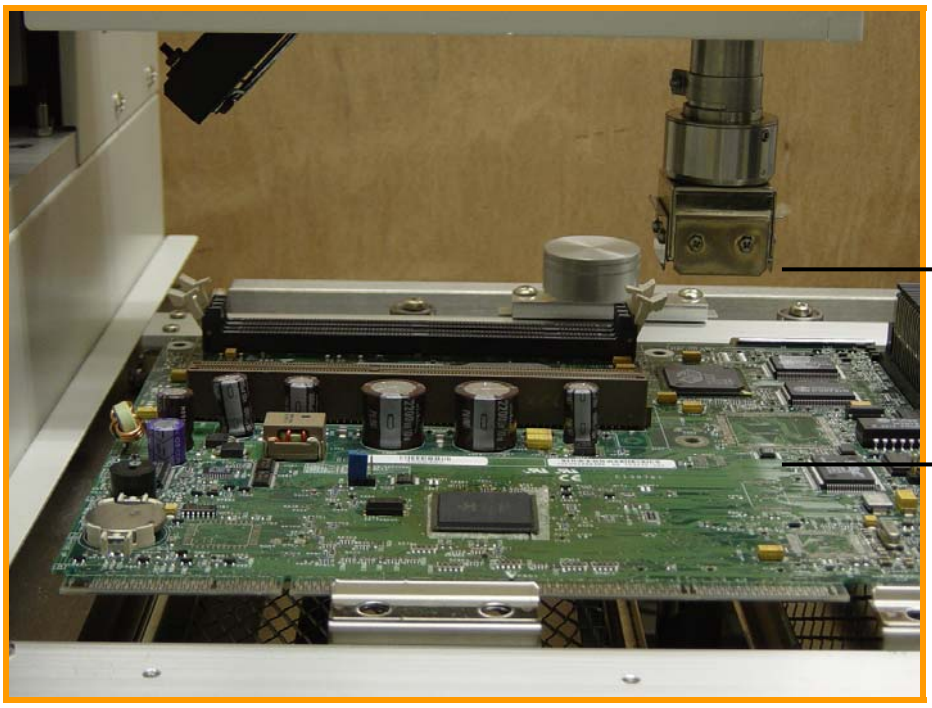
4.10.1. Set the Profile as seen below. Note that the Top Heater Temperature is set to a temperature of 500 degrees C.



4.10.2. With the Preheat set to this Temperature, the Heater Head will raise up twice.

4.10.3. The first time it will raise about 2.5 cm. above the board after the end of the Preheat cycle. This is to allow the component to be removed from the board with a set of tweezers.

4.10.4. The second time it will raise about 25 cm. above the board after the end of the Ramp 1 cycle. This is to allow the user time to clean the remaining underfill from the board using the scraping tool.



5. Maintenance

5.1. Preventative Maintenance

5.1.1. Reference Figure 28

5.1.2. The shafts and slides of the RD-500 II and RD-500S II are made of precision ground, high carbon steel. This material generally prevents rust. But it is also the same material used in all machinery with similar slides so it will need to be lubricated from time to time. This keeps all parts moving smoothly and prevents items from rusting. However, since these machines are used in an electronics environment, please do not over-lubricate them. Doing so will possibly cause the transfer of oil to the parts being reworked. If in doubt, please use the same precautions as used when lubricating pick and place machines, screen printers, AOI and other similar equipment.

Figure 28

5.1.3. Reference Figure 29

5.1.4. The RD-500 II and RD-500S II have an air regulator on the rear of the machine. This regulator has a water trap to capture moisture from the incoming air. Depending on the air source, this water trap will need to be drained. With the air still attached and pressure applied, loosen the valve on the bottom of the trap to release the water into a suitable container.

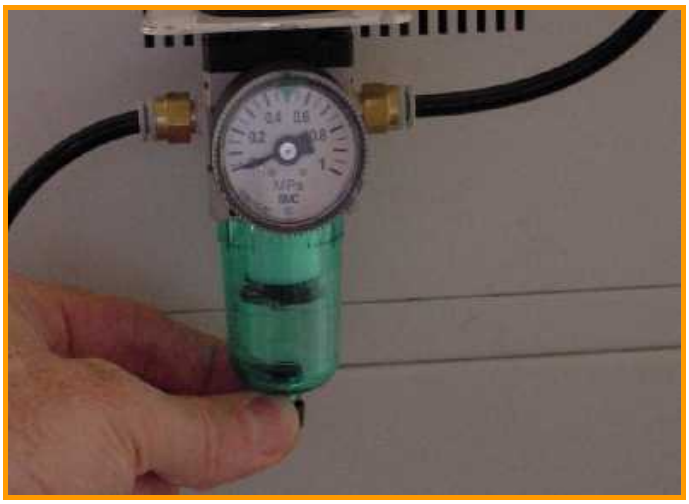


Figure 29

5.2. Mechanical

5.2.1. Replacement of Top Heater

5.2.1.1. Remove the four (4) screws with M3 from the Heater Cover and remove the Theta Knob. For reference see Figure 6 earlier in this manual.

5.2.1.2. Reference Figure 30.

5.2.1.3. Once the Heater Cover is off, remove the Nozzle

5.2.1.4. Remove the Nozzle Adapter.

5.2.1.5. Remove the Vacuum Pad Assembly. (To remove it, insert the Allen Wrench into the hole 5 and loosen the set screw, then pull the Vacuum Shaft out.

5.2.1.6. Remove the Thermo-protector.

5.2.1.7. Remove the Screw N1, N2 N3, and N4 (not visible in this photo) and the Top Heater can be removed from the socket.

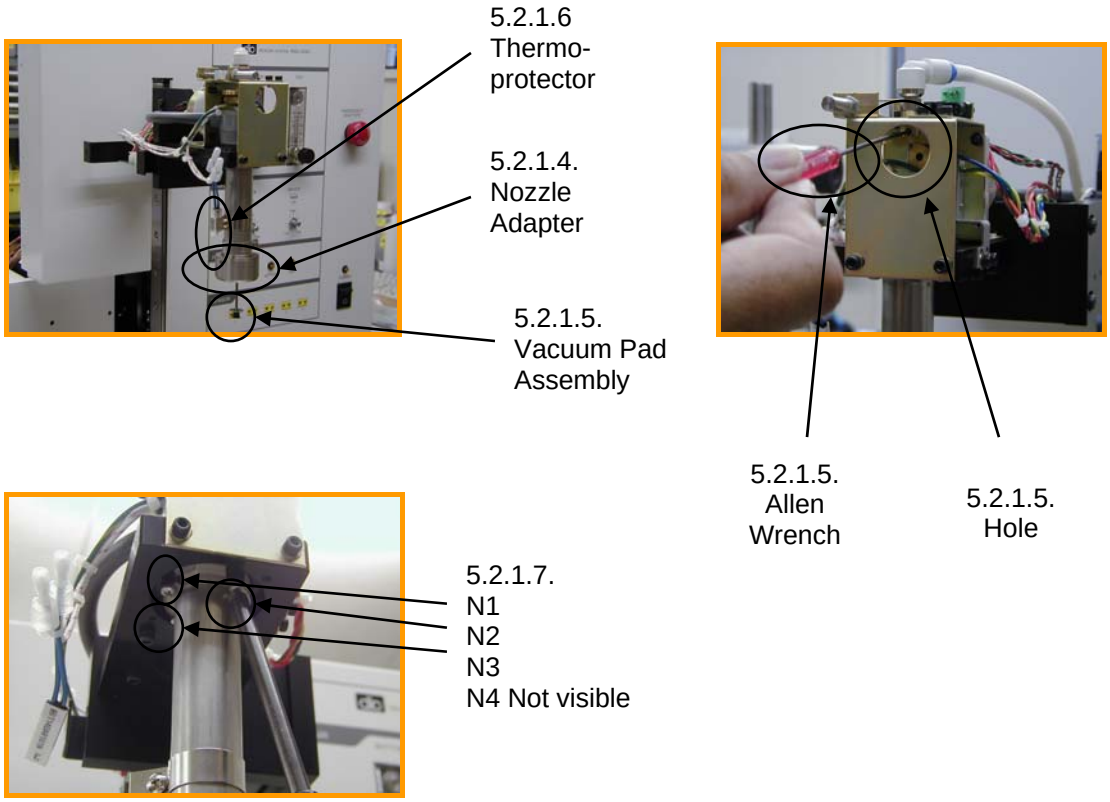


Figure 30

5.2.1.8. Fit a new Top Heater

5.2.1.9. After the replacement of Top Heater, fit the Vacuum Shaft and adjust the height of Vacuum Pad in the following manner.

