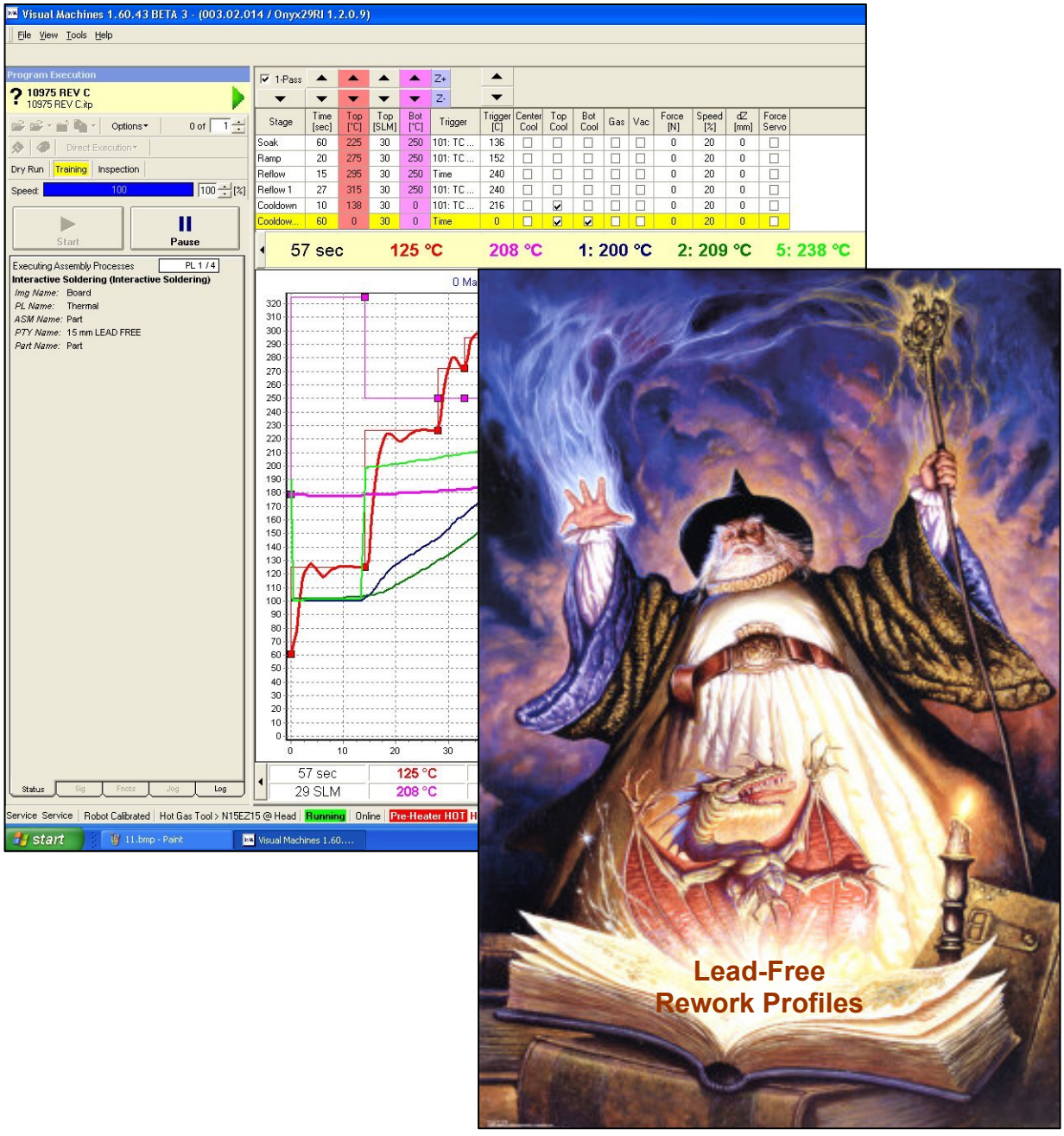
ONYX29

Program Development Wizard
Software Guide #0029.00.905

Revision 04.00



Program Development Wizard (PDW) for the ONYX29

1 Overview

The Program Development Wizard (PDW) is designed to provide ONYX29 users with the capability to quickly and easily develop and execute profiles for new devices and assemblies. Once the user responds to the structured questions in the Wizard, a complete rework process structure (ie. Thermal Profile, Removal, Site Cleaning and Replacement) is automatically created.

The user is then automatically directed to the execution mode where the complete (or partial) new process can be run. During the Thermal Profiling Process, “1-Pass” allows the user to make on-the-fly adjustments to the process parameters.

We hope that you find the Wizard to be an easy and effective way to develop new programs.

Sincerely,

Air-Vac Engineering

Contact:
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Director Marketing & Sales
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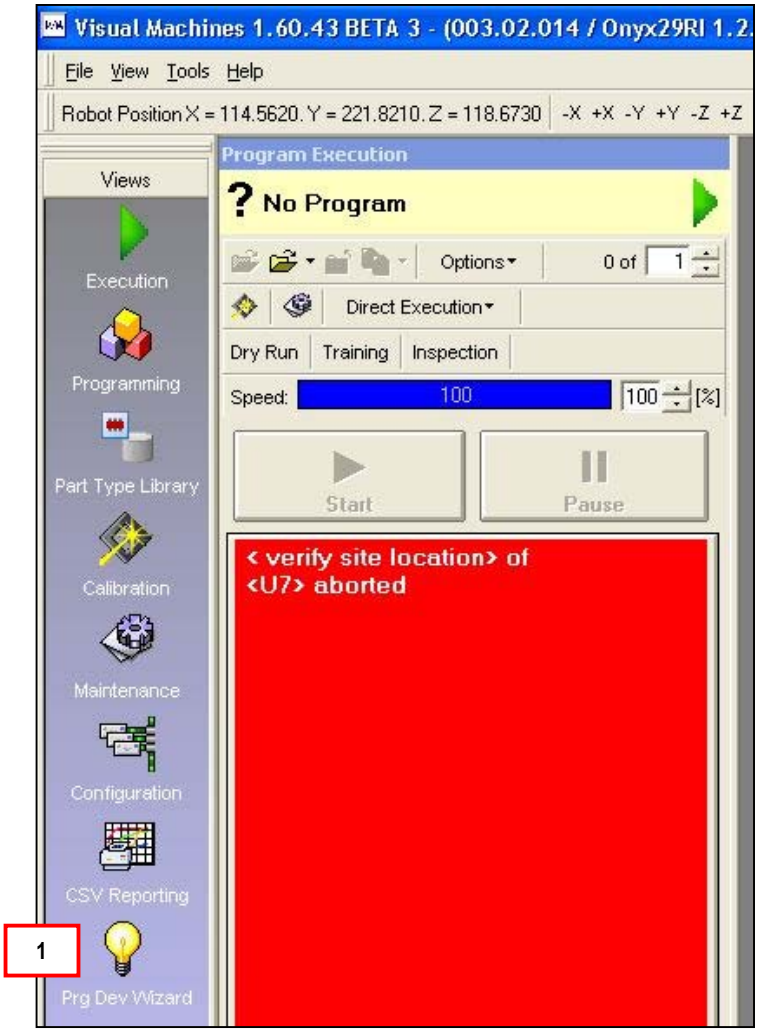
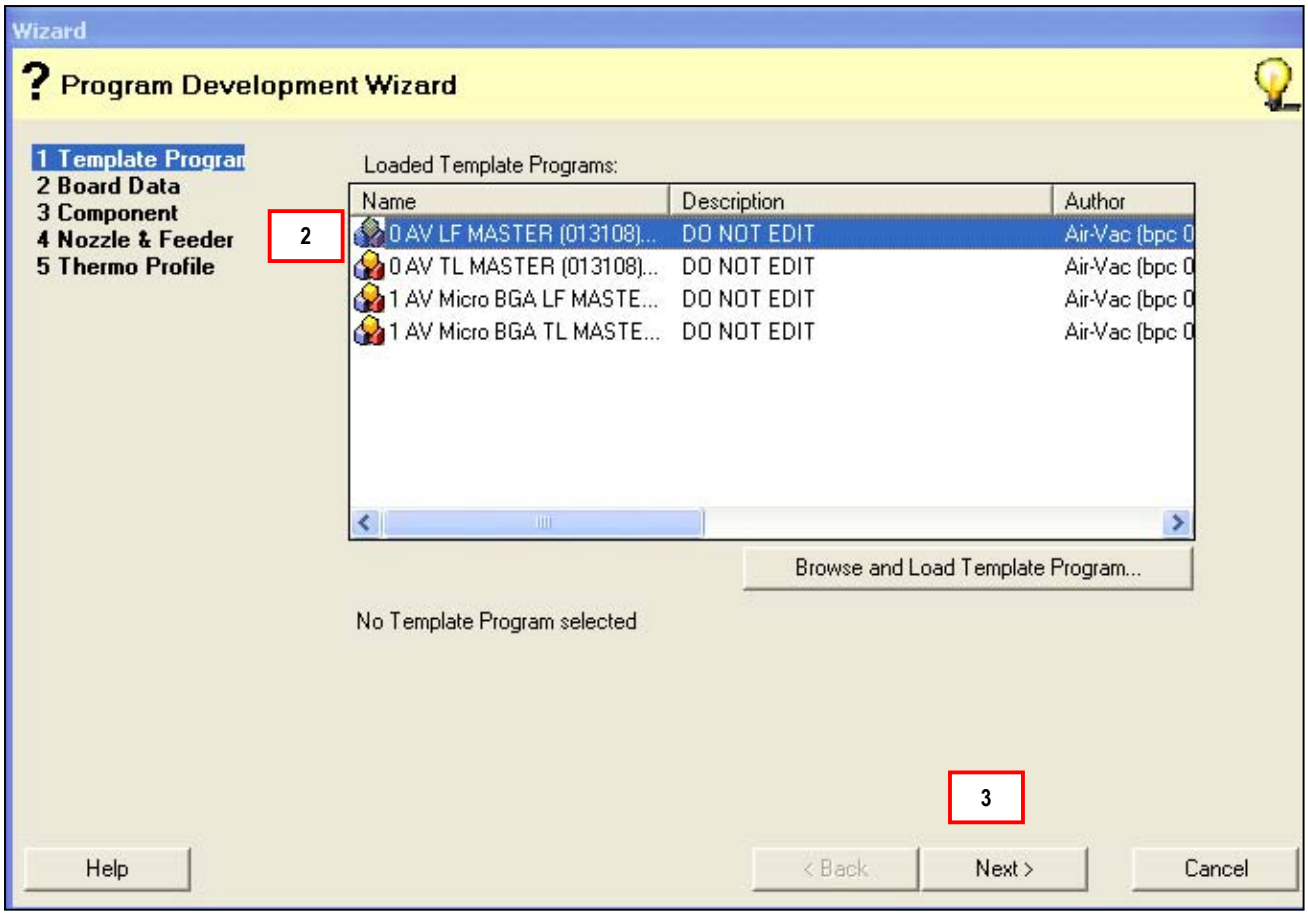
2 Program Development Wizard

1. Click on the PDW (Prog Dev Wizard) icon in the Views tab to enter the Wizard.



2. Select (highlight) the master template program that you want to use. In this case, we want to create a Lead-Free BGA process, so we will select the LF Master template.
3. Select Next.



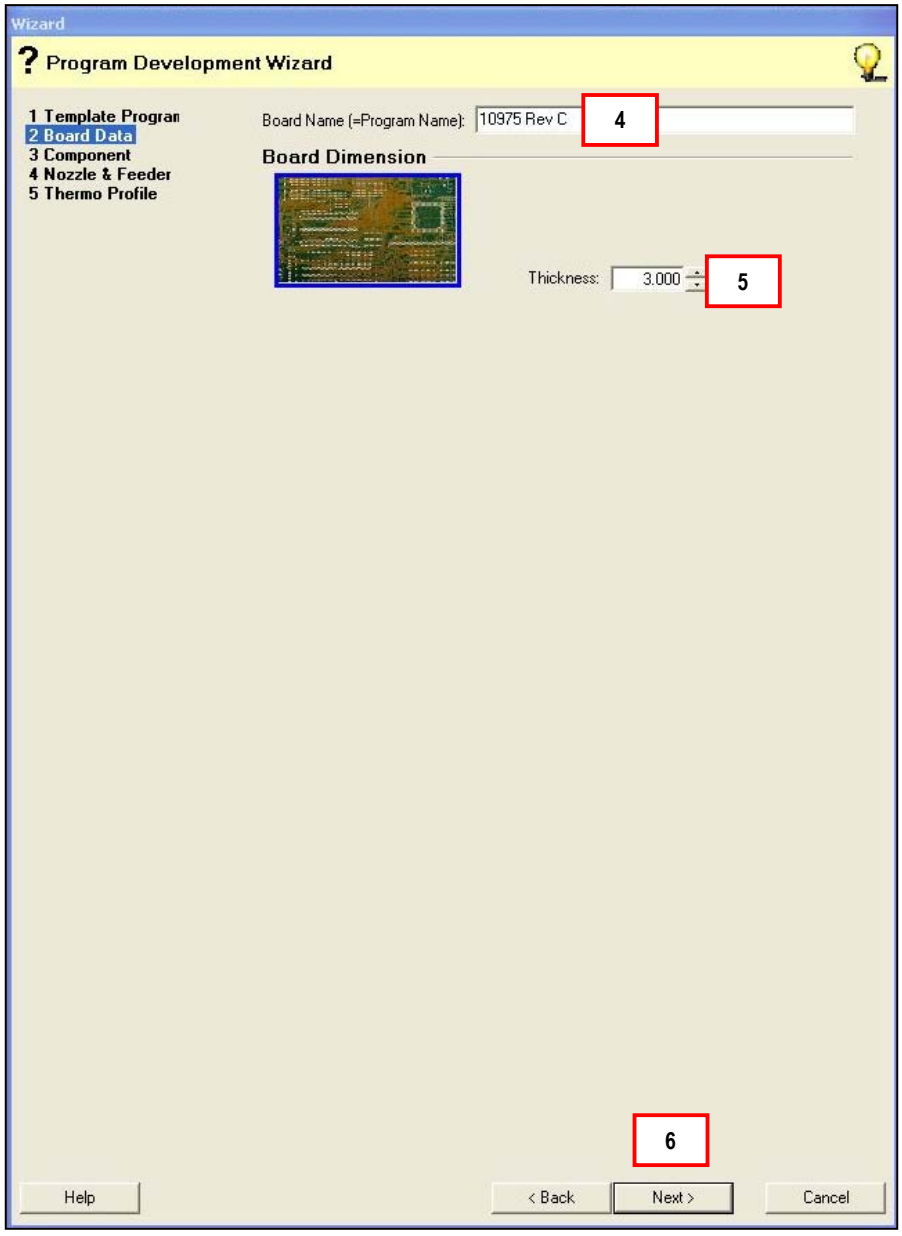
4. Type in the board name.
5. Measure the board thickness in millimeters. Use the up/down arrow to change the thickness from 3.0mm to the actual thickness of the new board.

USER NOTES: IMPORTANT INFORMATION

- Board thickness is one of the three parameters used to determine “near-board” position.

6. Select Next.

- The “Next” box will not become active until all required data is entered.

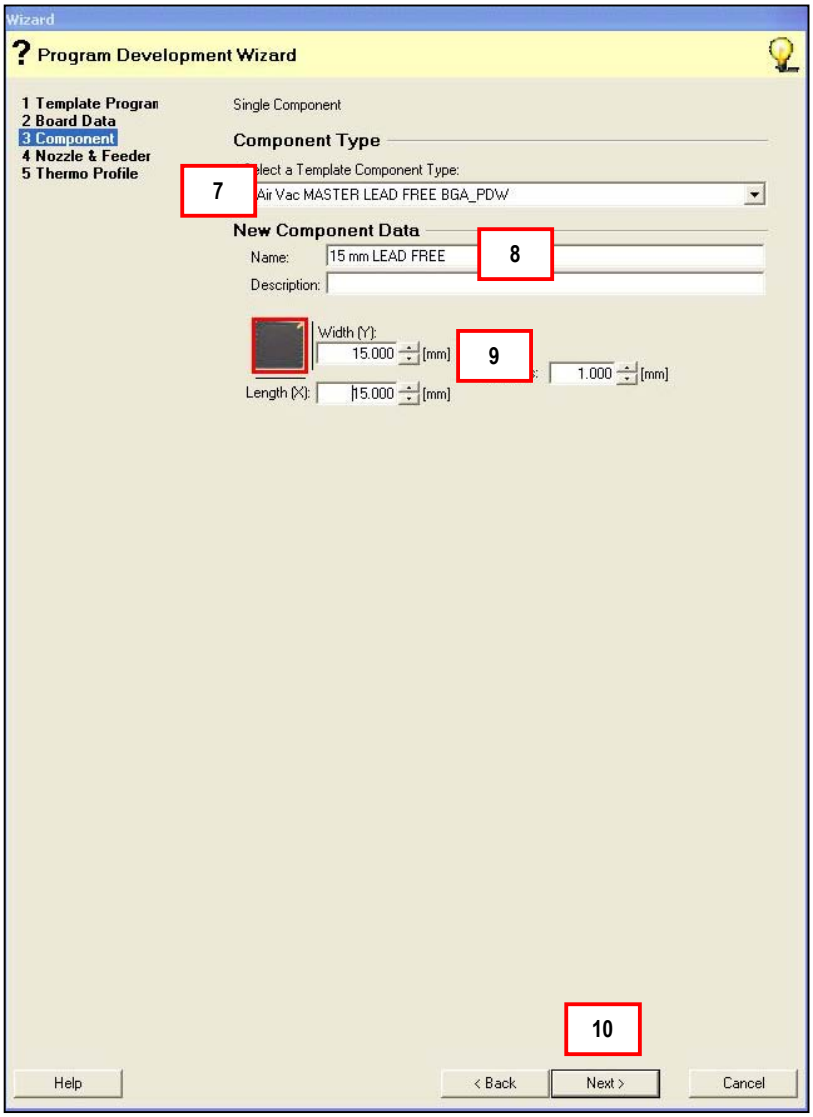


7. Use the pull down list to select the master component type. In this case, we want to create a Lead-Free BGA process, so we will select the master Lead-Free component type.
8. Name the new component type. Typically the component size and solder type is used. In this example, the new component name is 15mm Lead-Free. The description field is optional.
9. Measure and enter the component dimensions in mm, in this example 15mm.

USER NOTES: IMPORTANT INFORMATION

- The component length and width is used for both component alignment (corner viewing) and automatic site cleaning.
- The component thickness is one of the three parameters used to determine “near-board” position.
- The “Next” block will not be active until all required data is entered.