5.2.1.10. Reference Figure 31

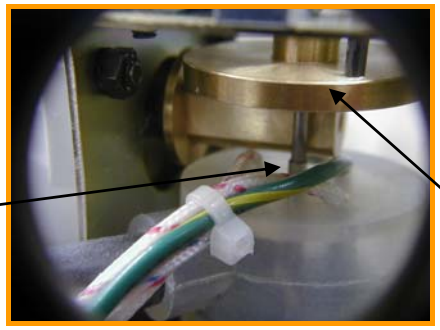


Figure 31

5.2.1.11. Slide the Vacuum Shaft into the central hole of Top Heater. Slide it through the Guide Pipe located at the top side of Top Heater. Insert it into the center of the Theta Adjusting Disc.

5.2.1.12. Tentatively fasten it with the set screw at a position where the tip of Vacuum Shaft protrudes about 20mm from the bottom face of Top Heater.

5.2.1.13. Raise the Nozzle Adapter to the maximum height until it hitting the bottom face of Nozzle and tighten the clamp screw.

5.2.1.14. Attach a nozzle and a Vacuum Pad.

5.2.1.15. Confirm that the Vacuum Shaft moves freely. Test this with your finger and it should move up and down about 5mm. If it does not move freely then the Friction Cam is probably engaged and needs to be adjusted.

5.2.1.16. Rotate the Cam with a Needle Nose Pliers until the flat part of Friction Cam is parallel to the Vacuum Shaft shown in Figure 31.

5.2.1.17. Then properly fasten the set screw in the hole shown in Figure 30 at a position where the vacuum face of Vacuum Pad at the low end is parallel to the bottom face of the Nozzle.

5.2.1.18. Replacement of Vacuum Pad, refer to Figure 32.

5.2.1.19. The Vacuum Pad is just inserted into the Vacuum Shaft. To remove it simple pull on the rubber while holding the Vacuum Shaft. Take care not to lose the two metal washers (large and small).

5.2.1.20. Reattach a new Vacuum Pad by sliding it onto the shaft. Be sure to replace the washers as well. The small washer is put on closer to the Vacuum Pad.

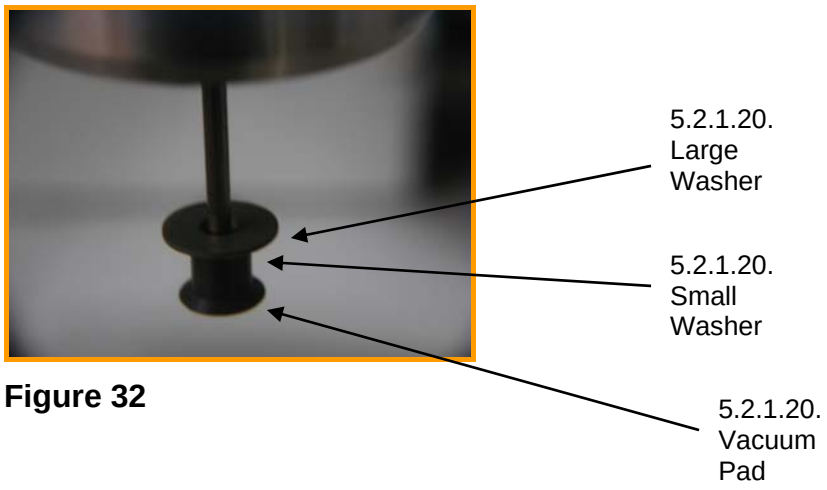


Figure 32

5.2.2. Replacement of Bottom Heater

5.2.2.1. Reference Figure 33.

5.2.2.2. Remove the Nozzle.

5.2.2.3. Remove the Nozzle Adapter.

5.2.2.4. Remove the Thermo-protector.

5.2.2.5. Remove the 4 Heater Screws holding the heater in place. These are shown in Figure 33.

5.2.2.6. Bottom Heater can now be unplugged from the socket.

5.2.2.7. Reverse the procedure to install the new heater.

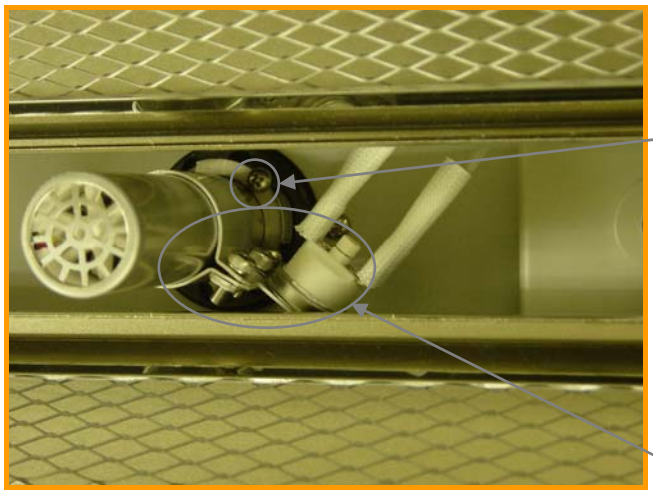


Figure 33

5.2.3. Adjustment of Optics

5.2.3.1. Reference Figure 34.

5.2.3.2. On very rare occasions (after rough shipment) the Alignment Prism might need calibration.

5.2.3.3. Remove the Optics Arm cover by removing the 4 screws that secure it to the frame.

5.2.3.4. Set the Optical Alignment Board and the BGA into the Board Holder.

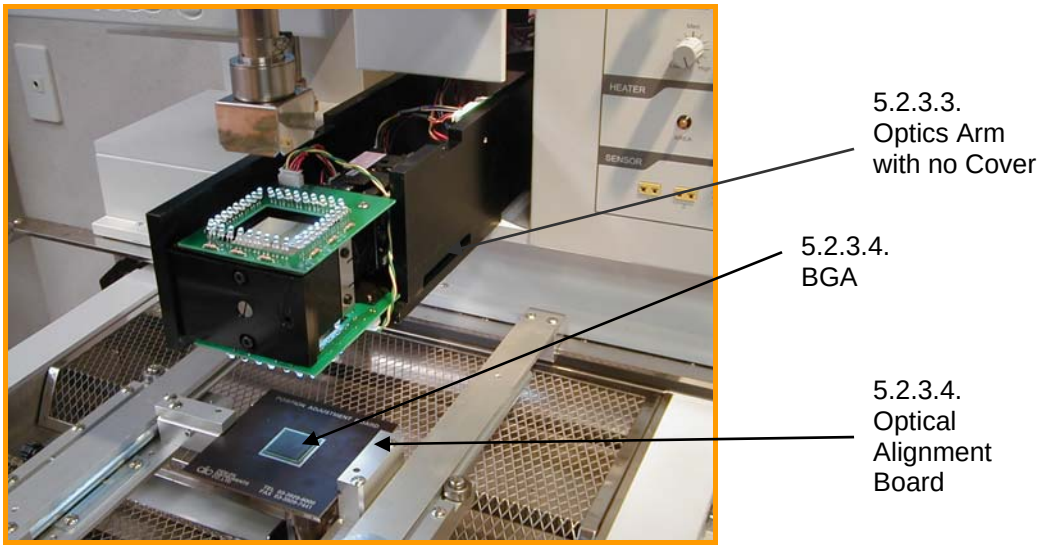


Figure 34

5.2.3.5. Start up the RD-500 II and click the Optics Tab.

5.2.3.6. Click the Optics Arm button to deploy the Arm.

5.2.3.7. Align the Nozzle over the BGA as shown in Figure 35.

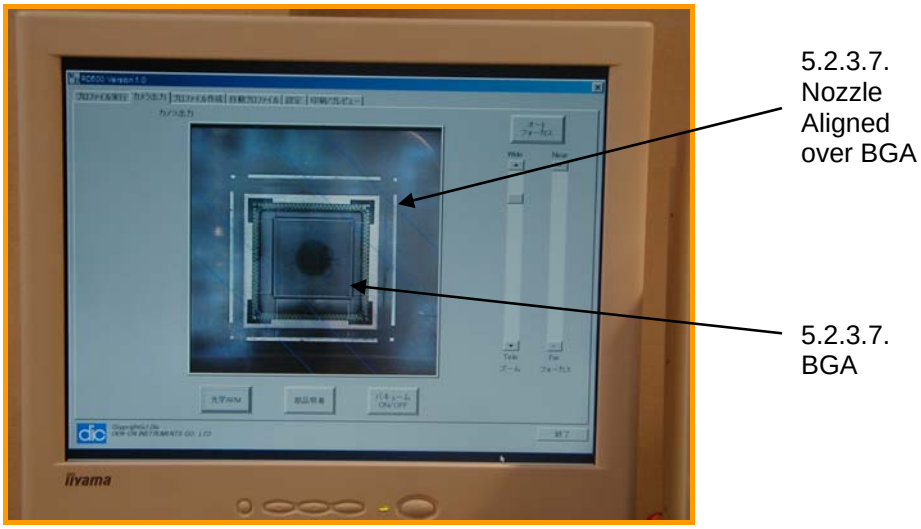


Figure 35

5.2.3.8. Lock the Board Holder in place using Knobs 7, 8 and 11 in Figure 16.

5.2.3.9. Click the Operation Tab to return the Arm.

5.2.3.10. Click the Optics Tab again. This will also activate the Vacuum Pump.

5.2.3.11. Click on the Component Pick Button and the Heater Head will automatically move down and pick up the BGA. It will then automatically return to the up position.

5.2.3.12. Click the Optics Arm Button to Deploy the Optics Arm.

5.2.3.13. In Figure 36 you will see an image where the Prism that is out of alignment. This can be seen in the discrepancy between the ball of the BGA and the Land of the Alignment Board. If you do not see any discrepancy then the Prism does not require any adjustment. If there is a discrepancy, the following instructions will explain how re-align the Prism.

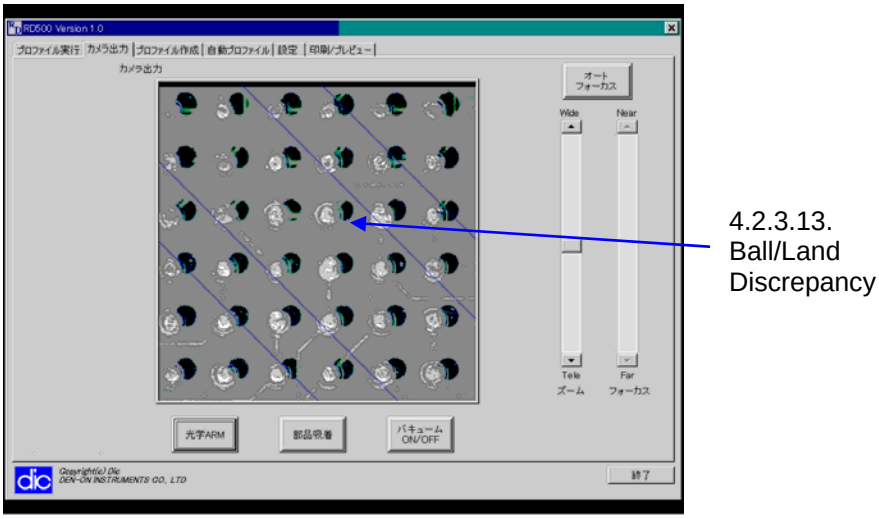


Figure 36

5.2.3.14. Reference Figures 37 and 38

5.2.3.15. Figure 37 shows the calibration for the prism in the Y direction. Figure 38 shows the adjustment for the prism in the X direction. The procedure is the same for both directions.

5.2.3.16. First loosen the two Clamp Screws. Keep some tension on them so that the prism does not move freely. This will make the calibration much easier.

5.2.3.17. Once the screws have been loosened, insert a 2.5mm Allen Wrench (for M3 screws) in the Prism Calibration Hole.

5.2.3.18. Next tweak the Allen Wrench up or down while watching the image. When the images become aligned, tighten the Clamp Screws.

5.2.3.19. Repeat the process for the Y direction if necessary.

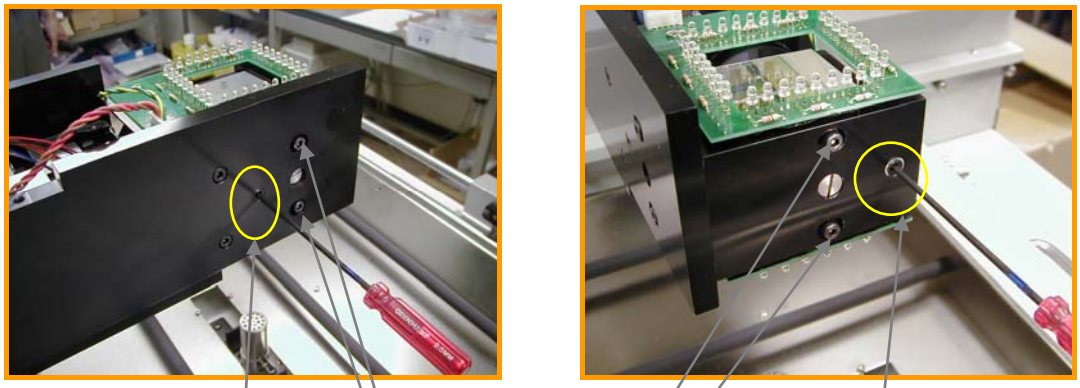


FIGURE 37

RD-500 II

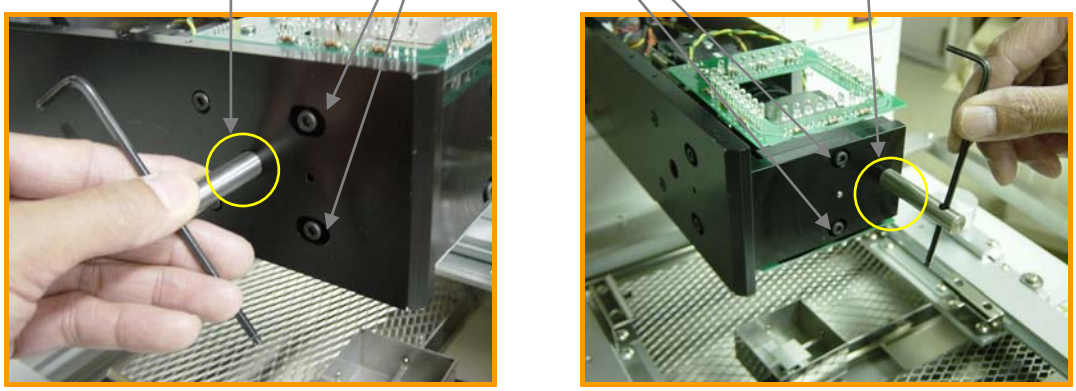


FIGURE 38

RD-500S II

5.3. Electrical

5.3.1. Resetting the Thermo-protectors

CAUTION: BEFORE PROCEEDING, TURN OFF THE MAIN POWER ON THE FRONT PANEL AND BE SURE THAT THE HOT AIR HEATERS ARE COOL. FAILURE TO DO SO CAN CAUSE SERIOUS INJURY.