10. Select Next.

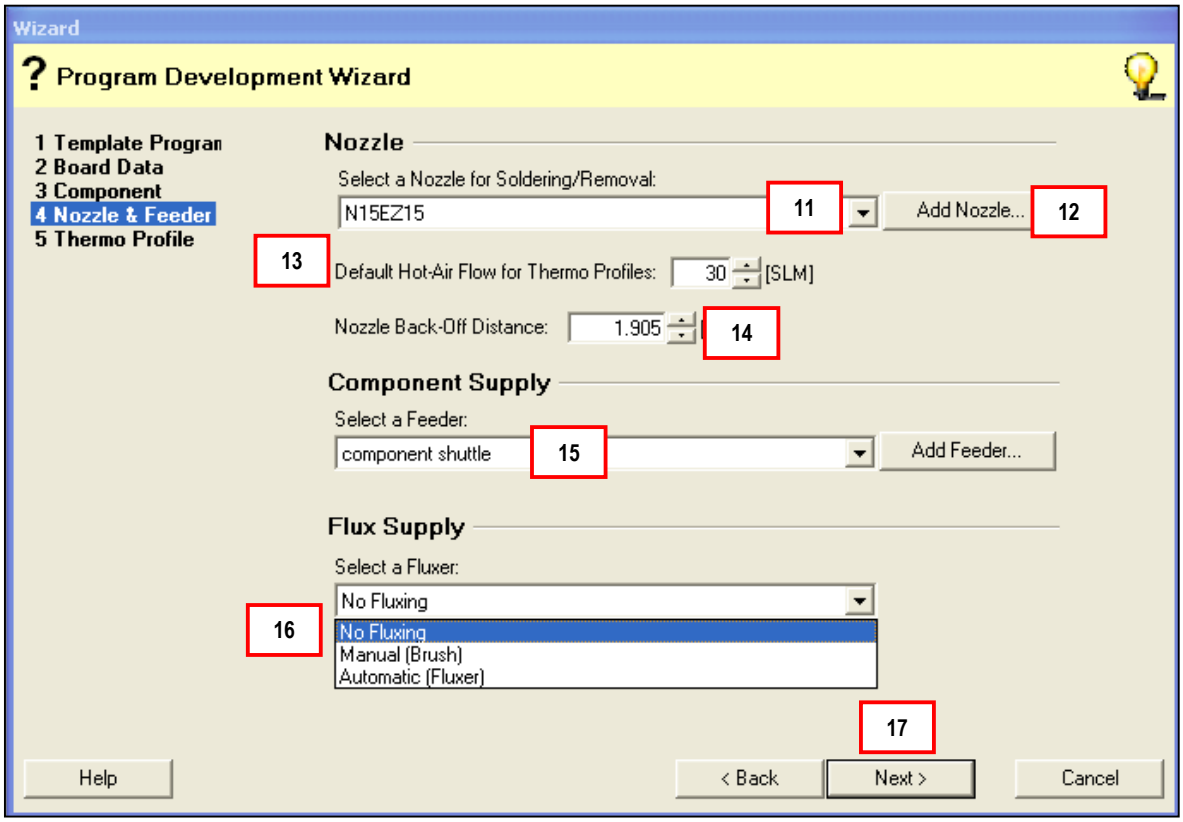


11. Use the pull down list to select the nozzle. Typically the nozzle matches the component X/Y dimensions (ie. N15EZ15 is used for a 15mm component).
12. If the nozzle you need is not on the pull down list, a new nozzle can be added (see PDW advanced features).
13. The default hot air flow will be set automatically based on the nozzle selected.
14. The default nozzle back-off distance is 1.5mm.
15. The component shuttle should be used as the component feeder (see the PDW advanced features if you want to create a custom feeder).
16. Flux supply is typically manual with a brush or flux pen. Use the pull down arrow to select “Automatic” if you have a custom flux pedestal for the device or “No Fluxing” if you will use solder paste.

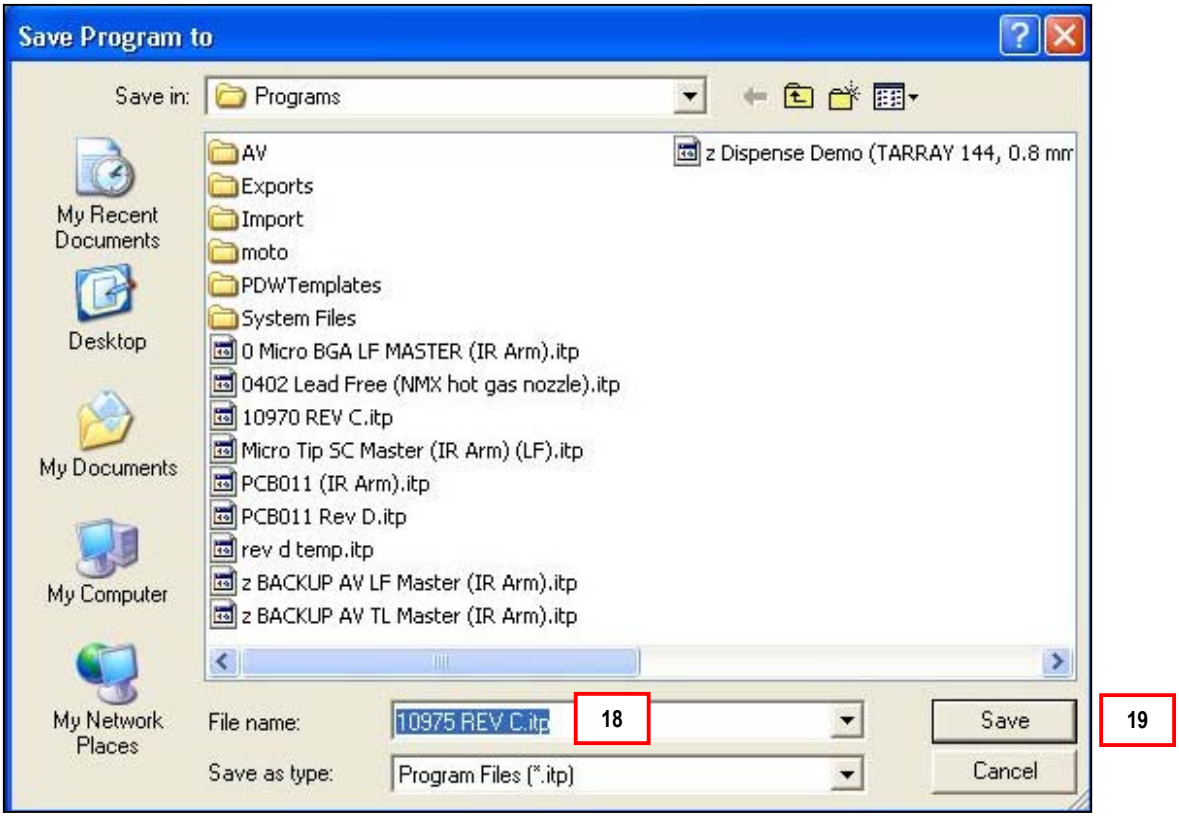
USER NOTES:

- Selecting the correct nozzle is important for proper reflow of the device. Also, each nozzle has a specific length, which is one of the three parameters used to determine “near board” position.
- The nozzle must not be in contact with the BGA/CSP during reflow. A sufficient nozzle back off distance is required to allow for growth of the nozzle, component and board during reflow. The default back off distance is 1.905mm (0.075”).

17. Select Next.

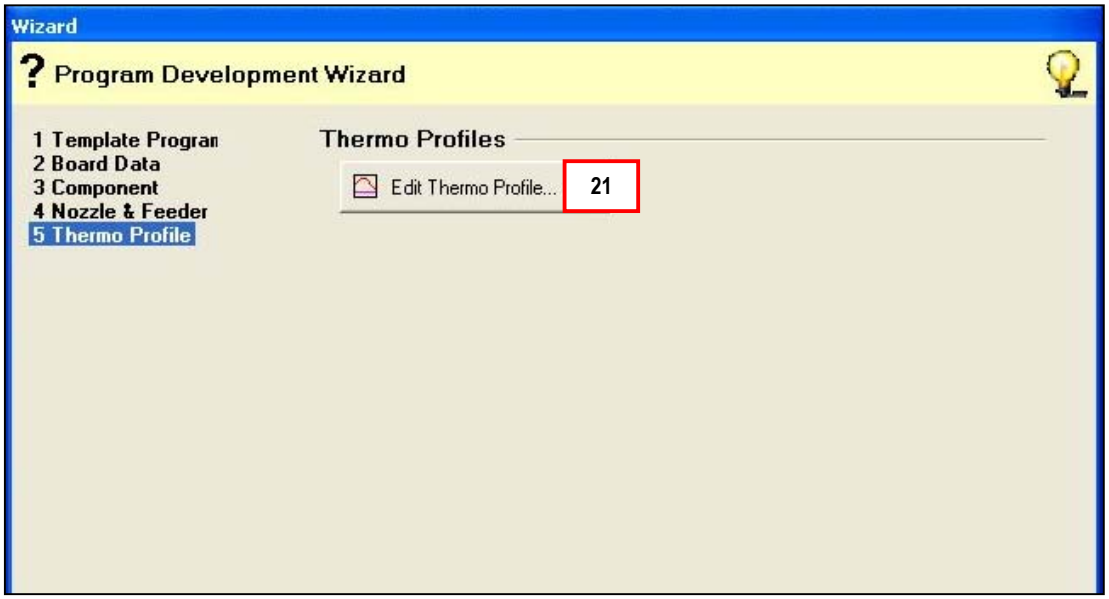


18. The Wizard is ready to automatically save the new program based on the user provided board name. The default save folder is “Programs”, or you can create a new folder.
19. Select Save.



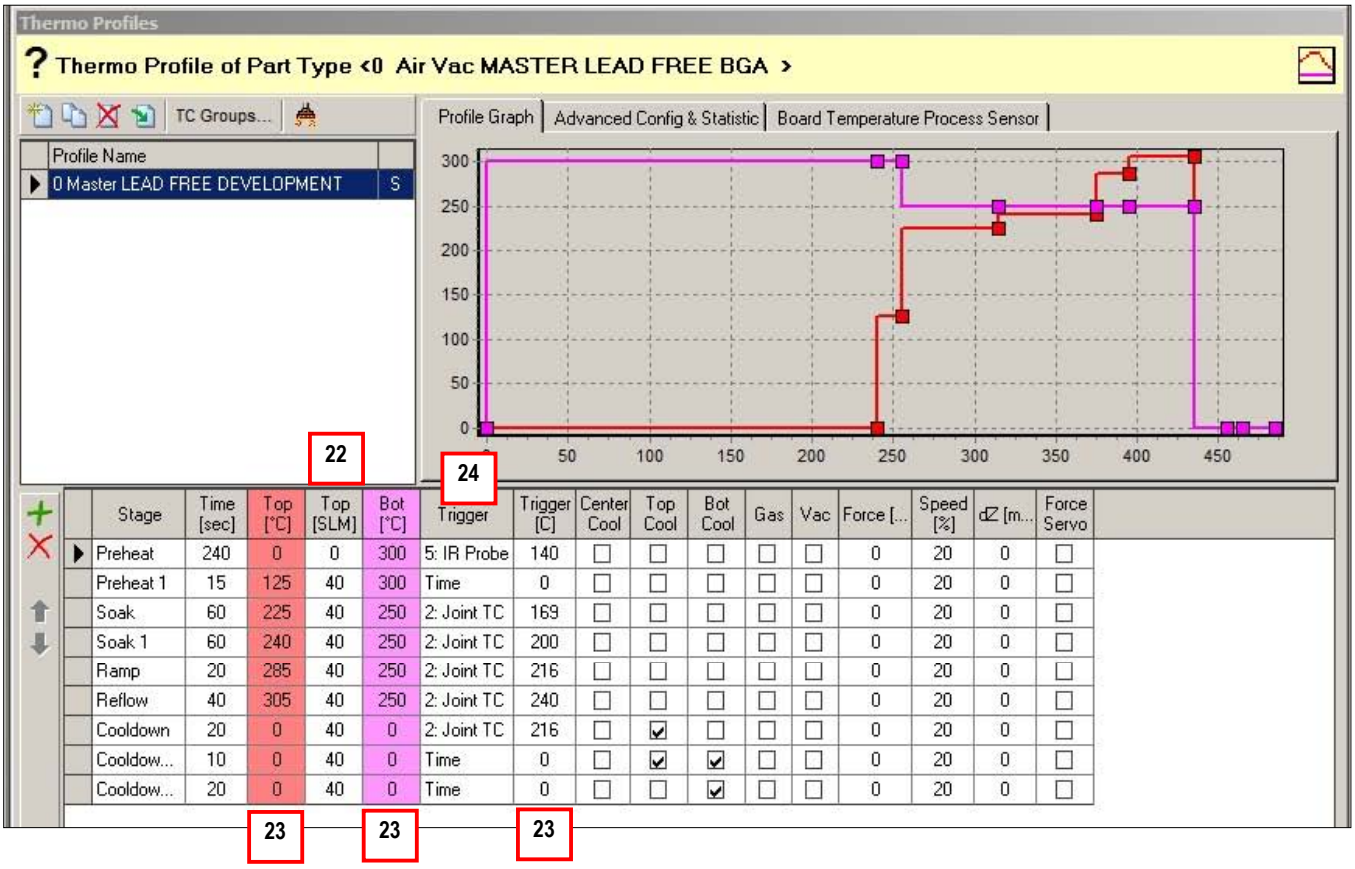
20. The Wizard automatically creates the new component type. **PLEASE WAIT!**

21. Click on the “Edit Thermal Profile” bar. The master thermal profile will be displayed, in this case it is the Master Lead-Free Development profile.



USER NOTES:

22. The top heater flow rate (SLM) has been automatically adjusted based on the nozzle you selected.
23. The top and bottom heater temperatures and the stage trigger temperatures were developed based on Air-Vac's profiling experience and have proven to work "as-is" for 90% of new applications. **Parameter changes should only be made based on process knowledge or application-specific information.**
24. Thermocouple channel #2 is used to trigger all stages except preheat based on solder joint temperature (see advanced features for use of multiple TC's to control the process).
25. Select OK.



Stage	Time [sec]	Top [°C]	Top [SLM]	Bot [°C]	Trigger	Trigger [C]	Center Cool	Top Cool	Bot Cool	Gas	Vac	Force [...	Speed [%]	dZ [m...	Force Servo
Preheat	240	0	0	300	5: IR Probe	140	☐	☐	☐	☐	☐	0	20	0	☐
Preheat 1	15	125	40	300	Time	0	☐	☐	☐	☐	☐	0	20	0	☐
Soak	60	225	40	250	2: Joint TC	169	☐	☐	☐	☐	☐	0	20	0	☐
Soak 1	60	240	40	250	2: Joint TC	200	☐	☐	☐	☐	☐	0	20	0	☐
Ramp	20	285	40	250	2: Joint TC	216	☐	☐	☐	☐	☐	0	20	0	☐
Reflow	40	305	40	250	2: Joint TC	240	☐	☐	☐	☐	☐	0	20	0	☐
Cooldown	20	0	40	0	2: Joint TC	216	☐	☑	☐	☐	☐	0	20	0	☐
Cooldow...	10	0	40	0	Time	0	☐	☑	☑	☐	☐	0	20	0	☐
Cooldow...	20	0	40	0	Time	0	☐	☐	☑	☐	☐	0	20	0	☐

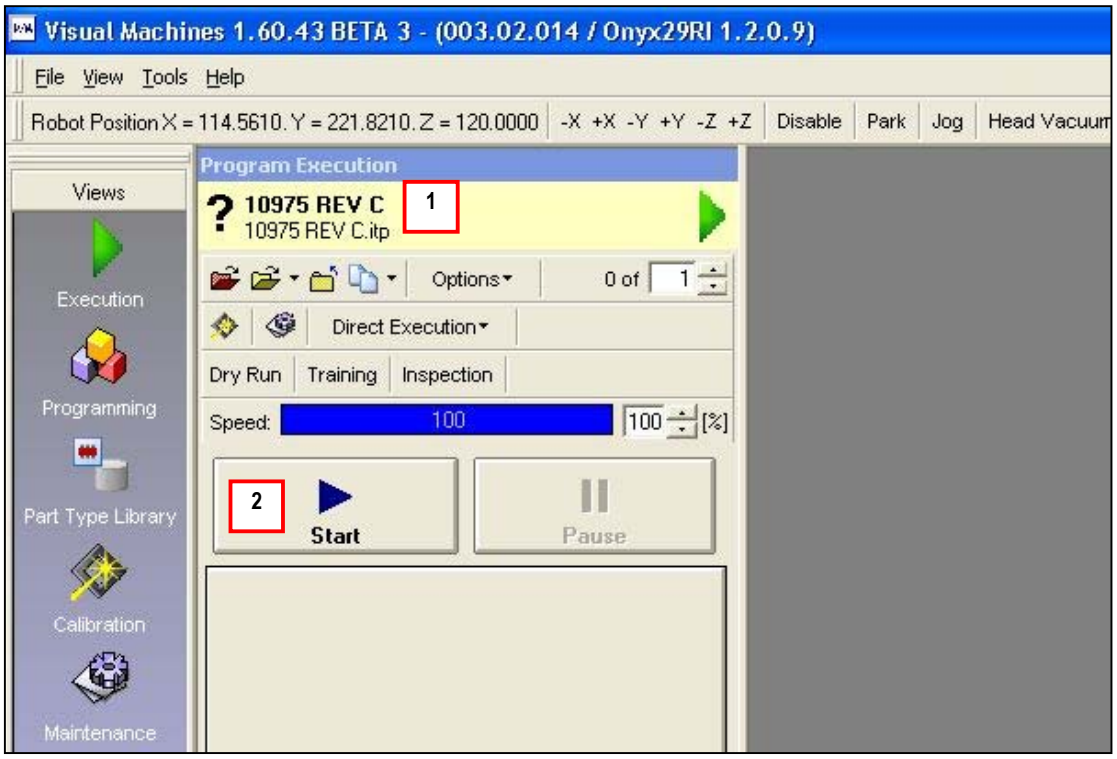
26. Select Next.

CONGRATULATIONS!
You have developed a complete Rework Process for your new device/board. The Wizard will now escort you directly to the execution screen.

3 Thermal Profiling

1. The Wizard automatically escorts you to the program execution mode where the newly created program is automatically loaded and ready to run.

2. Select Start.



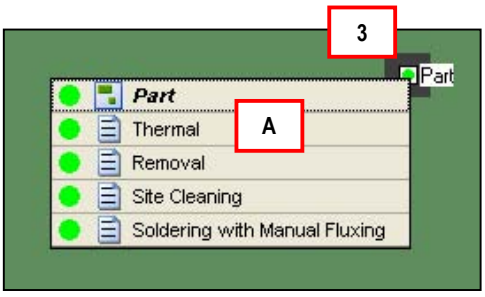
3. Right click on the small part green or red dot. The Process List created by the Wizard is displayed. A green dot indicates the Process will be executed, a red dot means it is not selected.

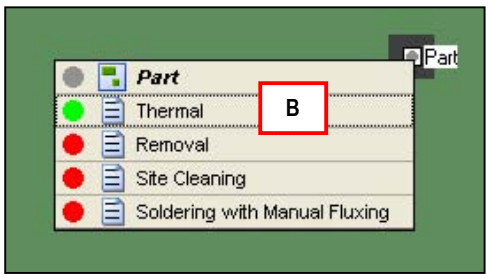
USER NOTES:

- The graphical image of the new Program you created in the Wizard includes the following processes:

    - Thermal
    - Removal
    - Site Cleaning
    - Soldering

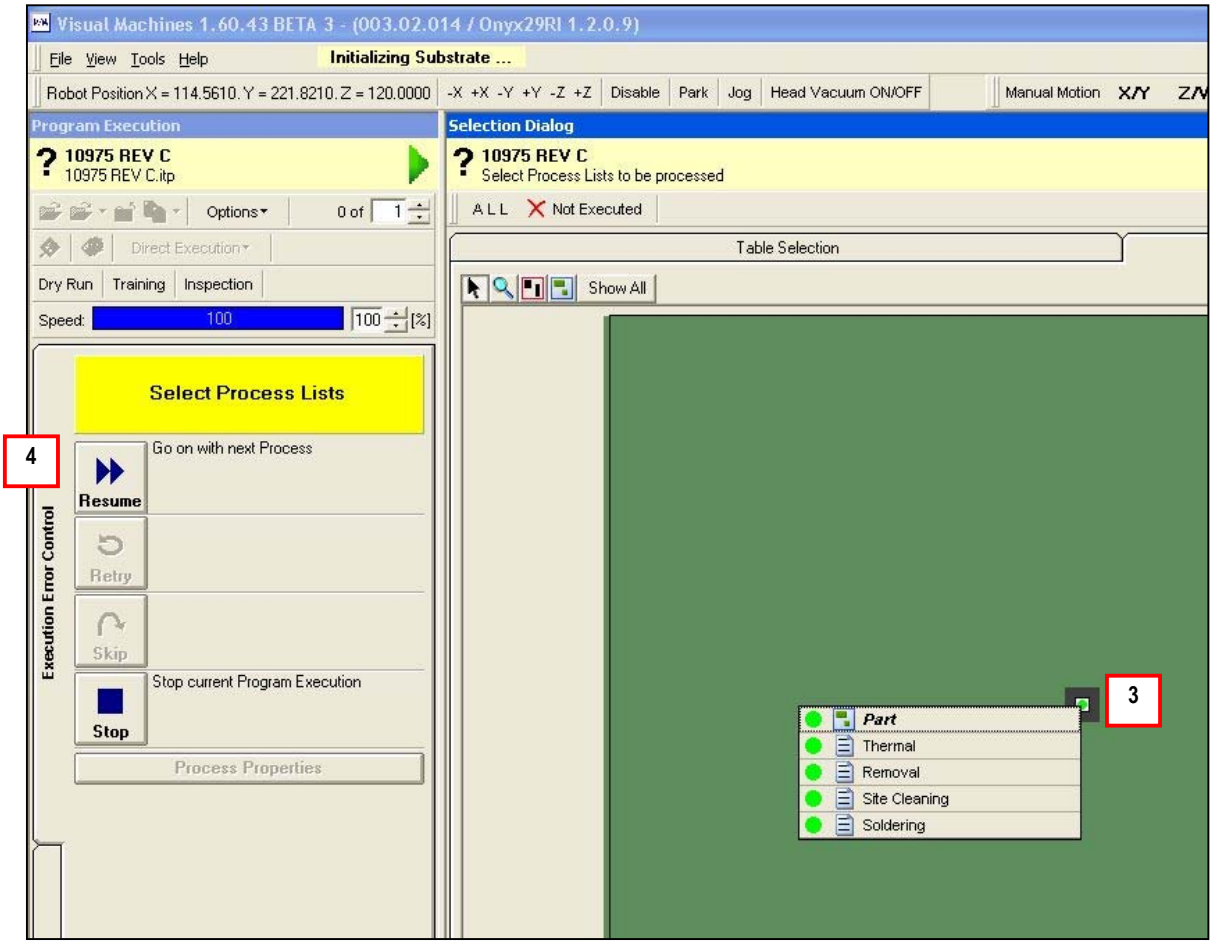
    - **A** - If you activate all processes (all buttons green), all four processes will be run in sequence. However,
    - **B** - If you have created an instrumented test board for process development only, and you want to only develop the Thermal Profile at this time, activate the thermal process (green button) only (other processes have red buttons).