5.3.1.1. Each of the Hot Air Heaters has a Thermo-protector attached to the outside of the unit. It is there to sense if the heater goes into an out of control overheat condition. If this happens, then the Thermo-protector would sense the heat from the outside of the heater and cut off the power going into the heater.

5.3.1.2. To reset the Thermo-protector, first turn off the main power on the front panel.

5.3.1.3. Reference Figure 39

5.3.1.4. Next push the button that is located in between the two power input wires leading to the Thermo-protector. This will reset the Thermo-protector.

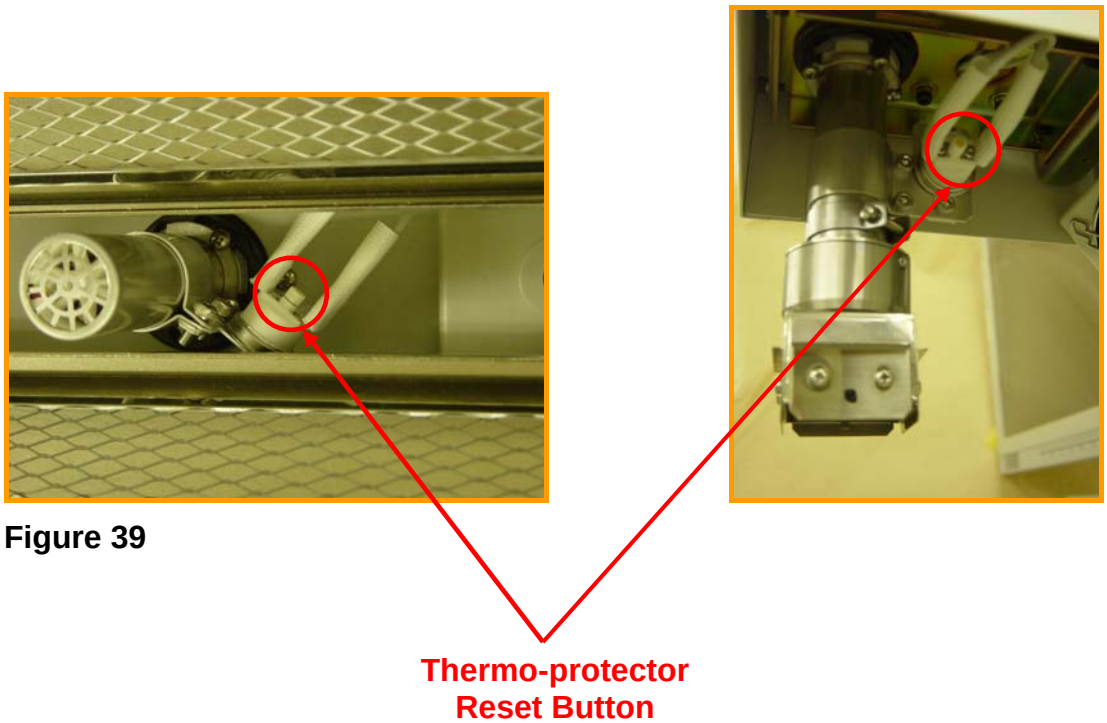


Figure 39

5.3.2. Calibrating the Sensor Inputs

5.3.2.1. Reference Figure 40.

5.3.2.2. Remove the 4 screws holding the cover panel.

5.3.2.3. Put in a sample board and set the unit up to run a profile.

5.3.2.4. Insert a Probe into the Sensor 1 and using a Temperature Calibrator such as a Yokogawa 2422, input a standard temperature of 200 degrees Celsius.

5.3.2.5. Start the profile and observe whether the Sensor 1 line on the Flat Panel Display properly shows 200 degrees Celsius. If so, then check the other Sensors the same way. If not, adjust VR2 until the Flat Panel Display reading shows 200 degrees Celsius.

5.3.2.6. The other Sensors are controlled by the following VRs:

Calibration VR4 for Sensor 2
Calibration VR6 for Sensor 3
Calibration VR8 for Sensor 4
Calibration VR10 for Sensor 5

5.3.3. Function of the other VRs

5.3.3.1. For Reference the function of the other VRs are given below. These are factory set and do not need adjustment. CAUTION: Adjusting these VRs will invalidate any warranty.

VR1 - Span for Sensor 1
VR3 - Span for Sensor 2
VR5 - Span for Sensor 3
VR7 - Span for Sensor 4
VR9 - Span for Sensor 5
VR13 - Temperature of the Area Heater
VR14 - Temperature of the Bottom Heater
VR15 - Temperature of the Top Heater
VR17 - Lower Limit Temperature of Cooling
VR18 - Speed Control for the Heater Head Descent

5.3.3.2. All other VRs are used for internal board adjustment.

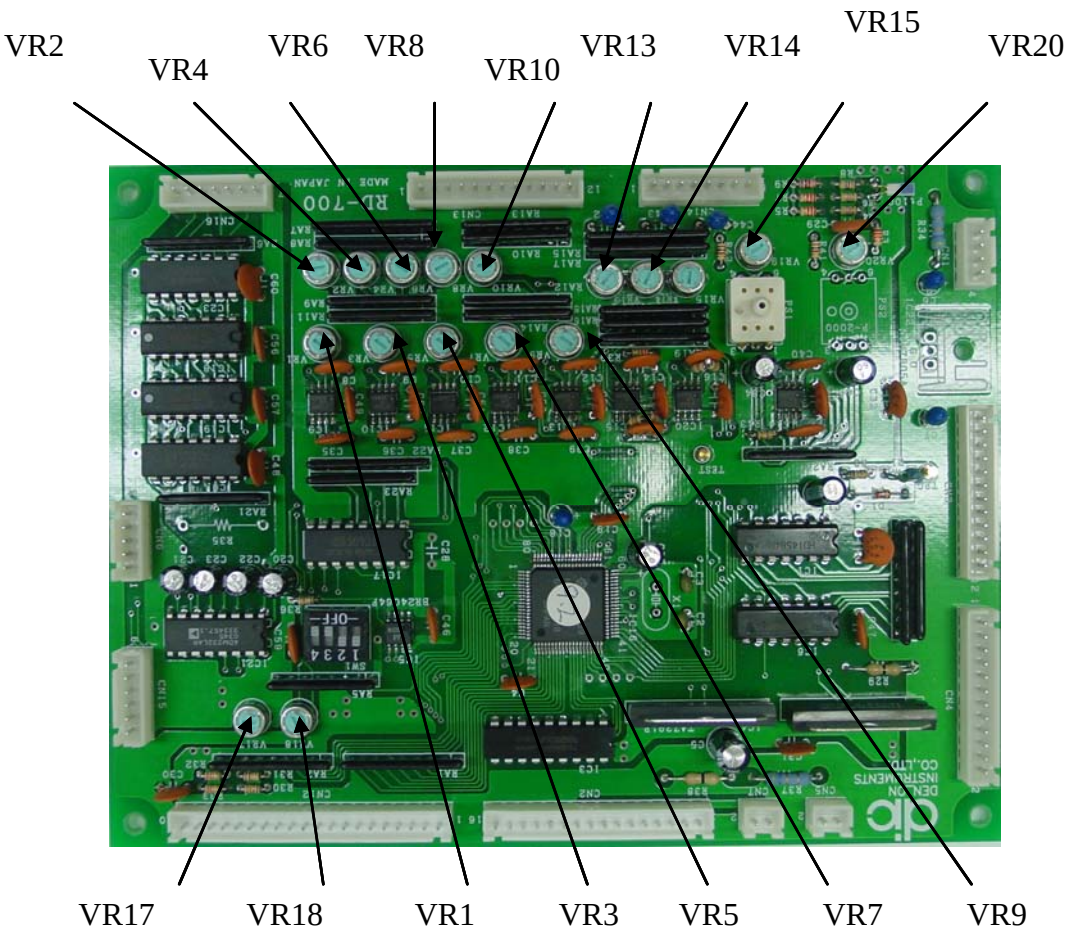
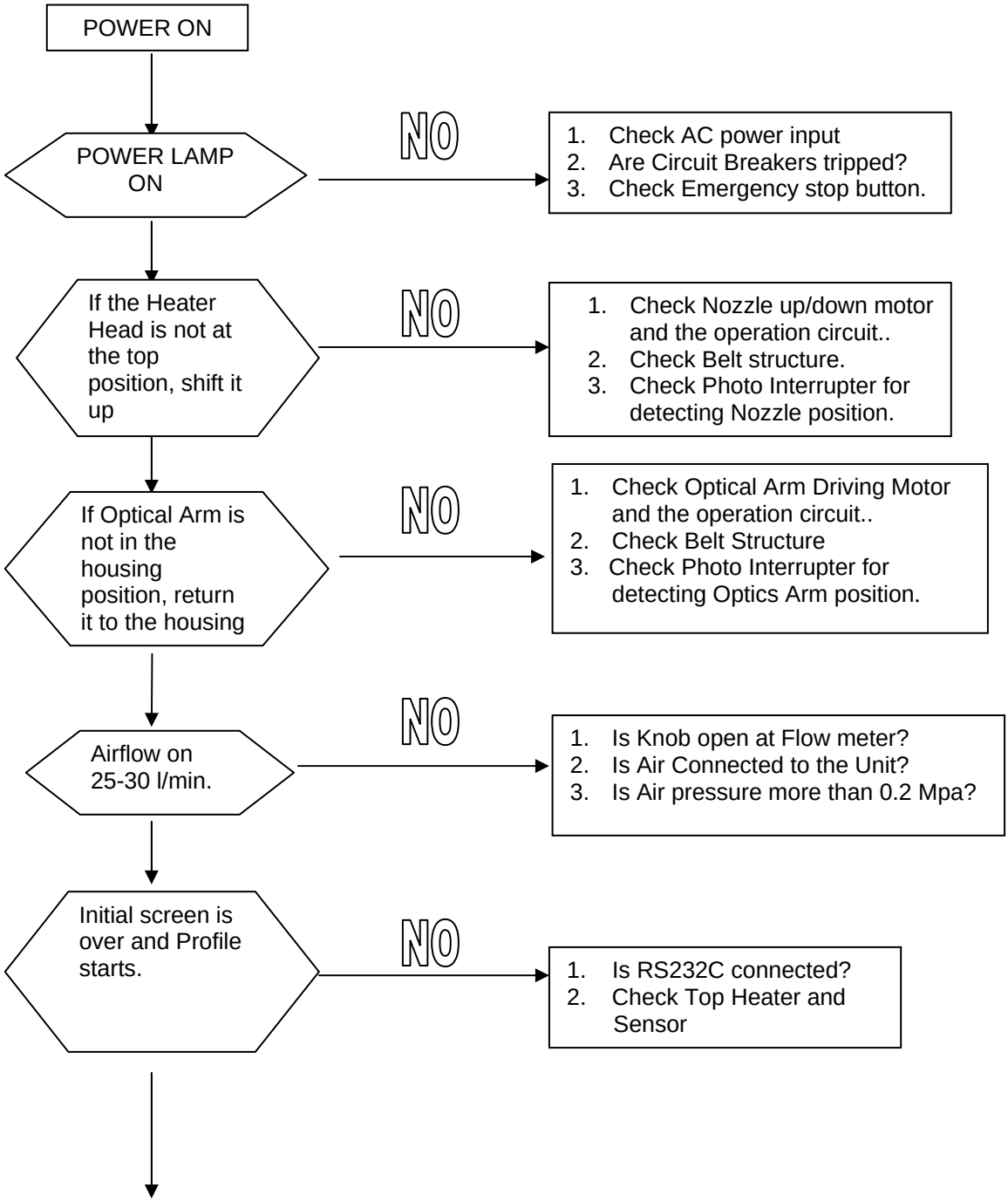


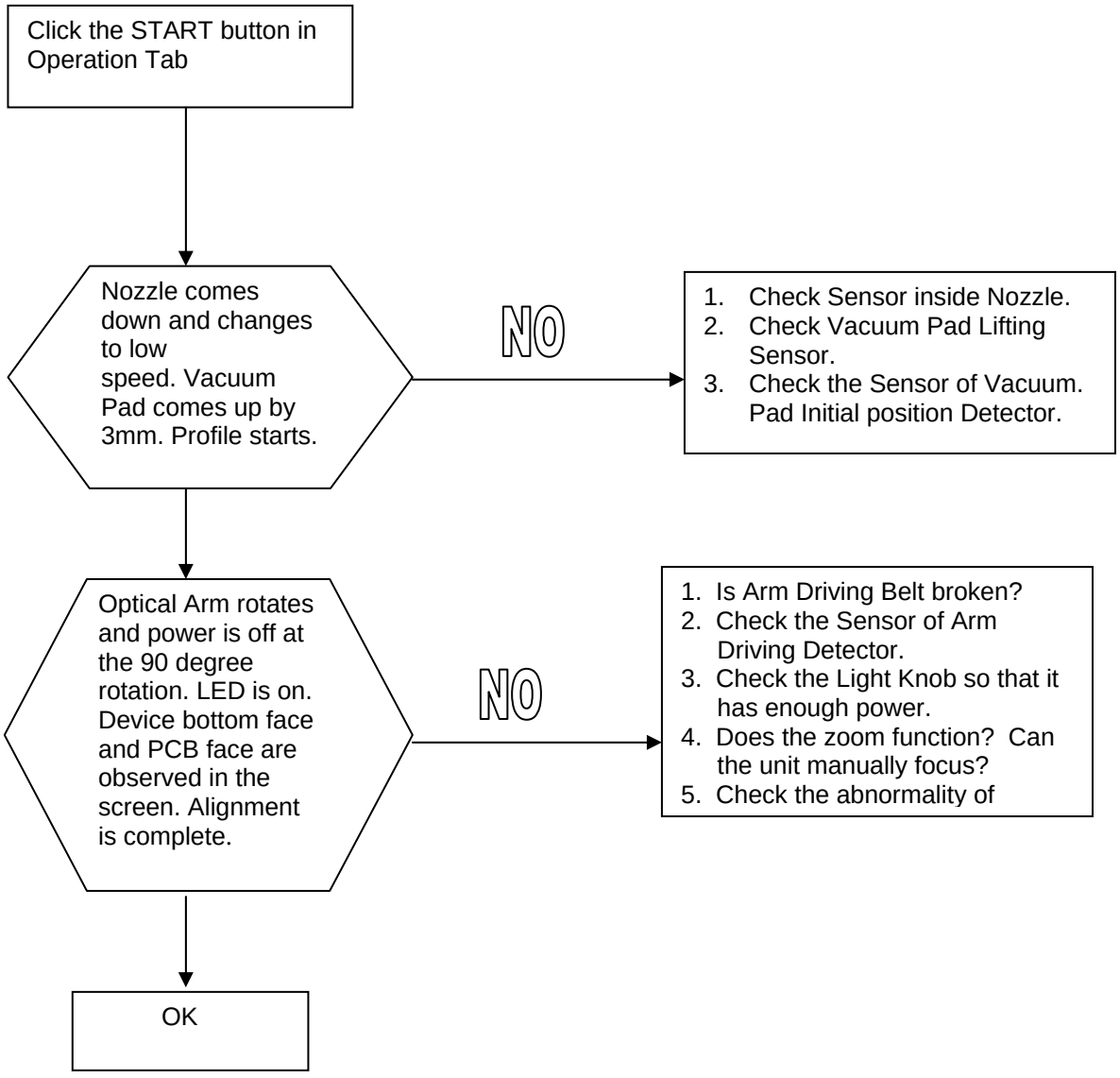
Figure 40

6. GENERAL TROUBLESHOOTING

6.1. The following procedures are designed to allow the operator to perform basic visual inspections of system components (i.e. loose connections, equipment misalignment, etc.) If you have any questions, contact DENON or your local agent for further help.