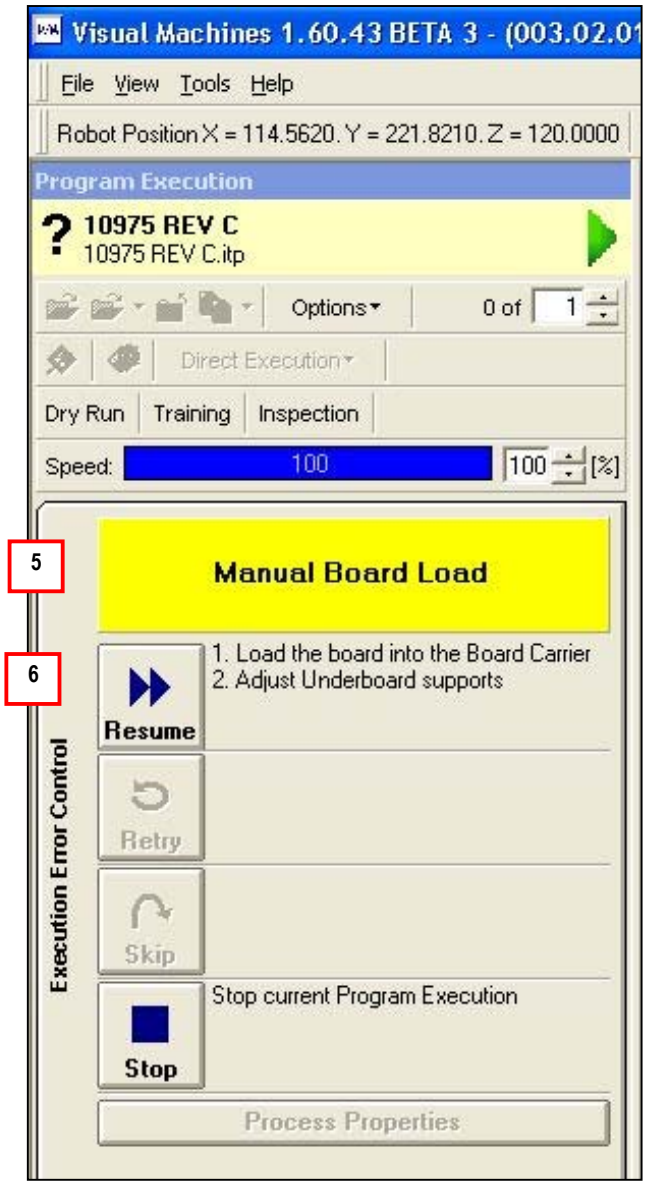


- The footswitch can be depressed to resume the process instead of clicking on Resume with the mouse.

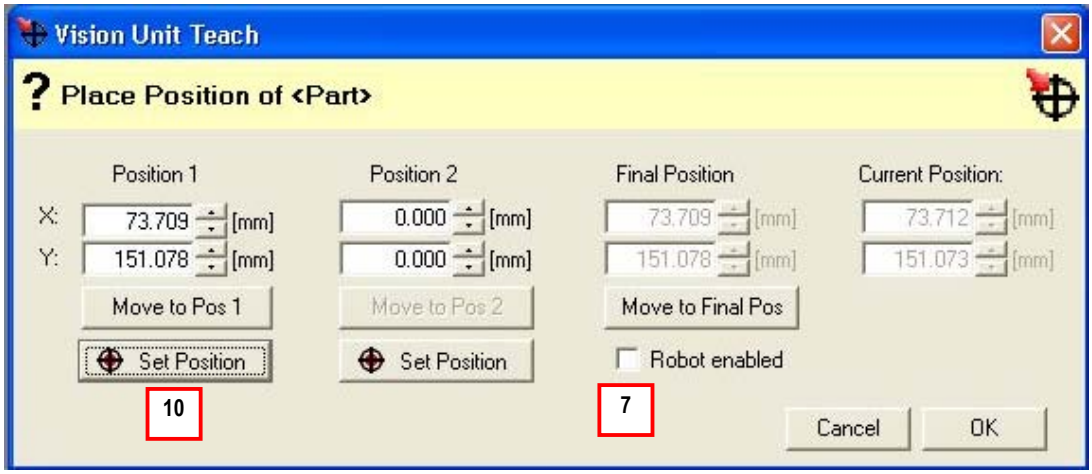
4. Select Resume.

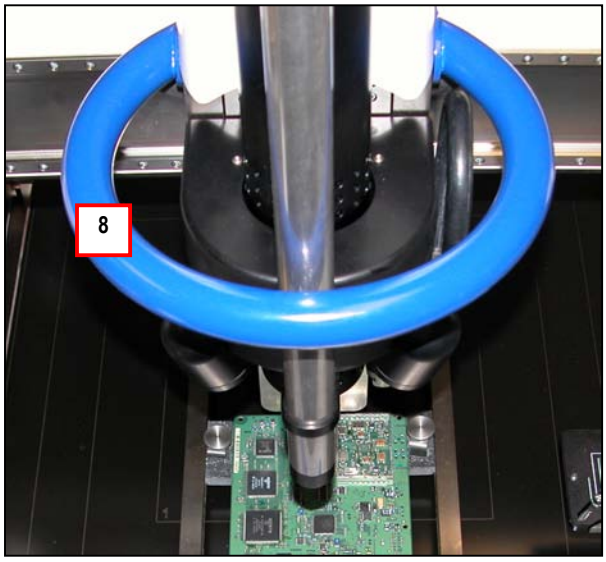


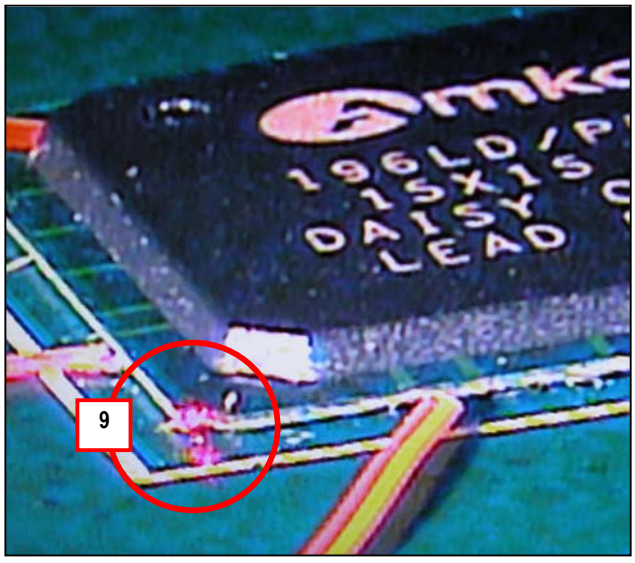
5. Install the board into the machine and position the supports.
6. Select Resume.



7. Un-check the “Robot Enabled” box to de-power the head.
8. Use the blue machine handle to move the head.
9. Position the laser pointer on one corner of the device.
10. Click the “Set Position” box under **Position 1.**



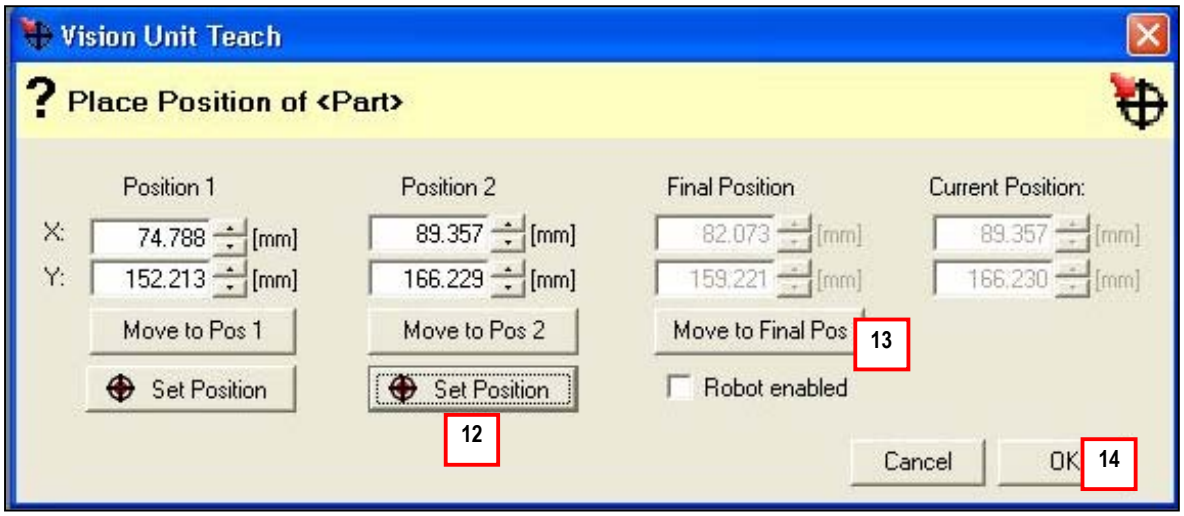


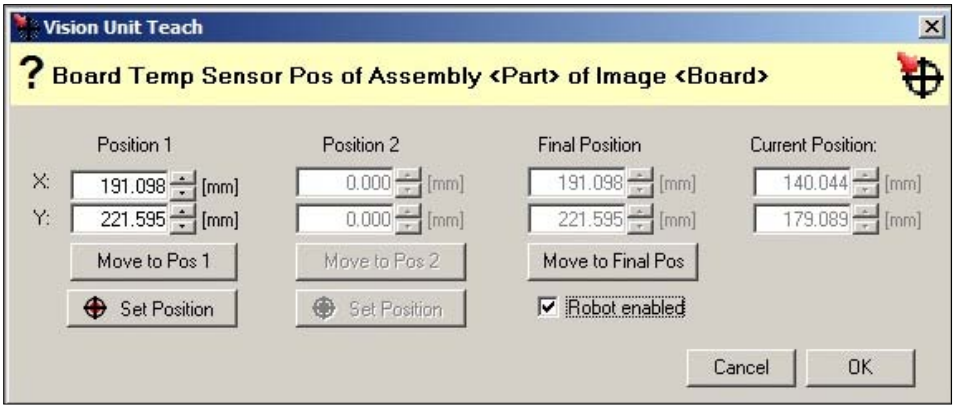


11. Position the laser pointer on the ***opposite corner*** of the device.
12. Click on the “Set Position” box under **Position 2.**
13. Click on “Move to Final Pos”. The laser pointer will move to the center of the part.

USER NOTE:
If the Laser Pointer is not centered over the device, depower the robot and repeat the opposite corner Teaching Process.

14. Select OK.





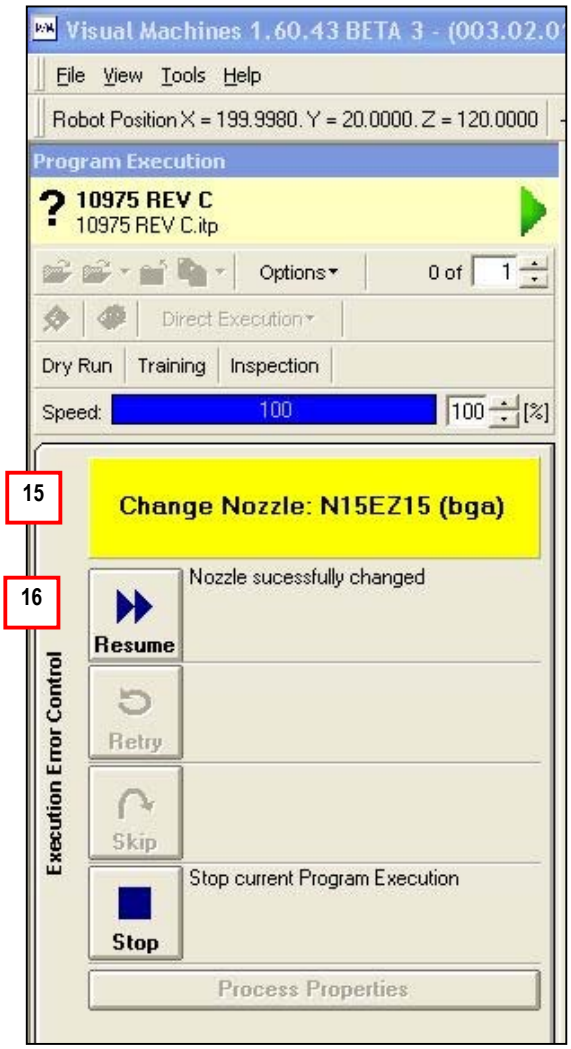
15. Change the nozzle if prompted to do so.

CAUTION:

Nozzle may be hot. Use nozzle handling tool to change nozzle.

USER NOTE:

- The nozzle required for the process was user-defined during the PDW (Wizard).



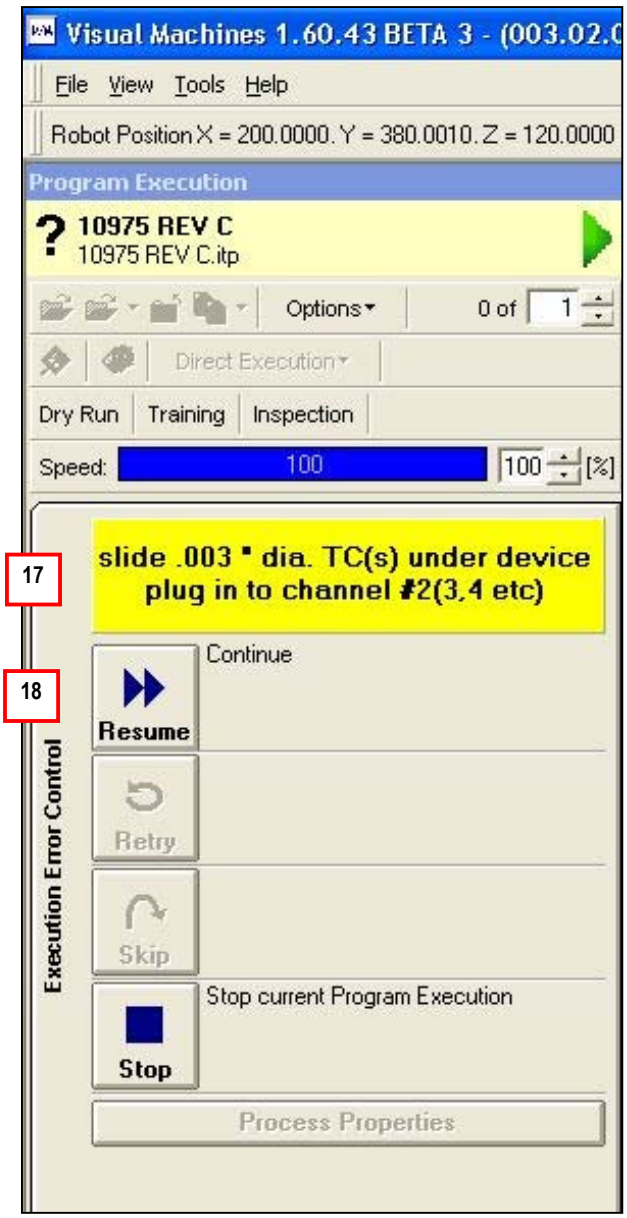
16. Select Resume

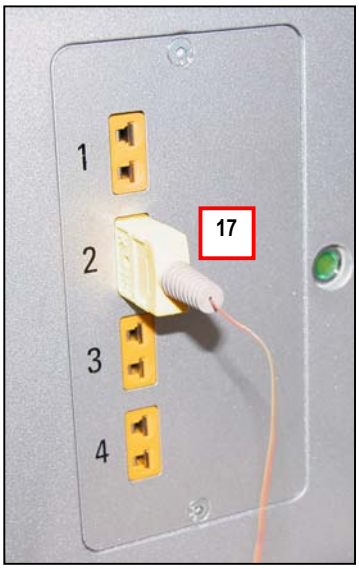
17. Install a thermocouple under the BGA and plug into T/C **Channel #2.**

USER NOTES:

- Keep the T/C wire off the black bottom heater to prevent the T/C wire from melting.
- See PDW advanced features if you want to use multiple T/C's to measure joint temperature.
- Air-Vac uses ultra-fine gauge (.003" dia.) thermocouples from Omega Engineering (1-888-TC-OMEGA, part #5 SRTC-TT-IC-40-36; pkg of 5).

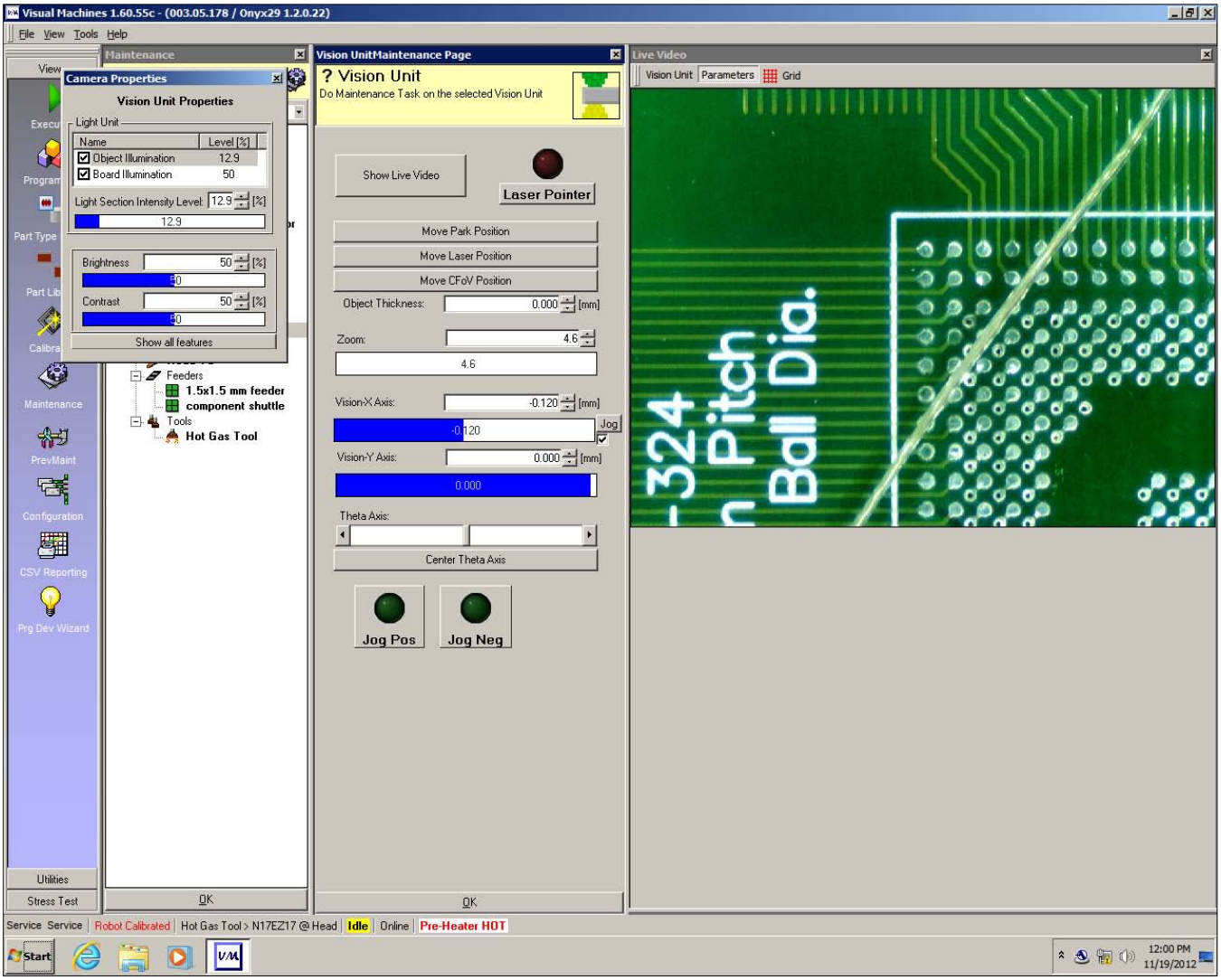
18. Select Resume.