6.1.1. To begin, start up the PC and click the icon ofRD-500 II.


POWER ON
POWER LAMP ON
NO
1. Check AC power input
2. Are Circuit Breakers tripped?
3. Check Emergency stop button.
If the Heater Head is not at the top position, shift it up
NO
1. Check Nozzle up/down motor and the operation circuit..
2. Check Belt structure.
3. Check Photo Interrupter for detecting Nozzle position.
If Optical Arm is not in the housing position, return it to the housing
NO
1. Check Optical Arm Driving Motor and the operation circuit..
2. Check Belt Structure
3. Check Photo Interrupter for detecting Optics Arm position.
Airflow on 25-30 l/min.
NO
1. Is Knob open at Flow meter?
2. Is Air Connected to the Unit?
3. Is Air pressure more than 0.2 Mpa?
Initial screen is over and Profile starts.
NO
1. Is RS232C connected?
2. Check Top Heater and Sensor


Click the START button in Operation Tab
Nozzle comes down and changes to low speed. Vacuum Pad comes up by 3mm. Profile starts.
NO
1. Check Sensor inside Nozzle.
2. Check Vacuum Pad Lifting Sensor.
3. Check the Sensor of Vacuum. Pad Initial position Detector.
Optical Arm rotates and power is off at the 90 degree rotation. LED is on. Device bottom face and PCB face are observed in the screen. Alignment is complete.
NO
1. Is Arm Driving Belt broken?
2. Check the Sensor of Arm Driving Detector.
3. Check the Light Knob so that it has enough power.
4. Does the zoom function? Can the unit manually focus?
5. Check the abnormality of
OK

7. SPECIFICATIONS

7.1. RD-500 II Main Unit

Maximum Board Size…….....500 x 600mm
Minimum Device Size…….....2 x 2mm
Maximum Device Size……50 x 50mm
Placement Accuracy……+/-0.025mm
Top Heater……700 Watt Hot Air
Bottom Heater……..700 Watt Hot Air
Bottom Area Heater……4 x 400 Watt IR Rod type
Overall Dimensions……770(W) x 755(D) x 670(H)mm
Weight ……..Approximately 78kg
Air Requirements…….....60 l/min. 1-10kdf/cm2 (0.1-1.0 Mpa)
Voltage……..200-230VAC, 50/60Hz
Power Consumption……3.0kw

7.2. RD-500S II Main Unit

Maximum Board Size……..400 x 420mm
Minimum Device Size…….....2 x 2mm
Maximum Device Size……50 x 50mm
Placement Accuracy……..+/-0.025mm
Top Heater……...700 Watt Hot Air
Bottom Heater……700 Watt Hot Air
Bottom Area Heater (Optional).....2 x 400 Watt IR Rod type
Overall Dimensions……770(W) x 755(D) x 670(H)mm
Weight ……..Approximately 50kg
Air Requirements……....60 l/min. 1-10kdf/cm2 (0.1-1.0 Mpa)
Voltage……..100-120 VAC or 200-230VAC, 50/60Hz
Power Consumption……1.4kw, 2.2kw with optional area heater

7.3. RD-500 II Flat Panel Display (Common for both RD-500 II and RD-500S II)

Voltage……...100-240 VAC, 50/60Hz
Current……...1.5 Amps

7.4. RD-500 II Computer (Common for both RD-500 II and RD-500S II)

Operating System……..Windows 2000
Voltage……100-240 VAC, 50-60Hz
Current……2 Amps

8. OPTIONS

8.1. Nozzles

8.1.1. Inside Dimensions

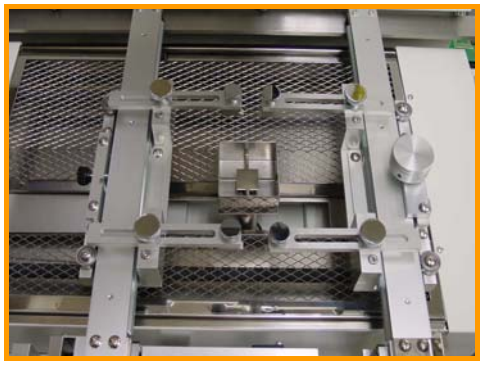
BNZ-07……07 X 07 mm
BNZ-09……09 X 09 mm
BNZ-13……13 X 13 mm
BNZ-15……15 X 15 mm
BNZ-18……18 X 18 mm
BNZ-20……20 X 20 mm
BNZ-22……22 X 22 mm
BNZ-24……24 X 24 mm
BNZ-26……26 X 26 mm
BNZ-28……28 X 28 mm
BNZ-30……30 X 30 mm
BNZ-32……32 X 32 mm
BNZ-35……35 X 35 mm
BNZ-37……37 X 37 mm
BNZ-39……39 X 39 mm
BNZ-44……44 X 44 mm
BNZ-49……49 X 49 mm
BNZ-52……52 X 52 mm
Custom Nozzles Available Upon Request.

8.2. Compressor

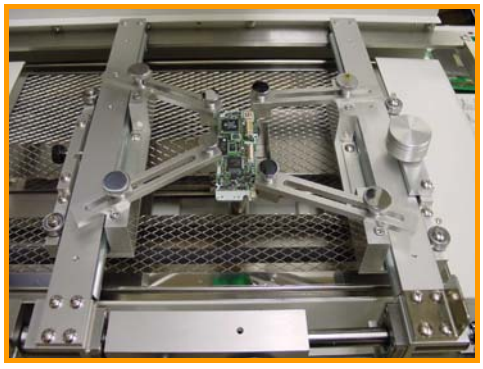
Voltage……...100, 120 or 230 VAC, 50/60 Hz
Current……3, 2.5, or 1.5 Amps

8.3. Table with Wheels
Dimensions……770(W) x 770(D) x 700(H) mm

8.4. Odd Shape PCB Holder



Without PCB



With PCB

SOFTWARE VERSION 1.8.1x RELEASE DOCUMENT

Document Version: 1.0
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Date: 01-09-2005

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1. Introduction

The purpose of this document is to summarise the main differences between the new version 1.8.x and the old version 1.7 of the software driver for the RD 500 Denon rework machine.

2. General Changes

- The order of the control tabs has been changed from: **Operation → Optics → Development → Autoprofile → Setup → Print/Review → Inspection** in version 1.7 to **Operation → Development → Autoprofile → Inspection → Optics → Setup → Print/Review** in version 1.8.x. This has been done to serve a more logical tab organisation, i.e. the communication tabs first then the setup tabs afterwards. Figure 1 highlights these changes.
- The splash screen has been slightly modified to mark the new 1.8.x version.
- No changes have been made to the Optics window.

Figure 1: Tab reorganisation

3. OPERATION Window

In terms of looks, this tab has had a modest reorganisation of the buttons and the sensor check boxes. Below are the main changes which took place. These are shown in Figure 2.

- The grid colour of the main table is now showing in light blue rather than the grey of version 1.7.
- The graph window has been extended to accommodate temperatures up to 500 ˚C in the y-direction.
- The x-axis of the graph has also had a change in terms of its range. It is now able to expand to accommodate times up to 28 minutes. However, since at this time the firmware is unable to support this feature the full time range will never be seen in this version. This is planned for Version 2.0.
- The sensors check boxes have been moved to the right hand side and incorporated with their current temperature readings with full colour support. This is basically more of an aesthetic job and makes the window look much tidier.
- The colour of sensor 4 is now brown rather than the green in version 1.7.
- The sensors check boxes are now fully selected at start up.
- The buttons have been rearranged to reflect a new universal tab look with the START and the STOP buttons taking the first row.
- When the START button is clicked, all the buttons become unavailable except the STOP button. This has been done to give the user the opportunity to stop the machine at any time after the START button has been clicked. In particular, this is important during the time between the pressing of the START button and the start up of the firmware.

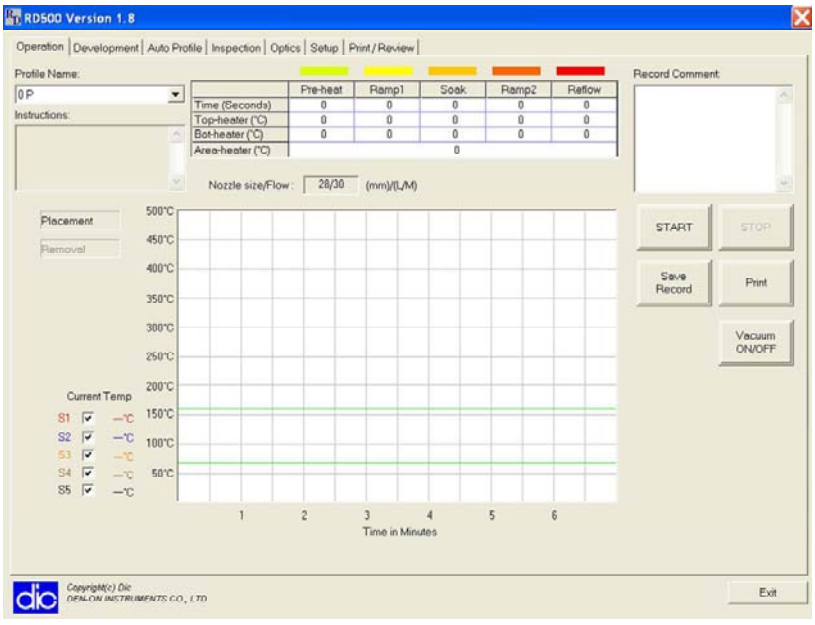

Figure 2: OPERATION Tab

4. DEVELOPMENT Window

This window has had many new features and changes. Below is a full list of all these. Figure 3, on the other hand illustrates the new look of this window.

- The first change is the extension of the graph window as was done for the previous tab. The y-axis can now support temperatures up to 500 ˚C. In the same manner the x-axis can automatically expand to accommodate longer profiles.
- The sensor check boxes have been moved to the left hand side and incorporated with their temperature readings along with full colour support.
- The colour of sensor 4 has been changed to brown.
- The right hand side buttons have been rearranged to support the intended universal look of the tabs.
- Some button name changes have also taken place such as SAVE PROFILE changed into OVERWRITE PROFILE, RESET into RESET GRAPH, and DOWNLOAD CSV FILE into SAVE AS CSV FILE.
- When the START button is clicked, all the buttons become unavailable except the STOP button. This has been done to give the user the opportunity to stop the machine at any time after the START button has been clicked. In particular, this is important during the time between the pressing of the START button and the start up of the firmware.
- A new text field called TOTAL TIME has been added to show the current total time of the profile. This time has a preset upper bound of 16 minutes.
- The time fields must add up to 16 minutes in total. If this is exceeded the user would get a warning message and the time will be adjusted automatically in the current selected field. The user should however bear in mind that the total time only reflects the time addition of all the time fields. This obviously does not have any time allowance for the cooling phase. The current total time supported by the firmware is 16 minutes including any cooling time. When this is not adhered to the graph will stop at 16 minutes as the firmware will stop sending data back to the software.
- All the temperature fields have now an upper bound of 650 ˚C.
- A new button called SET INITIAL BOARD TEMP has been added. When this is clicked it sets the PREHEAT time to 0s and the PREAHEAT temperature to 80 ˚C. The purpose of this addition is to give the user the opportunity to hold starting the profile until the board temperature has reached 80 ˚C.
- A new button called COOLING FAN has been added. When this is clicked it turns the REFLOW time into the next odd number if this is not the case already. This will allow the fan to turn on at the end of the profile to cool down the component. This button is only available when the PLACEMENT mode is selected.
- A new button called CLEANING MODE has also been added. When this is clicked it changes the RELOW time into 60 s and the REFLOW temperature into 0 ˚C. The purpose of this button is to keep the bottom heater on allowing the user to clean the position of the removed

component. This button is only available when the REMOVAL mode is selected.

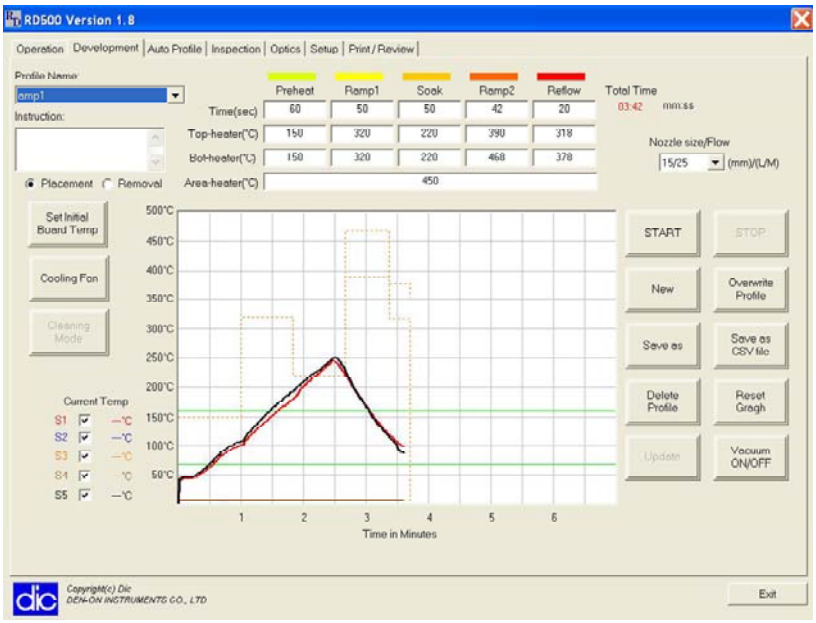

Figure 3: DEVELOPEMENT Tab

5. AUTOPROFILE Window

There are no major changes to this tab. The following are the main ones. Figure 4 shows the new window in version 1.8.x.

- The first change is the extension of the graph window as was done for the other tabs. the y-axis can support temperatures up to 500 ˚C. In the same manner the x-axis can automatically expand to accommodate longer profiles.
- The sensors check boxes have been moved to the left hand side and incorporated with their temperature readings along with full colour.
- The colour of sensor 4 has been changed to brown.
- Once again the right hand side buttons have been rearranged to support the intended universal look of the tabs.
- When the START button is clicked, all the buttons become unavailable except the STOP button. This has been done to give the user the opportunity to stop the machine at any time after the START button has been clicked. In particular, this is important during the time between the pressing of the START button and the start up of the firmware.

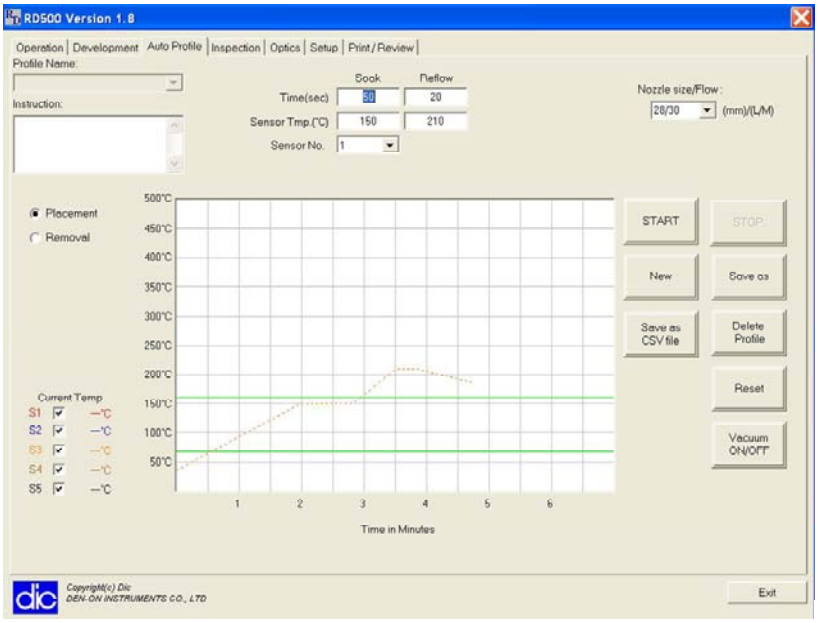

Figure 4: AUTOPROFILE Tab

6. INSPECTION Window

The main changes to this window are illustrated in Figure 5. The full list of changes is noted below.