19. The vision cube will come out to allow fine positioning of the nozzle over component.

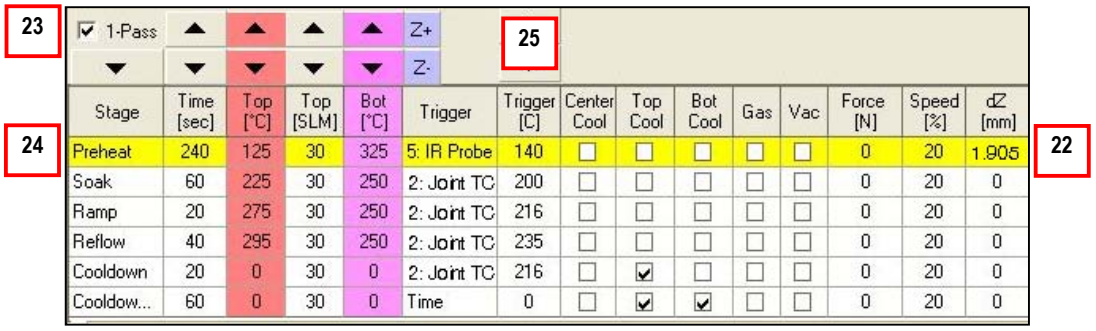
20. Click Resume.



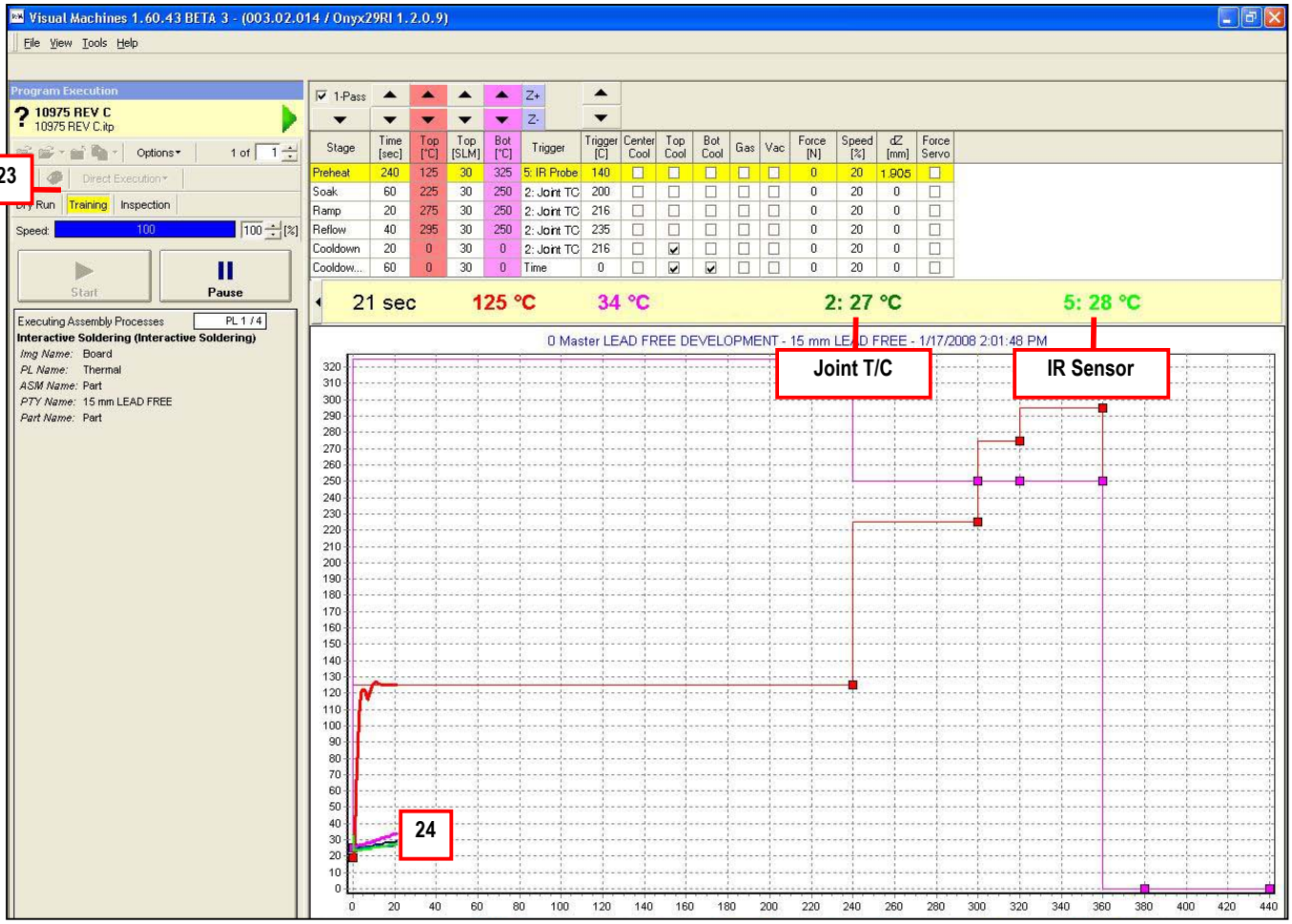
21. Nozzle will force touch on board. Head moves to park position. Stabilization event.

- After stabilization, nozzle will go back to site and touch component. Nozzle then retracts and head moves to IR sensor position.
- The Interactive Soldering Profile is displayed.

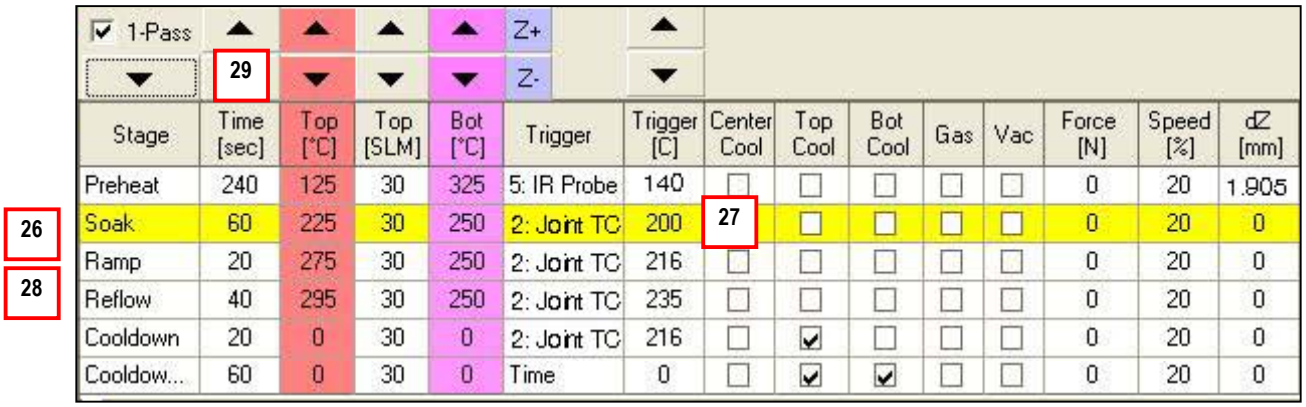
22. After board reaches target temp, nozzle moves back to the programmed height (1.905mm).
23. **IMPORTANT: Click on the "Training" box. It will be highlighted in yellow and the "1-Pass" function will activate.**
24. The Preheat stage will begin automatically. Heaters will turn on and T/C temperatures will be graphically and digitally displayed.
25. The Preheat stage will continue until the trigger temperature is reached (140C, T/C#5: IR Probe).



Stage	Time [sec]	Top [°C]	Top [SLM]	Bot [°C]	Trigger	Trigger [C]	Center Cool	Top Cool	Bot Cool	Gas	Vac	Force [N]	Speed [%]	dZ [mm]
Preheat	240	125	30	325	5: IR Probe	140	☐	☐	☐	☐	☐	0	20	1.905
Soak	60	225	30	250	2: Joint TC	200	☐	☐	☐	☐	☐	0	20	0
Ramp	20	275	30	250	2: Joint TC	216	☐	☐	☐	☐	☐	0	20	0
Reflow	40	295	30	250	2: Joint TC	235	☐	☐	☐	☐	☐	0	20	0
Cooldown	20	0	30	0	2: Joint TC	216	☐	☑	☐	☐	☐	0	20	0
Cooldow...	60	0	30	0	Time	0	☐	☑	☑	☐	☐	0	20	0



26. The Soak stage begins once the Preheat trigger is reached.
27. The Soak stage will continue until the trigger temperature is reached (200C, T/C#2 – Joint).
28. The Ramp and Reflow stages follow automatically as shown.
29. The actual time spent in each stage (except Preheat) is automatically recorded for production-based replay without joint T/C's.

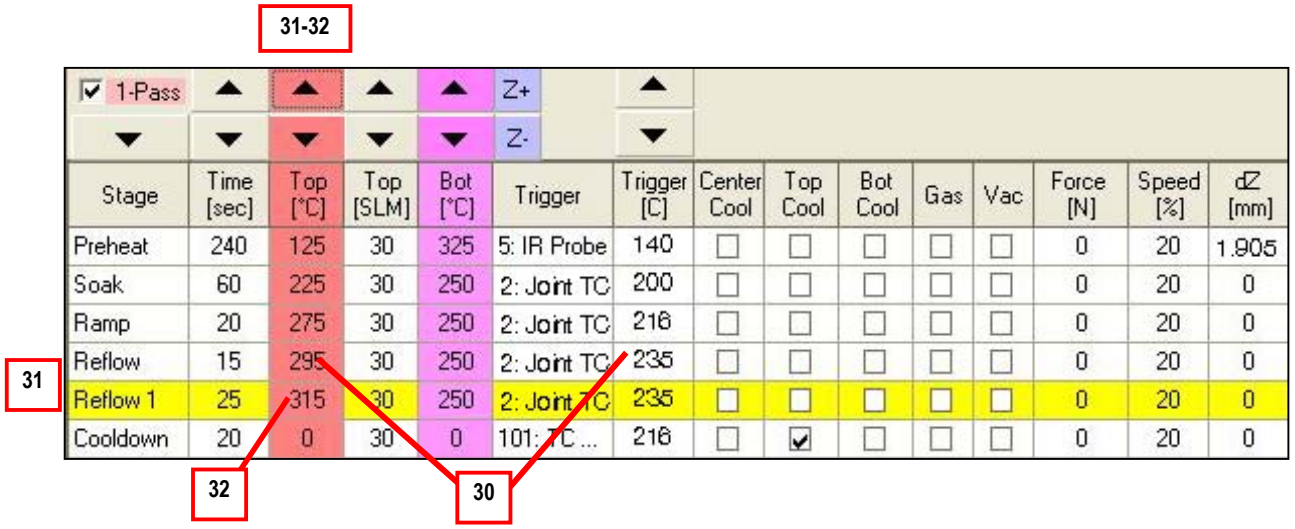


Stage	Time [sec]	Top [°C]	Top [SLM]	Bot [°C]	Trigger	Trigger [C]	Center Cool	Top Cool	Bot Cool	Gas	Vac	Force [N]	Speed [%]	dZ [mm]
Preheat	240	125	30	325	5: IR Probe	140	☐	☐	☐	☐	☐	0	20	1.905
Soak	60	225	30	250	2: Joint TC	200	☐	☐	☐	☐	☐	0	20	0
Ramp	20	275	30	250	2: Joint TC	216	☐	☐	☐	☐	☐	0	20	0
Reflow	40	295	30	250	2: Joint TC	235	☐	☐	☐	☐	☐	0	20	0
Cooldown	20	0	30	0	2: Joint TC	216	☐	☑	☐	☐	☐	0	20	0
Cooldow...	60	0	30	0	Time	0	☐	☑	☑	☐	☐	0	20	0

30. During the Reflow Stage, we determined that the top heater temperature (295) needed to be increased to achieve the 235 Joint Trigger target in a reasonable time.
31. One mouse click on the Top Heater "Up" arrow creates a new stage called "Reflow 1".
32. Four addditional mouse clicks on the Top Heater "Up" arrow increases the heater temp by 20 degrees, to 315 (each click increases by 5 degrees).

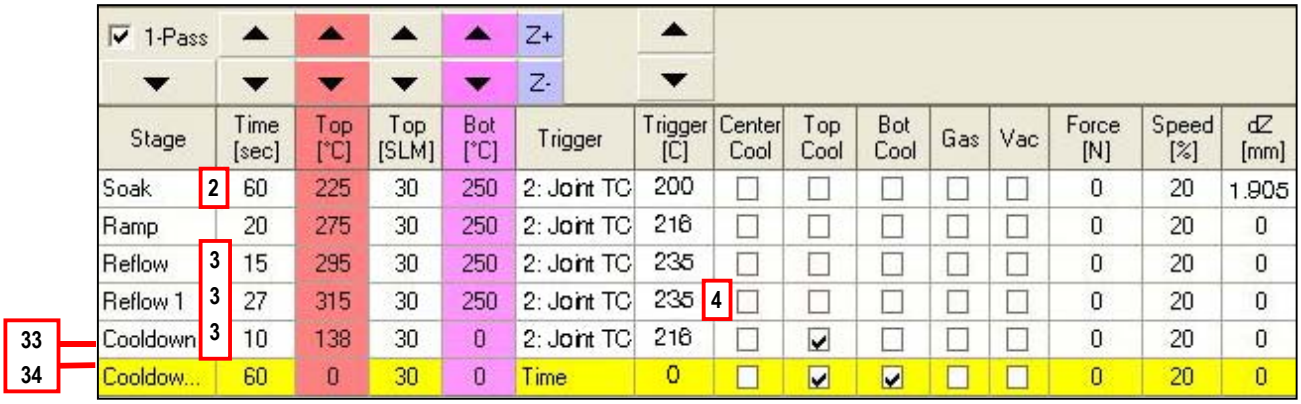
USER NOTE:

- See PDW advanced features for more information on 1-Pass.



Stage	Time [sec]	Top [°C]	Top [SLM]	Bot [°C]	Trigger	Trigger [C]	Center Cool	Top Cool	Bot Cool	Gas	Vac	Force [N]	Speed [%]	dZ [mm]
Preheat	240	125	30	325	5: IR Probe	140	☐	☐	☐	☐	☐	0	20	1.905
Soak	60	225	30	250	2: Joint TC	200	☐	☐	☐	☐	☐	0	20	0
Ramp	20	275	30	250	2: Joint TC	216	☐	☐	☐	☐	☐	0	20	0
Reflow	15	295	30	250	2: Joint TC	235	☐	☐	☐	☐	☐	0	20	0
Reflow 1	25	315	30	250	2: Joint TC	235	☐	☐	☐	☐	☐	0	20	0
Cooldown	20	0	30	0	101: TC ...	216	☐	☑	☐	☐	☐	0	20	0

33. The first Cooldown stage records the time from joint max temperature down to 216. Cooling air is injected into the nozzle during this event.
34. The second Cooldown stage cools the board and nozzle down.



1-Pass | Z+ | Z-

	Stage	Time [sec]	Top [°C]	Top [SLM]	Bot [°C]	Trigger	Trigger [C]	Center Cool	Top Cool	Bot Cool	Gas	Vac	Force [N]	Speed [%]	dZ [mm]
	Soak	60	225	30	250	2: Joint TC	200	☐	☐	☐	☐	☐	0	20	1.905
	Ramp	20	275	30	250	2: Joint TC	216	☐	☐	☐	☐	☐	0	20	0
	Reflow	15	295	30	250	2: Joint TC	235	☐	☐	☐	☐	☐	0	20	0
	Reflow 1	27	315	30	250	2: Joint TC	235	☐	☐	☐	☐	☐	0	20	0
33	Cooldown	10	138	30	0	2: Joint TC	216	☐	☑	☐	☐	☐	0	20	0
34	Cooldow...	60	0	30	0	Time	0	☐	☑	☑	☐	☐	0	20	0

2 3 3 3 4

The following is a brief description of each stage (Event):

- **PREHEAT:** Preheats the entire board to minimize the thermal differential between the reflow site and the rest of the board. Preheat minimizes board warpage and reduces the amount of component heating required to achieve reflow.
- **SOAK:** Presoak is the period between preheat and soak.
- **SOAK1:** Flux is activated during the soak1 stage. Typically, significant voiding will occur without proper soak.
- **RAMP:** Quickly takes the solder joints from the end of soak to the beginning of reflow.
- **REFLOW 1:** Time over liquidus until the heaters are shut off.
- **REFLOW 2:** Time until the joints fall back below liquidus.
- **COOL EVENTS:** Turns off the heaters and cools board and component.

The following are typical time/temperature targets for each stage (Event):

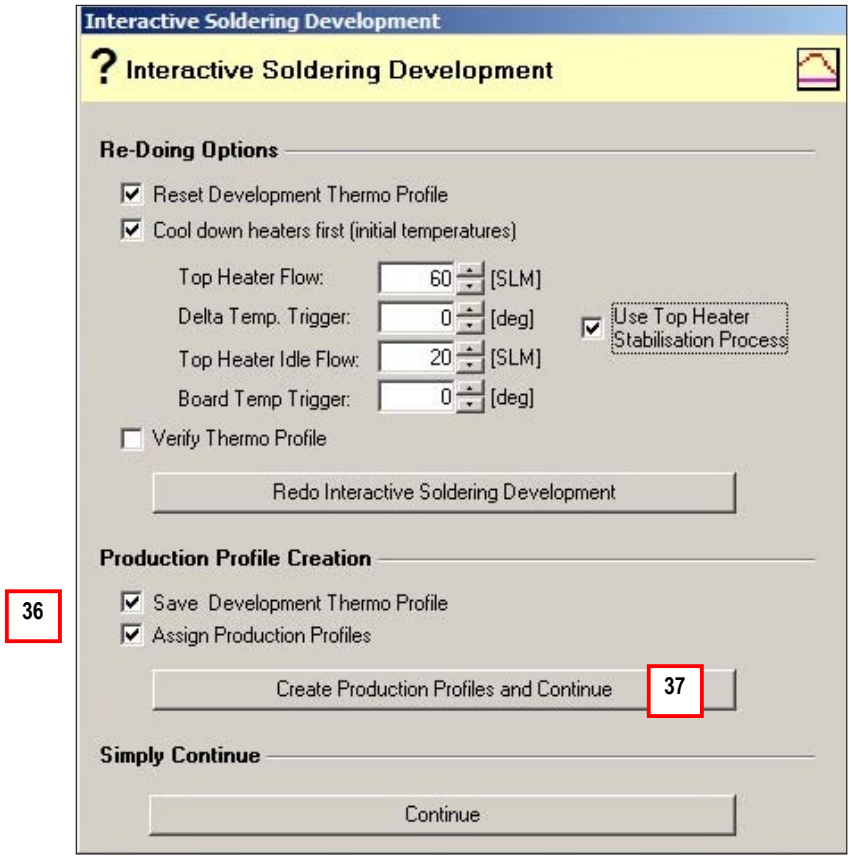
	Tin/Lead	Lead-Free
PREHEAT		
- Topside Board Temp (°C)	90-120 avg=100	130-150 avg=140
SOAK		
- Temp (°C)	101-139	141-169
- Time (seconds)	20-40	20-40
SOAK1 (joint)		
- Temp (°C)	140-165	170-200
- Time (seconds)	35-50	40-60
RAMP (joint)		
- Temp (°C)	165-182	201-216
- Time (seconds)	15-30	20-35
REFLOW 1 (joint)		
- Temp (°C)	183-210	217-240
- Time (seconds)	30-50	35-55
REFLOW 2 (joint)		
- Temp (°C)	210-183	240-217
- Time (seconds)	10-25	5-20
COOL 1,2,3	Heaters Off, cooling board and component	
Typical solder liquidus temp (°C)	183	217
Typical max joint temp (°C)	210	240
Typical max package temp (°C)	230	260

NOTE: Total Reflow time is the sum of the Reflow 1 and Reflow 2 times. Ideally this should total 60 to 70 seconds, but between 45 and 80 seconds is acceptable in most cases.

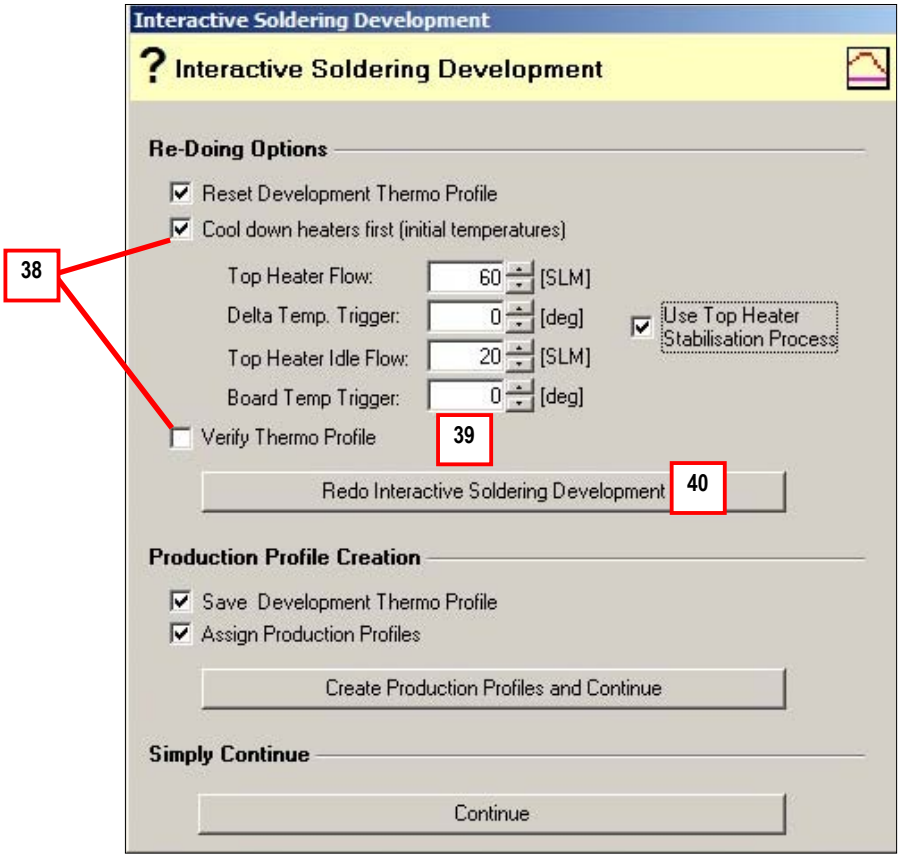
35. The Interactive Soldering Development screen will appear. You have three (3) options:

- Save the thermal profile and create production profiles
- Cooldown and Re-run
- Simply continue

36. If you wish to save the thermal profile and create production processes for removal and replacement, check “Save Development Thermo Profile” and “Assign Production Profiles”.
37. Click on the “Create Production Profiles and Continue” bar.



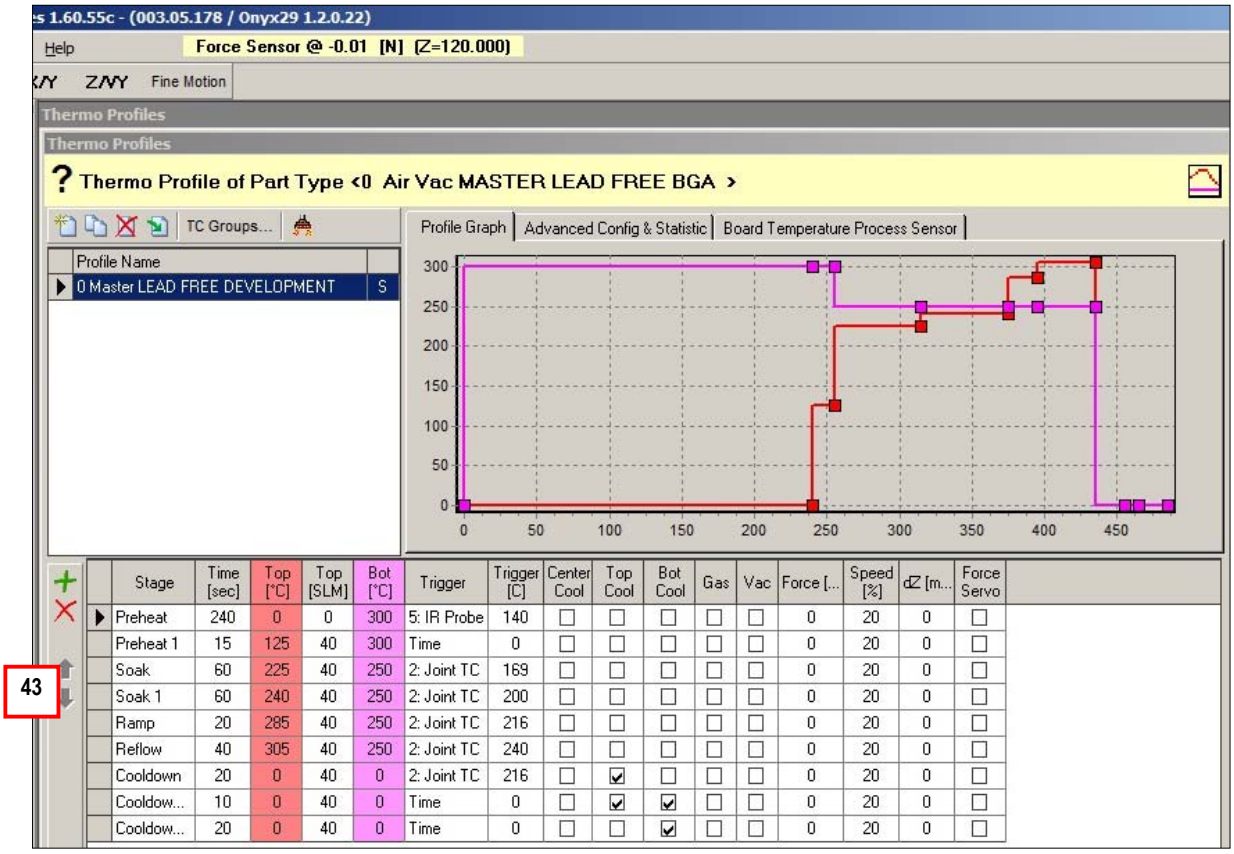
38. If you want to re-run the thermal profile without saving the first run, select “Cool down heaters first…) and “Verify Thermo Profile”.
39. Enter “70” in the Bottom Heater Trigger Box.
40. Click on the “Redo Interactive Soldering Development” bar.



USER NOTES:

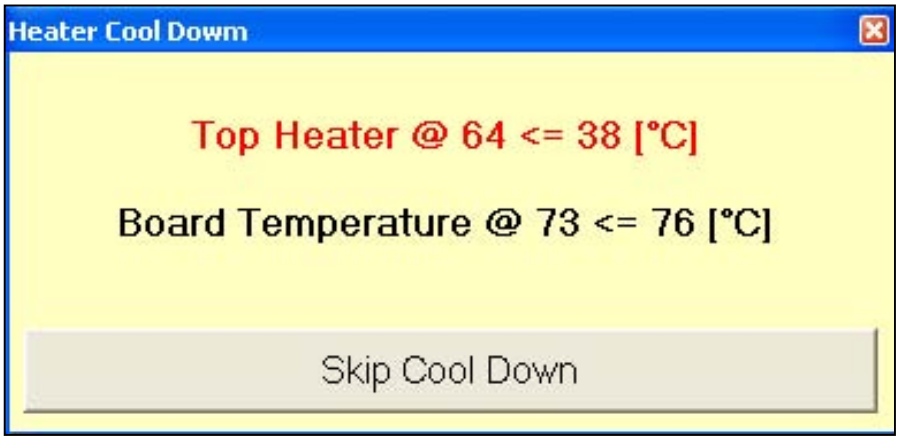
- If you made any on-the-fly changes using 1-Pass, the changes will be displayed in the Thermal Profile for you to edit prior to the second run.
- If you do not want to carry forward the changes you made during the first run, put a check in the “Reset Development Thermo Profile” box and the profile will be reset to the original master.

41. The nozzle will raise up automatically.
42. The top and bottom heater cooling routines will activate to cool down the top heater and board.
43. The thermal profile parameters will be displayed. Make changes as required based on analysis of first run results.
44. Select OK.

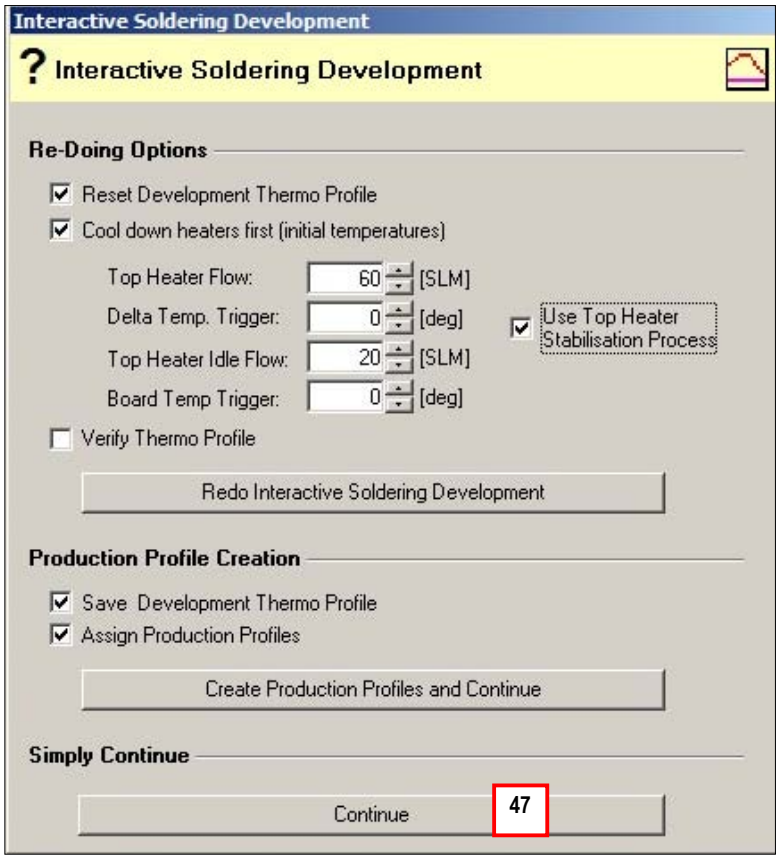


Stage	Time [sec]	Top [°C]	Top [SLM]	Bot [°C]	Trigger	Trigger [C]	Center Cool	Top Cool	Bot Cool	Gas	Vac	Force [...	Speed [%]	dZ [m...	Force Servo
Preheat	240	0	0	300	5: IR Probe	140	☐	☐	☐	☐	☐	0	20	0	☐
Preheat 1	15	125	40	300	Time	0	☐	☐	☐	☐	☐	0	20	0	☐
Soak	60	225	40	250	2: Joint TC	169	☐	☐	☐	☐	☐	0	20	0	☐
Soak 1	60	240	40	250	2: Joint TC	200	☐	☐	☐	☐	☐	0	20	0	☐
Ramp	20	285	40	250	2: Joint TC	216	☐	☐	☐	☐	☐	0	20	0	☐
Reflow	40	305	40	250	2: Joint TC	240	☐	☐	☐	☐	☐	0	20	0	☐
Cooldown	20	0	40	0	2: Joint TC	216	☐	☑	☐	☐	☐	0	20	0	☐
Cooldow...	10	0	40	0	Time	0	☐	☑	☑	☐	☐	0	20	0	☐
Cooldow...	20	0	40	0	Time	0	☐	☐	☑	☐	☐	0	20	0	☐

45. The heaters will continue to cool down until target temperatures are reached. The Interactive Soldering Profile screen will re-appear for run #2 and the nozzle will automatically return to the reflow position.
46. Save the thermal profile and assign production profiles after you achieve good thermal results as per the previous instructions.



47. If you do not want to save the profile and you do not want to re-run it, select the "Continue" bar under Simply Continue.

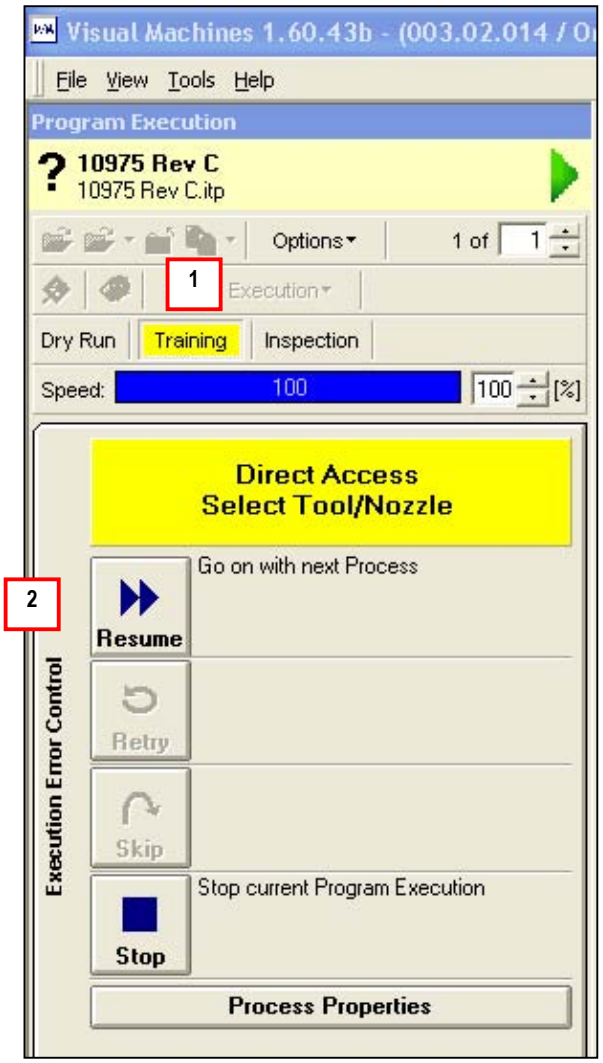


The heaters will continue to cool for an additional 30 seconds.

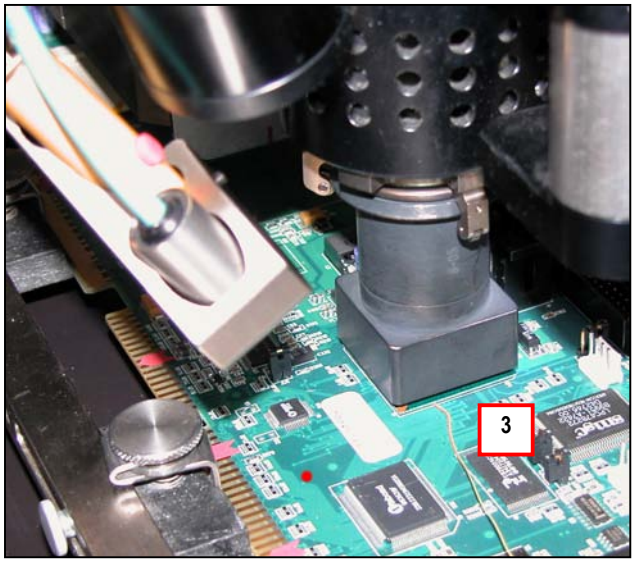
This completes the Thermal Profiling Process.

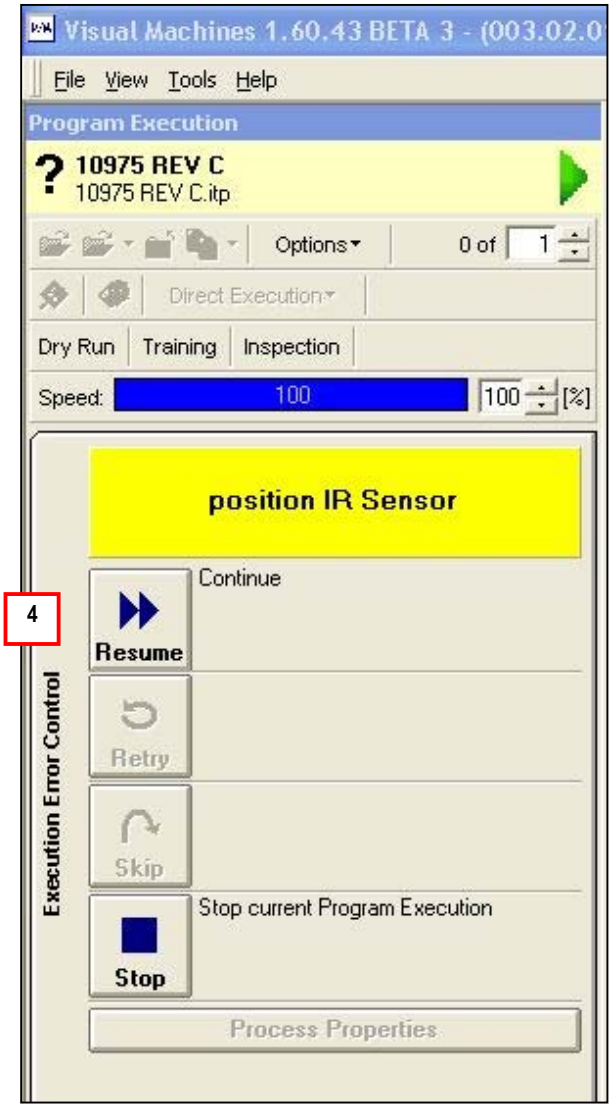
4 Removal

1. SHUT OFF the Training function used in the Wizard by clicking on the “Training” box. The box color should change from yellow (training mode) to gray (production mode).
2. Resume.