- The first change is the extension of the graph window as was done for the other tabs. The y-axis can support temperature up to 500 ˚C. In the same manner the x-axis can automatically expand to accommodate longer profiles.
- The name STANDARD has now been replaced by the more meaningful name MASK FILE.
- This has also been incorporated in the button names.
- The colour of the table grid has been changed to light blue.
- The sensor check boxes have been moved to the side of the table.
- A new text field has been added to represent the lower PEAK TEMP figure. This has also been made interactive with the table values.
- The colours of the table are now displaying green for OK and red for NG.
- Further adjustments to the algorithm driving the table to produce more meaningful reports.

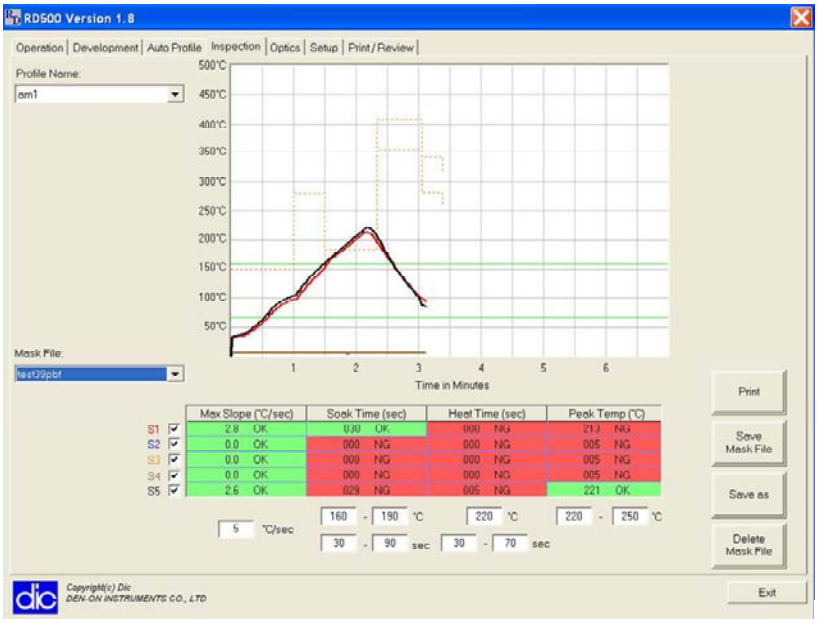

Figure 5: INSPECTION Tab

7. SETUP Window

The main changes for this tab are as follows

- At start up the AUTO radio button is selected automatically.
- Also at start up the AREA HEATER temperature is set at 350 ˚C.
- The UPPER TEMP and LOWER TEMP scroll boxes are now editable as well. The user is now able to either enter the temperature values directly via the keyboard or by scrolling using the up and down keys.
- The password is now set to lock both the PROFILE the AUTOPROFILE tabs. When the password is entered both windows are unlocked until the termination of the session. The password in reengaged when the software is re-launched.

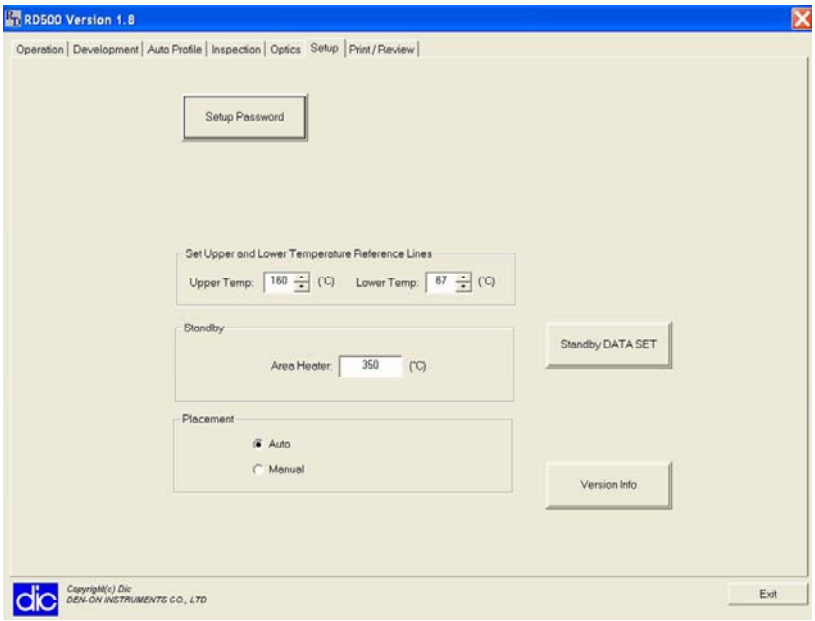

Figure 6: SETUP Tab

8. PRINT/REVIEW Window

The main changes for this window are basically the addition of all the features of the other windows. See Figure 7 for an illustration of these changes.

- The first change is the extension of the graph window as was done for the other tabs. The y-axis can support temperature up to 500 ˚C. In the same manner the x-axis can automatically expand to accommodate longer profiles.
- New check boxes for the sensors have been added to allow the user to select or deselect from the figure the appropriate sensor graphs.
- The familiar Green line marking the UPPER TEMP and the LOWER TEMP have also been added to the graph.
- The overlay profiles are now displayed in light colours rather then black.

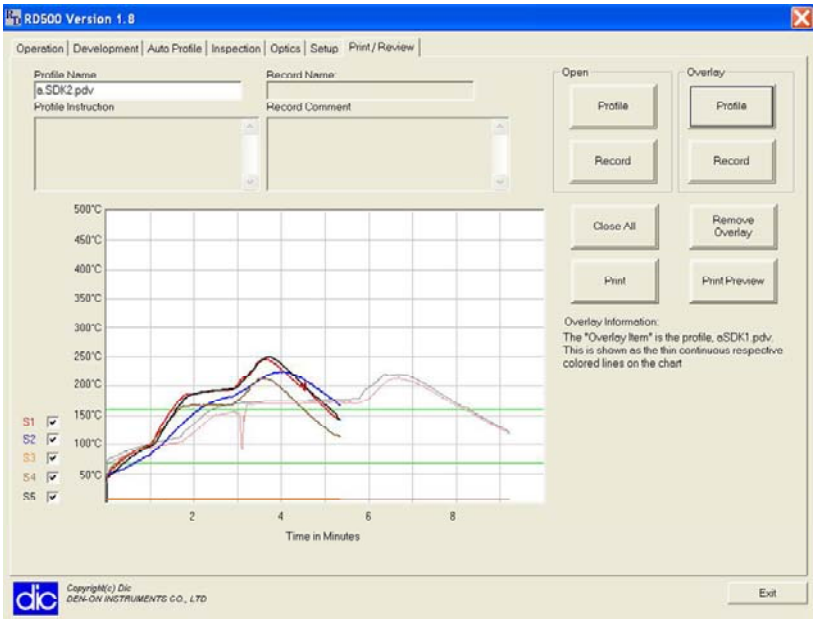

Figure 7: PRINT/REVIEW Tab

9. Conclusions

Version 1.8.x is a basically a response from the part of Denon Co. to its worldwide customers' comments about the software driver for the RD 500 rework machine. The new version is certainly a much better development than the previous versions both technically and aesthetically.
Customers currently using version 1.7 should be able to upgrade easily to version 1.8.x by initiating the installation file. The new version will overwrite the existing one keeping the current folders and files intact.
Denon Co. has spared no effort in ensuring the reliability of the new version 1.8.x. However, if customers have any reports of bugs or any other general comments about its software then they should forward them immediately to the software section at: soft@denondic.co.jp.