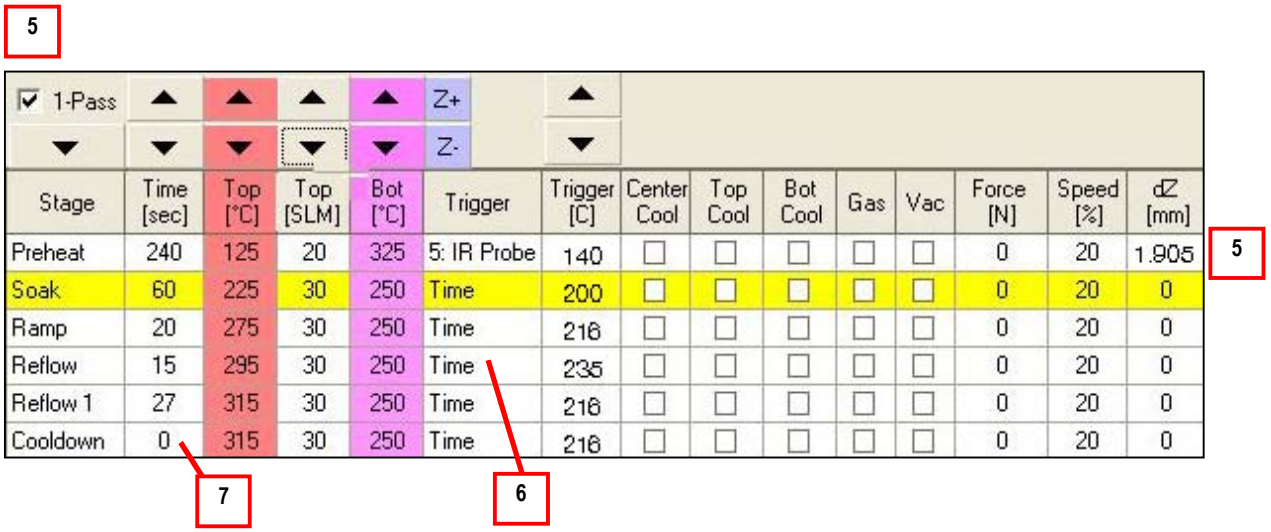


3. The nozzle will force touch the device.
4. Resume.



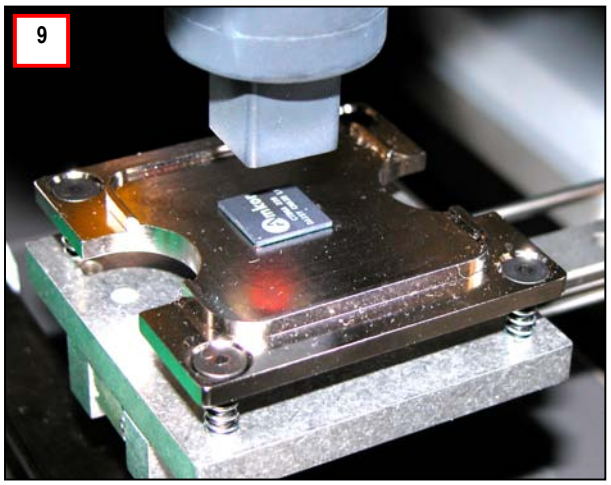


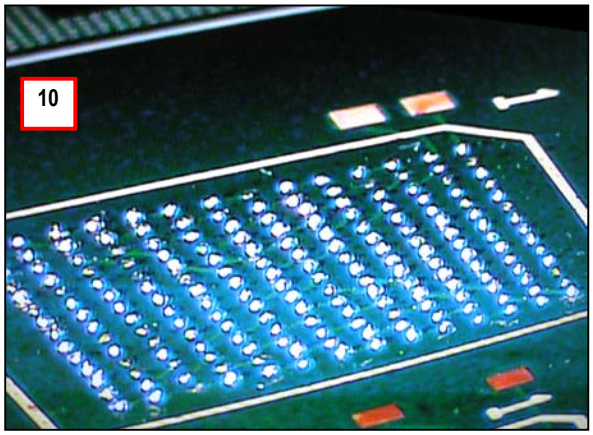
5. The interactive soldering screen will appear and the nozzle will retract to preheat position then return to desoldering position.
6. The Soak, Ramp and Reflow stages have been automatically converted to time-based events (ie. Production profile).
7. The Cooldown stage has been automatically changed to zero time as cooldown is not desired for removal.



Stage	Time [sec]	Top [°C]	Top [SLM]	Bot [°C]	Trigger	Trigger [C]	Center Cool	Top Cool	Bot Cool	Gas	Vac	Force [N]	Speed [%]	dZ [mm]
Preheat	240	125	20	325	5: IR Probe	140	☐	☐	☐	☐	☐	0	20	1.905
Soak	60	225	30	250	Time	200	☐	☐	☐	☐	☐	0	20	0
Ramp	20	275	30	250	Time	216	☐	☐	☐	☐	☐	0	20	0
Reflow	15	295	30	250	Time	235	☐	☐	☐	☐	☐	0	20	0
Reflow 1	27	315	30	250	Time	216	☐	☐	☐	☐	☐	0	20	0
Cooldown	0	315	30	250	Time	216	☐	☐	☐	☐	☐	0	20	0

8. After the reflow stage is complete, the nozzle will force touch the device, the vacuum will activate and the part will be removed and dropped off onto the shuttle.
9. The majority of the solder from the removed device remains on the pads. This is called residual solder, which must be removed by site cleaning.





This completes the Removal Process.

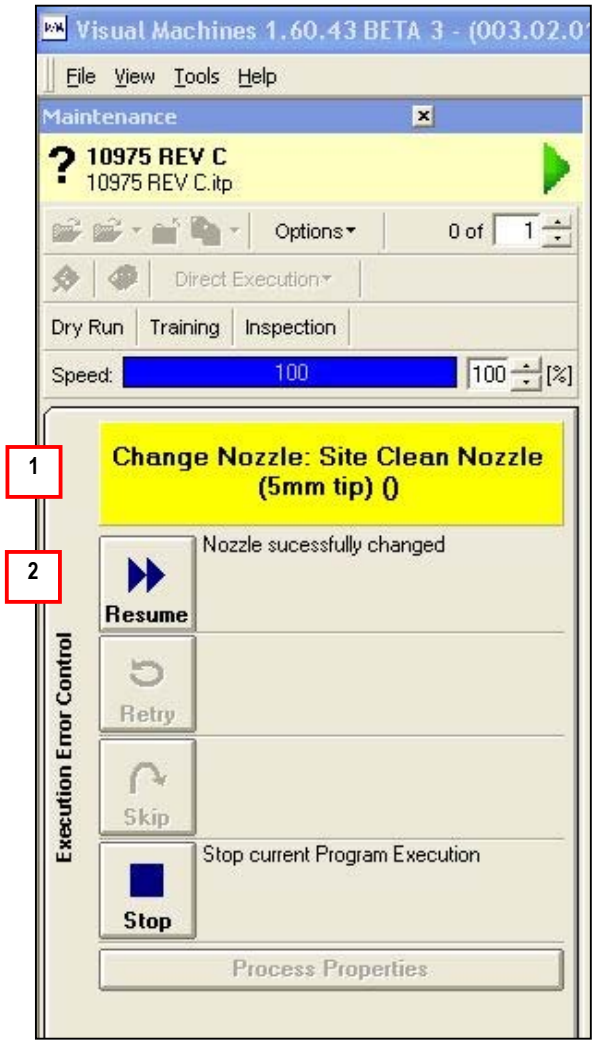
5 Site Cleaning

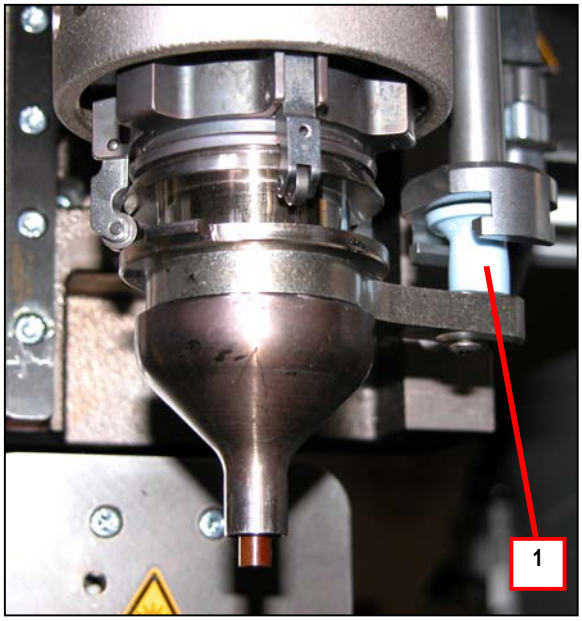
1. Remove the hot gas nozzle and install the site cleaning nozzle.

CAUTION: NOZZLES ARE HOT!

- Always use nozzle handling tool to change nozzles.
- Make sure that the black vacuum cup is properly engaged with the vacuum port as shown below.

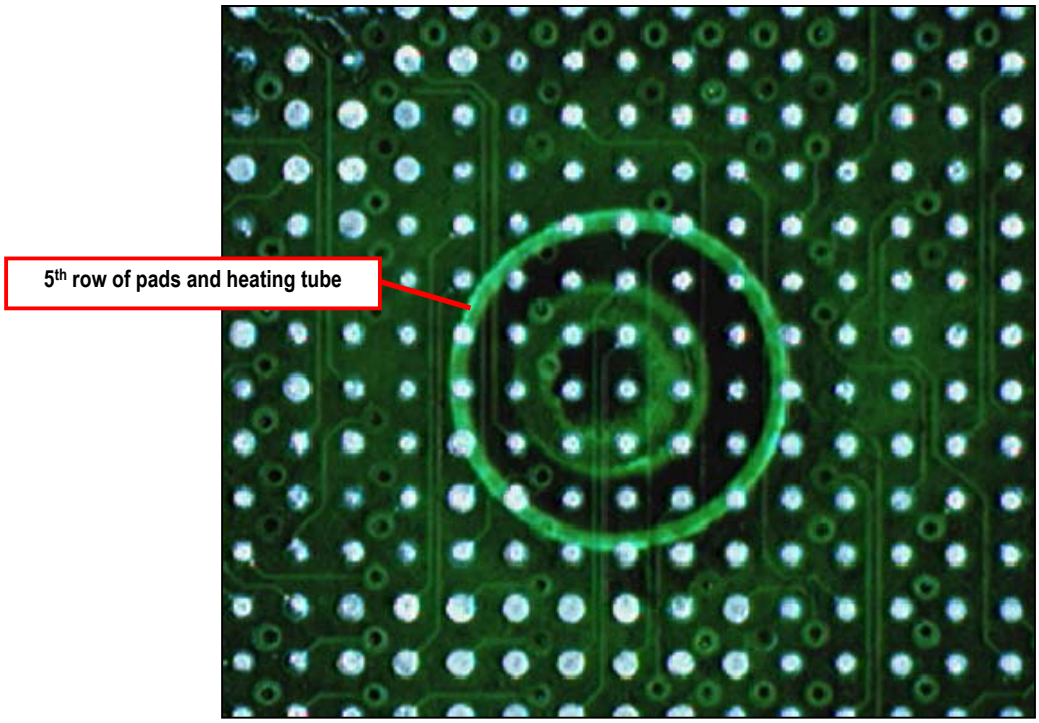
2. Resume. The site clean vacuum will activate automatically.





3. The vision system will open and the site clean heating tube will be displayed over the site. Verify that the site clean heating tube is centered over the site.

The image below shows that the 5th row of pads in from each side intersect the site clean heating tube, indicating proper centering of the site clean nozzle. If you cannot see the entire site from the center view position on minimum zoom, leave the site clean nozzle positioned as is.

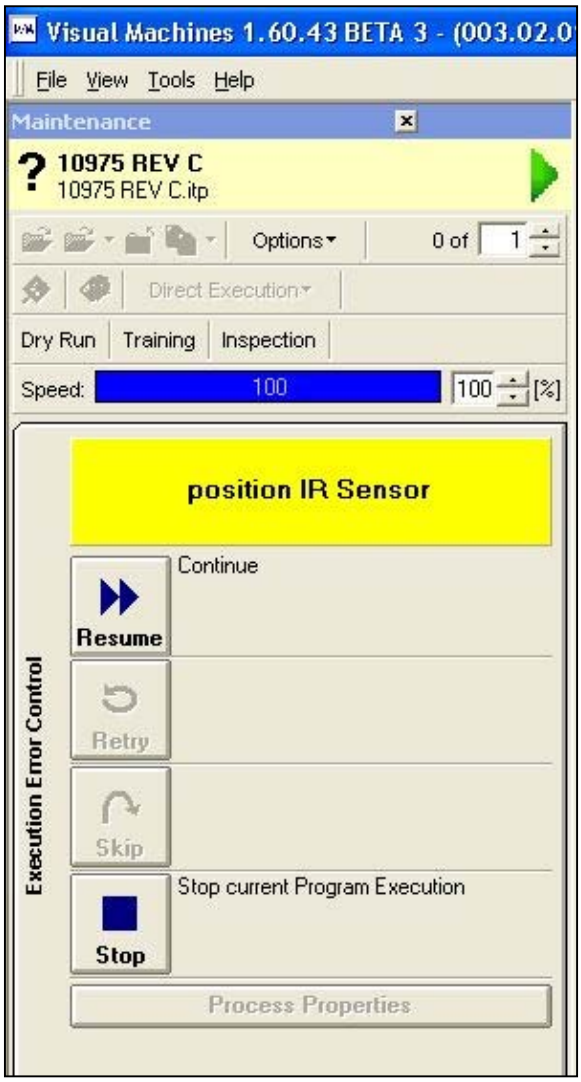


4. Use the X/Y wheels on the front of the machine to fine tune the site cleaning nozzle position if required.

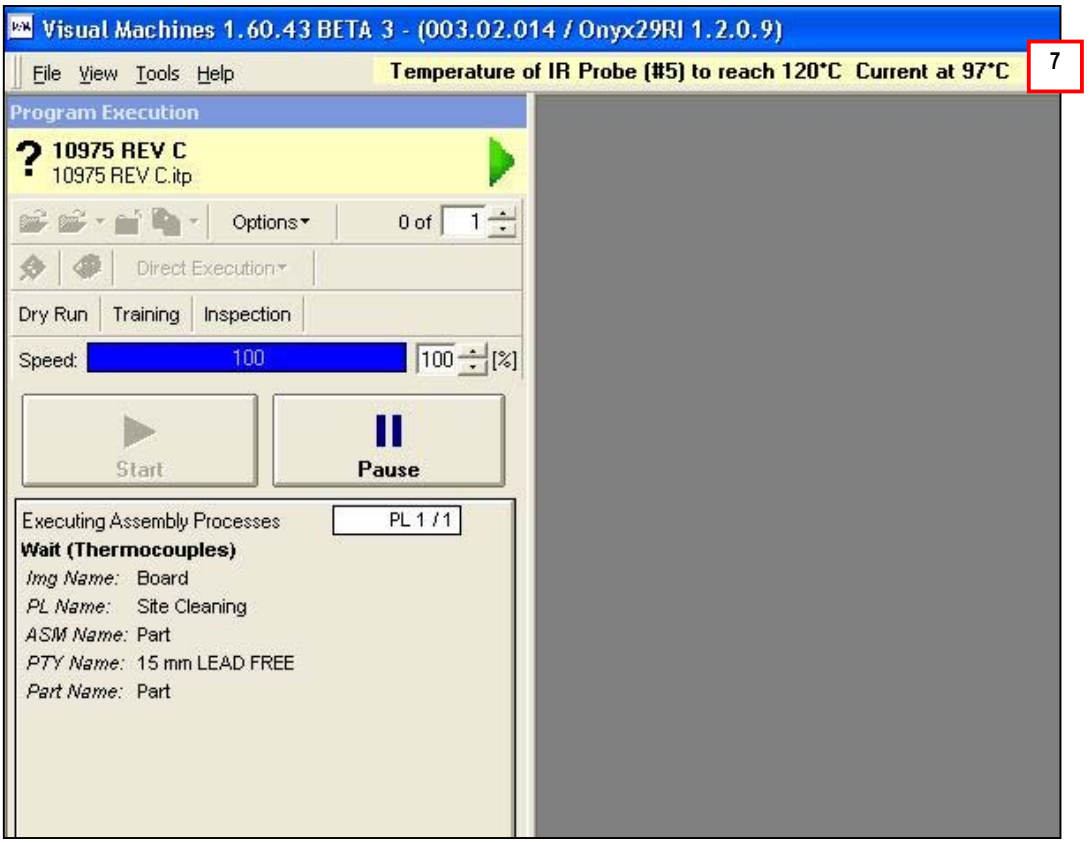
USER NOTE:

- If the site clean nozzle is not properly centered, adjacent discretes maybe displaced during site cleaning.
- See Section 9 for Advanced Site Cleaning Features.

5. Resume.


Visual Machines 1.60.43 BETA 3 - (003.02.0
File View Tools Help
Maintenance
10975 REV C
10975 REV C.itp
Options
0 of 1
Direct Execution
Dry Run
Training
Inspection
Speed:
100
100 [%]
position IR Sensor
Execution Error Control
Continue
Resume
Retry
Skip
Stop current Program Execution
Stop
Process Properties

6. The target and actual board temperature will be displayed at the top of the screen. This event will continue until the target board temperature is reached.



7. The Site Clean nozzle is preheated for 1 minute. Apply tacky flux to the site.

USER NOTE:

- Do not abort the preheating timer. Preheating the Site Clean nozzle is critical.

7

- The vacuum tip will come down close to, but not touching the site.

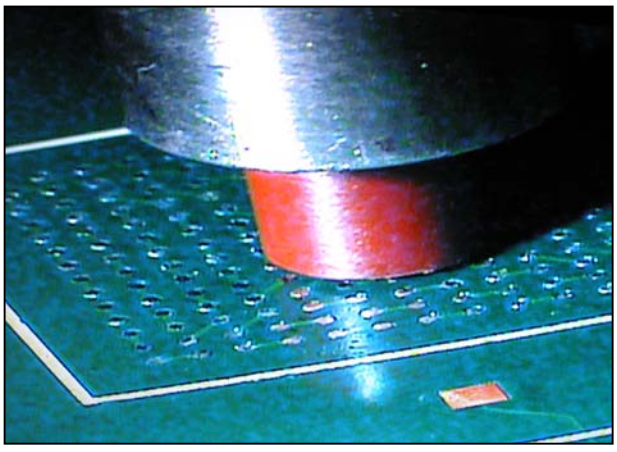
8. The tip will remain in this position initially to soften the solder on the site.
9. The tip will then automatically force touch the site and retract very slightly. The Site Clean nozzle will automatically remove the solder from the site.

USER NOTES:

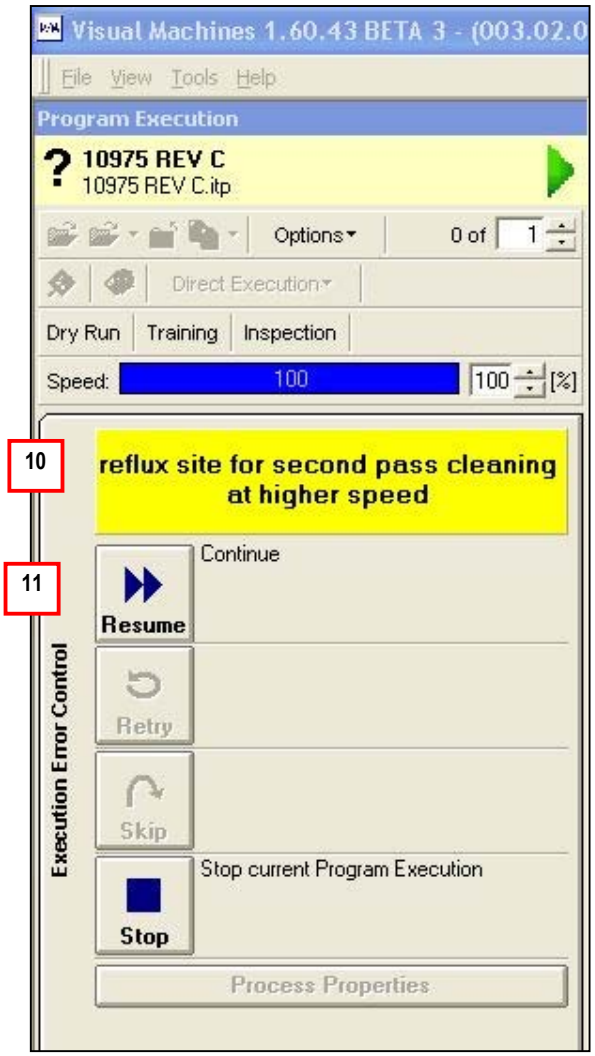
- Keep hands off the machine during force touch and site cleaning.
- The size of the site cleaning pattern is the component X/Y dimensions.
- See Section 10 (Advanced Site Cleaning Features) if modification of the standard Site Clean parameters is required.

8

9

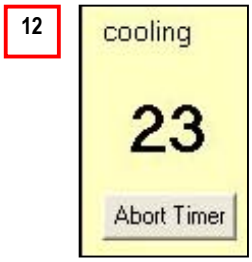


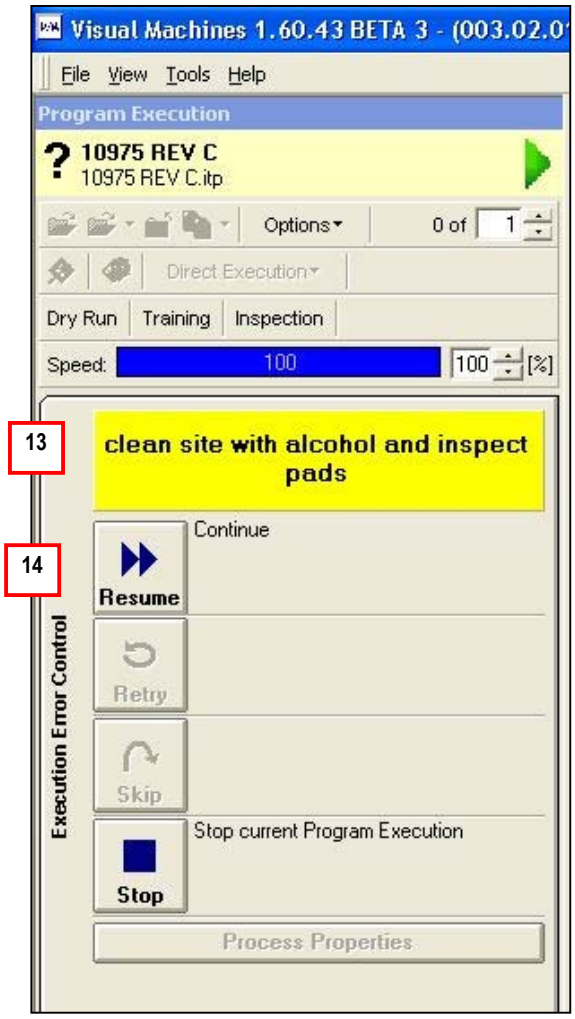
10. The Site Clean nozzle will raise up. Re-flux the site for second pass cleaning.
11. Resume.



The site will be cleaned again in reverse direction and faster to remove any remaining solder.

12. The board will cool for 30 seconds.
13. Clean the site with an alcohol swab and inspect the pads.
14. Resume.





This completes the Site Cleaning Process.

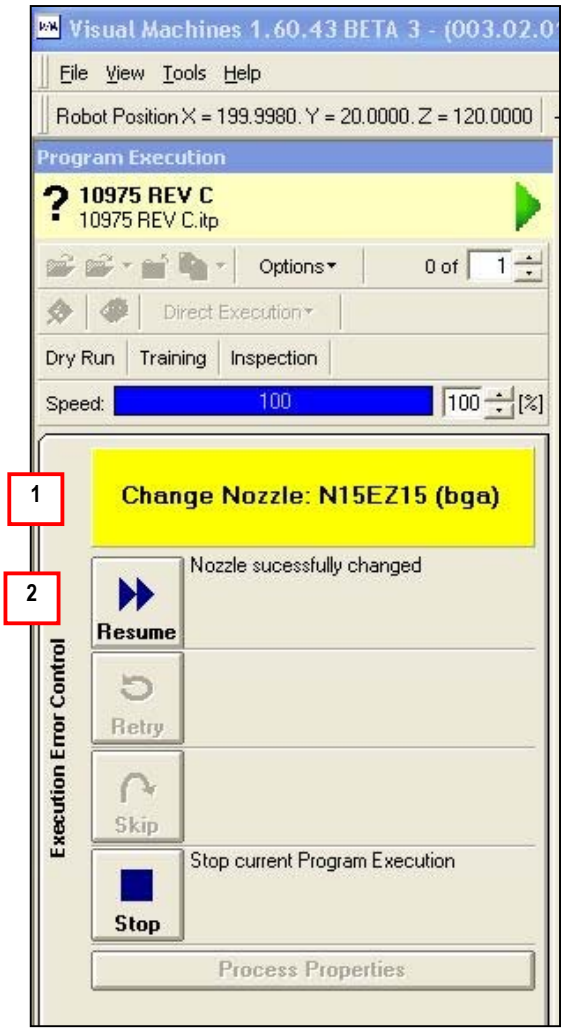
6 Replacement

1. Remove the Site Clean nozzle and install the nozzle for component replacement.

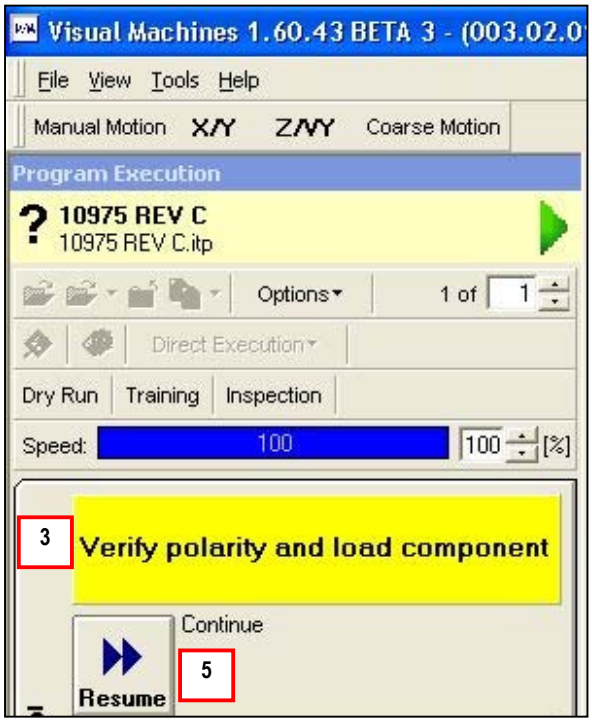
CAUTION: HOT NOZZLE

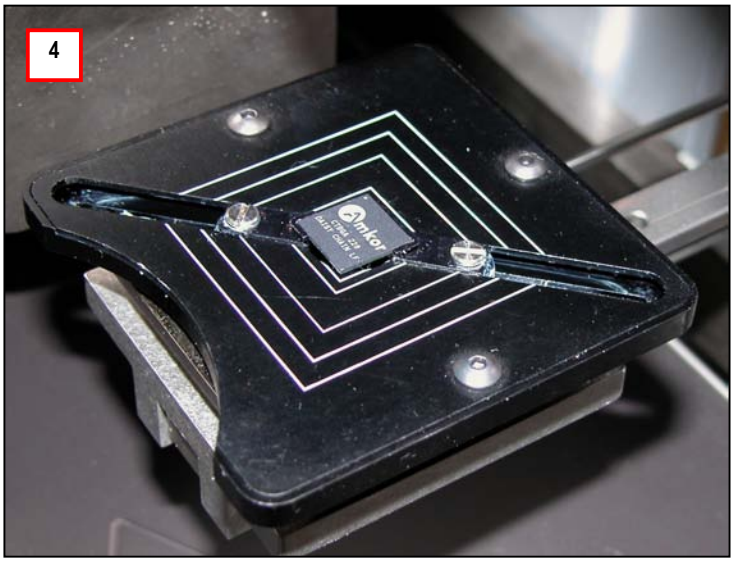
- Use nozzle handling tool to change nozzle.

2. Resume

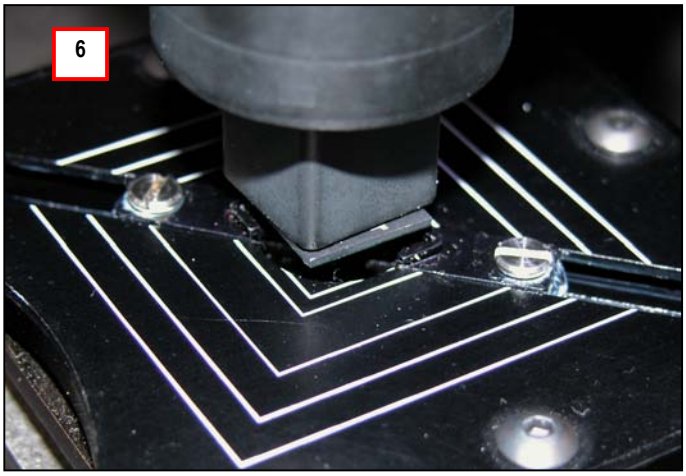


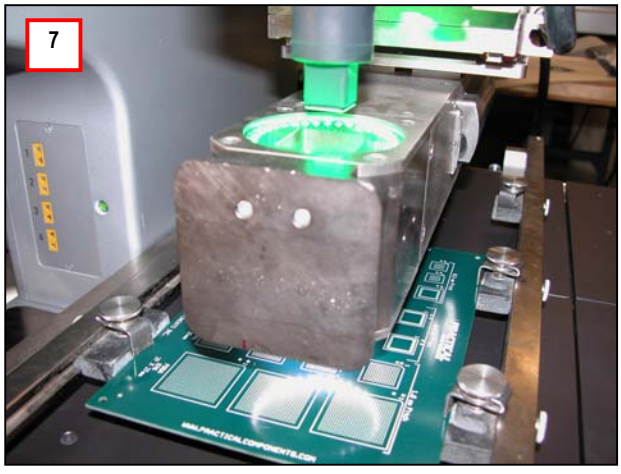
3. Verify polarity and load the component in the adjustable insertion tool.
4. Install the insertion tool in the component shuttle.
5. Resume



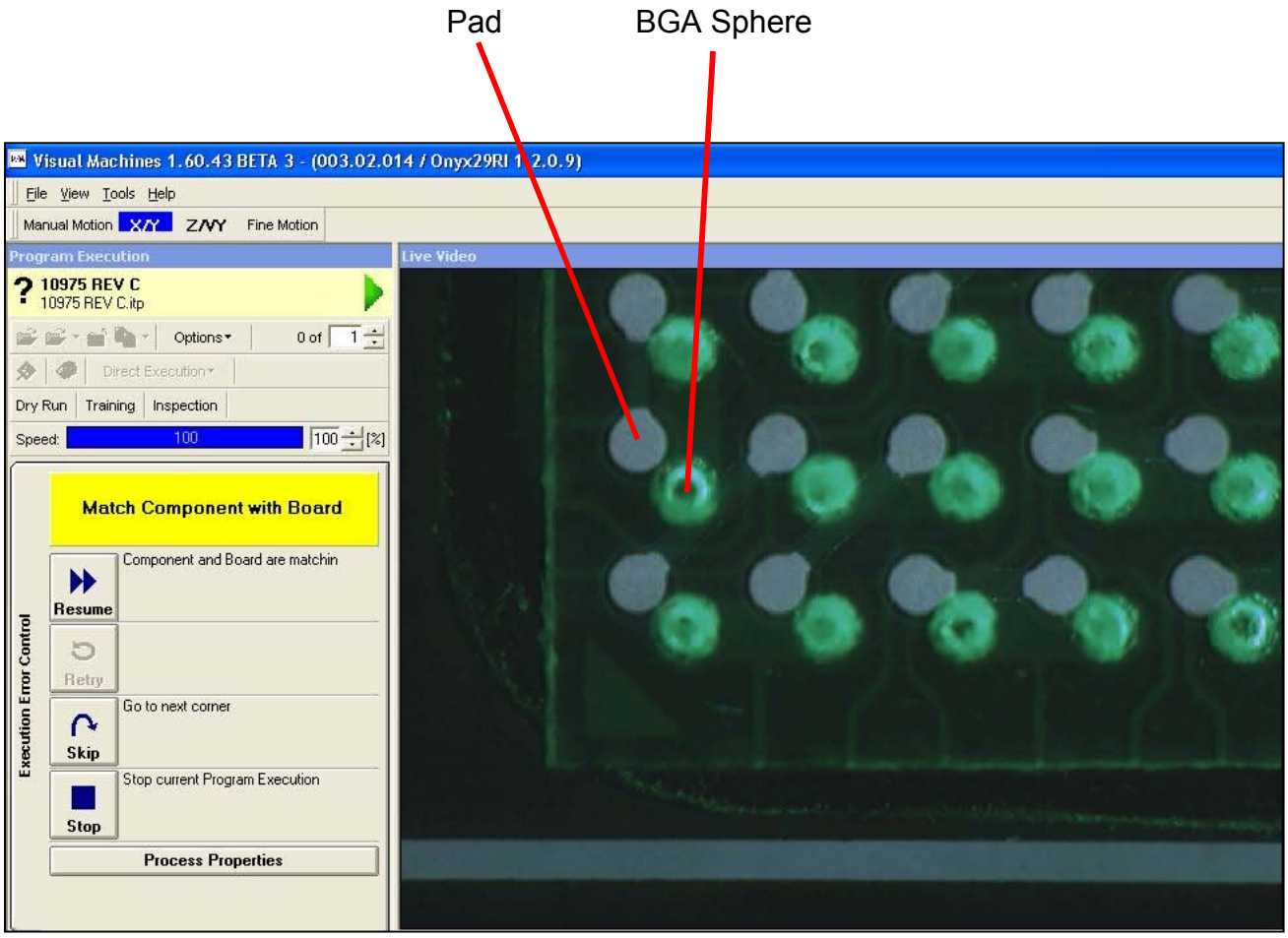


6. The component will be automatically picked up,
7. and brought to vision for alignment.



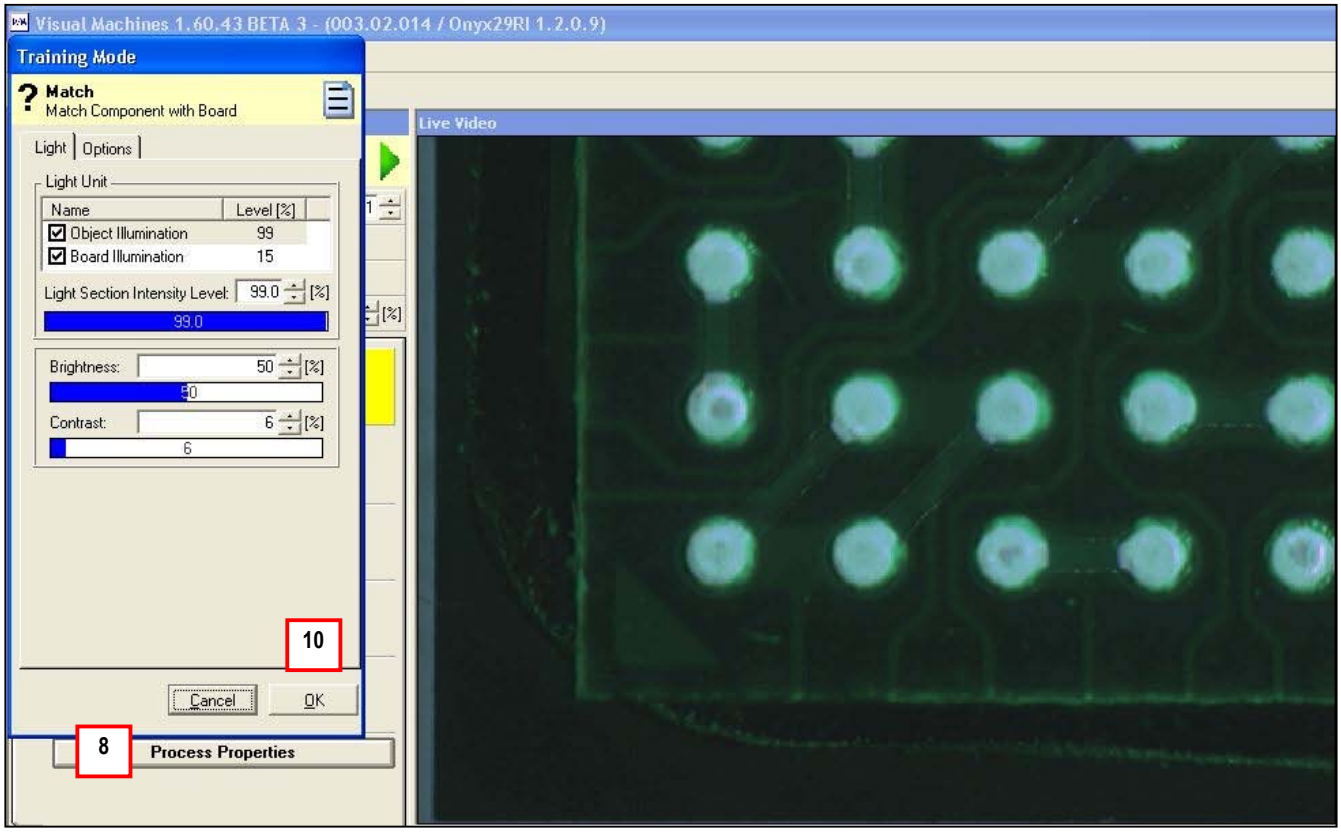


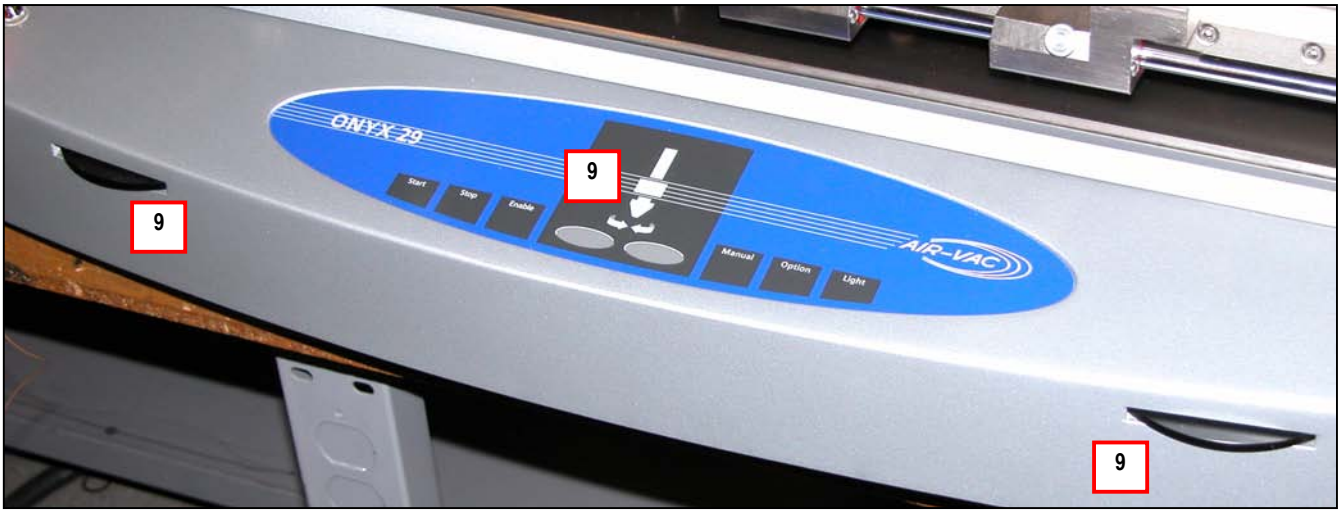
- Corner #1 of the device and site will be displayed based on the “X” and “Y” component dimensions you entered in the wizard.



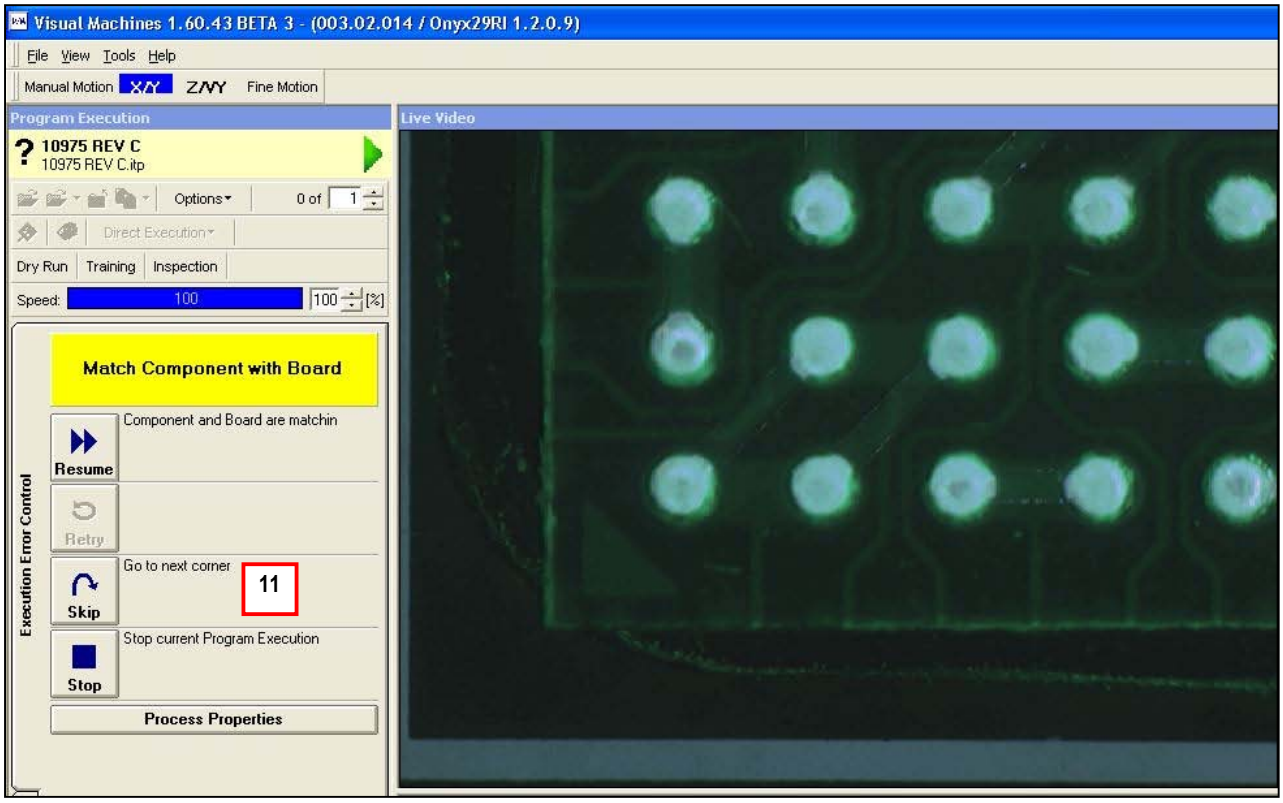
USER NOTE:
If the component X/Y dimensions are 15mm or less, the entire image can be shown rather than the corners.

8. Click on the “Process Properties” bar to change top and bottom lighting or to change the zoom magnification. **NOTE: Any changes you make to these settings is automatically saved.**
9. Use the X/Y wheels and motorized theta on the front of the machine to align the spheres and pads in Corner 1.
10. Click on the “OK” box to close Process Properties.

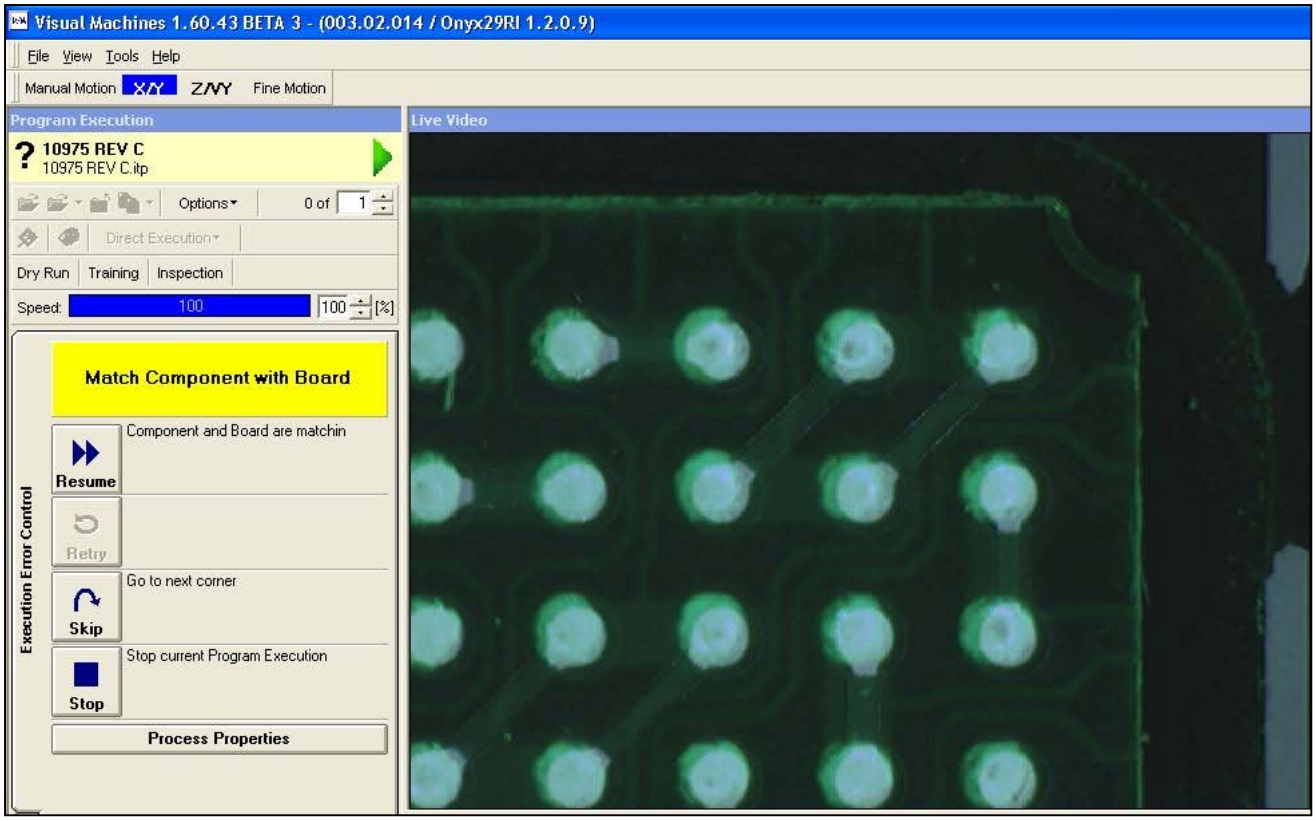




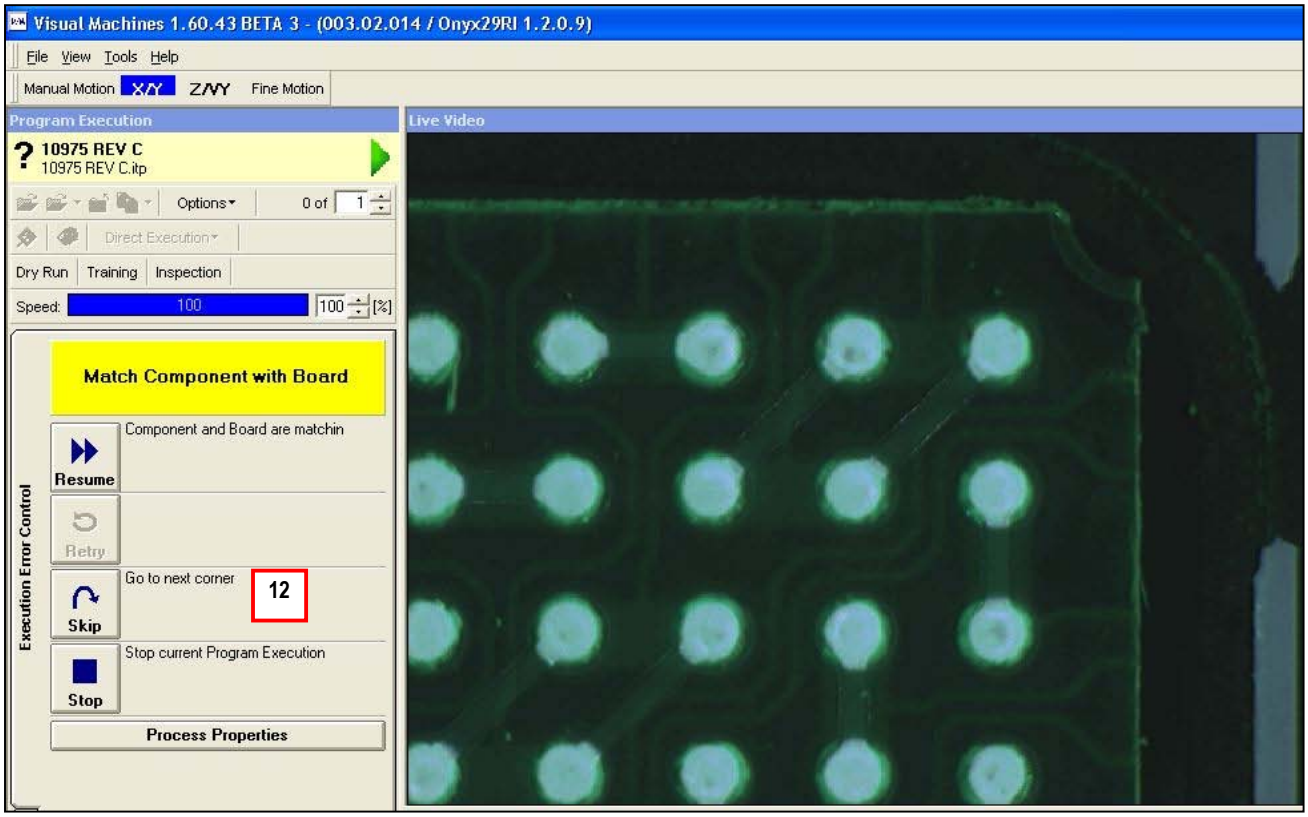
11. Click on the “Skip” box after Corner #1 alignment is complete to go to Corner #2.



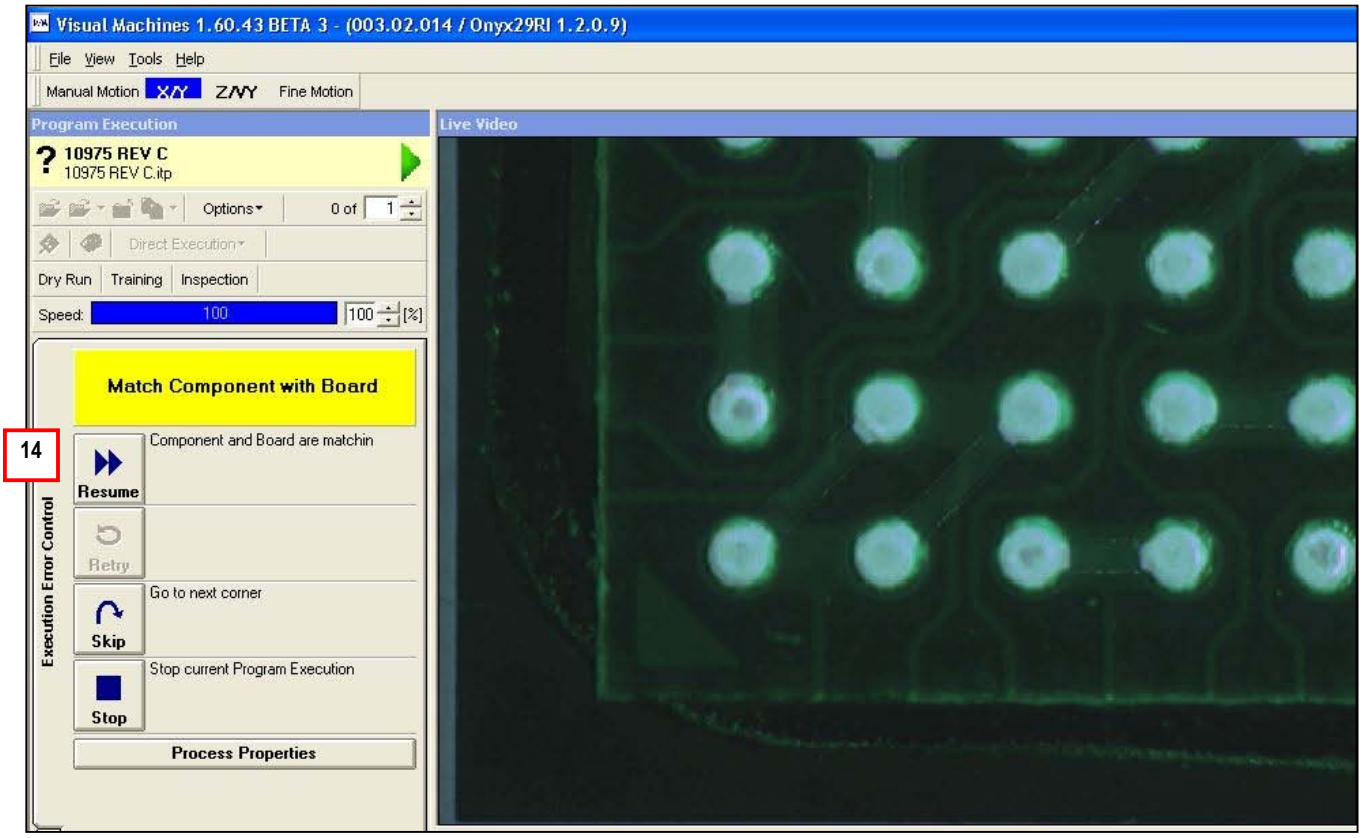
- If Corner #2 shows misalignment after aligning Corner #1 (as shown below), this means there is a theta error. If you align Corner #2 with “X” and “Y” only, the Corner #2 error will be transferred back to Corner #1.
- To correct for theta error, first make a **50% correction with theta, then finalize with X/Y.**



12. After Corner #2 is aligned in this manner (as shown below), click on the “Skip” box to return to Corner #1.



13. IF CORNER #1 IS MISALIGNED, repeat the alignment process **(ie. 50% theta correction, finalize with X/Y).** Click on “Skip” to recheck Corner #2. You can continue to skip between Corners #1 and #2 as many times as needed until both corners are aligned.
14. Click on Resume after both corners are aligned.



- The vision system will close.

15. Apply flux to the site.

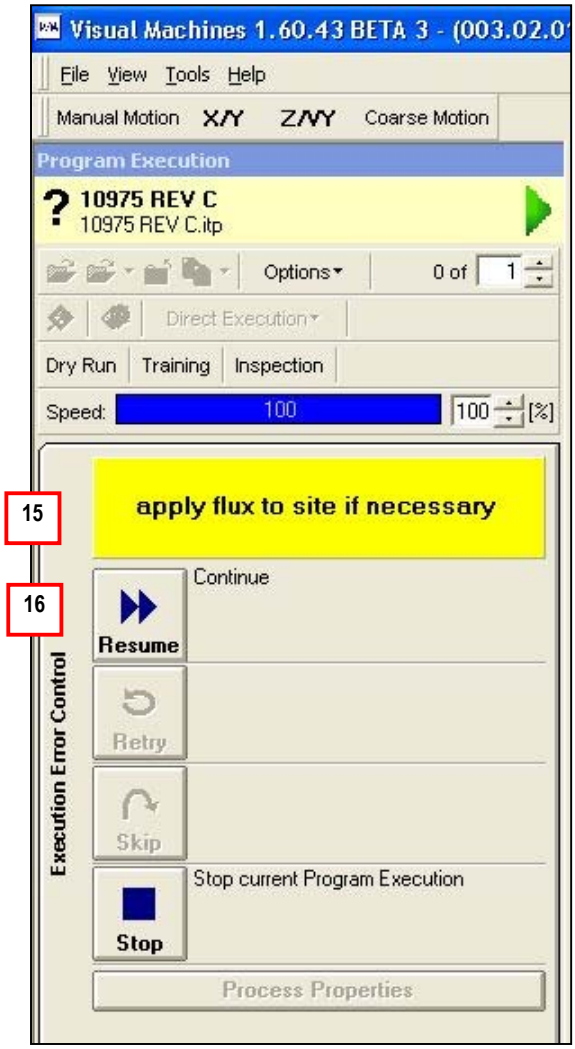
USER NOTE:

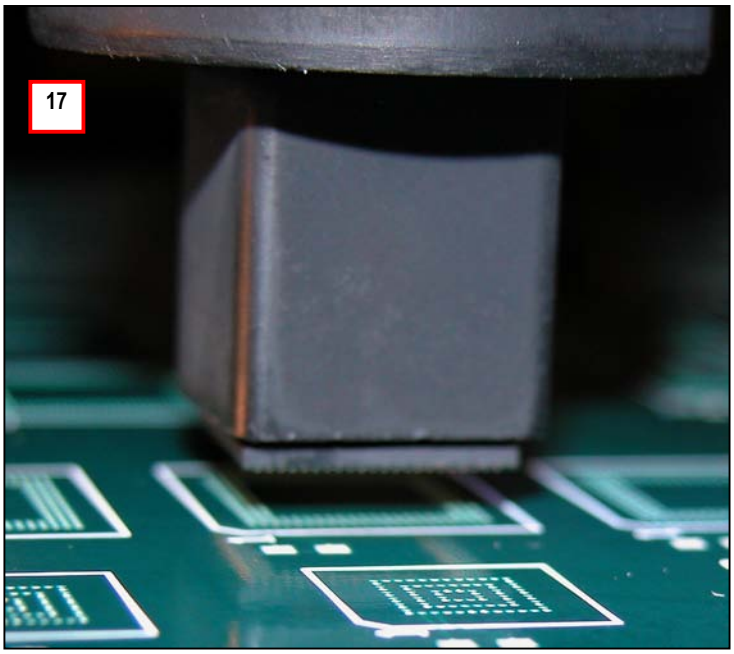
- This prompt will only appear if you selected “Manual Fluxing” in the Wizard.

16. Select Resume to continue.
17. The part will be automatically placed under force control.

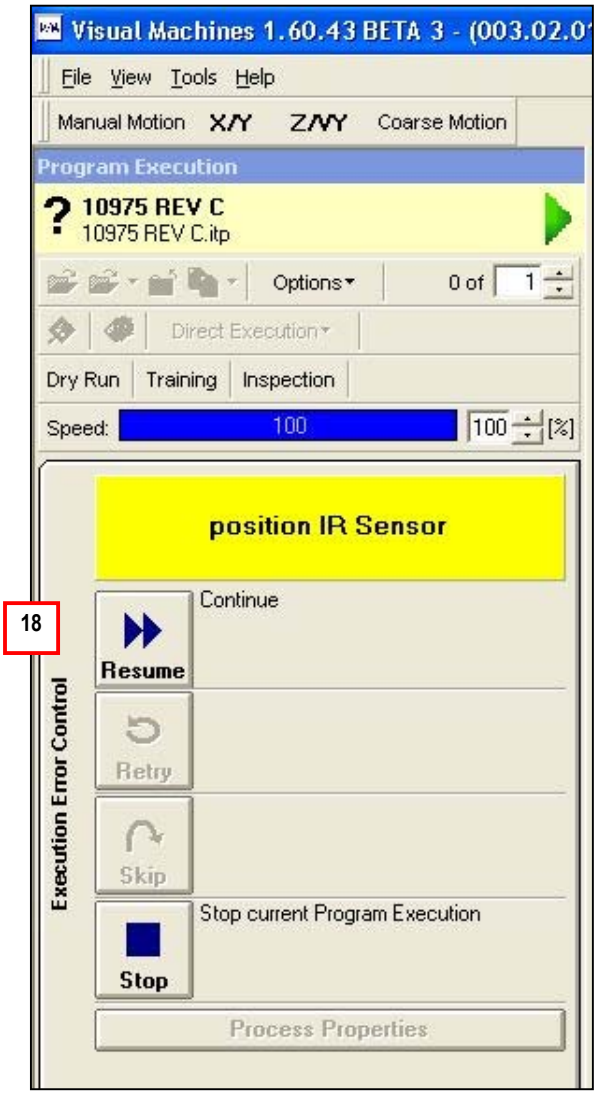
IMPORTANT:

- **Keep hands off machine during force placement.**

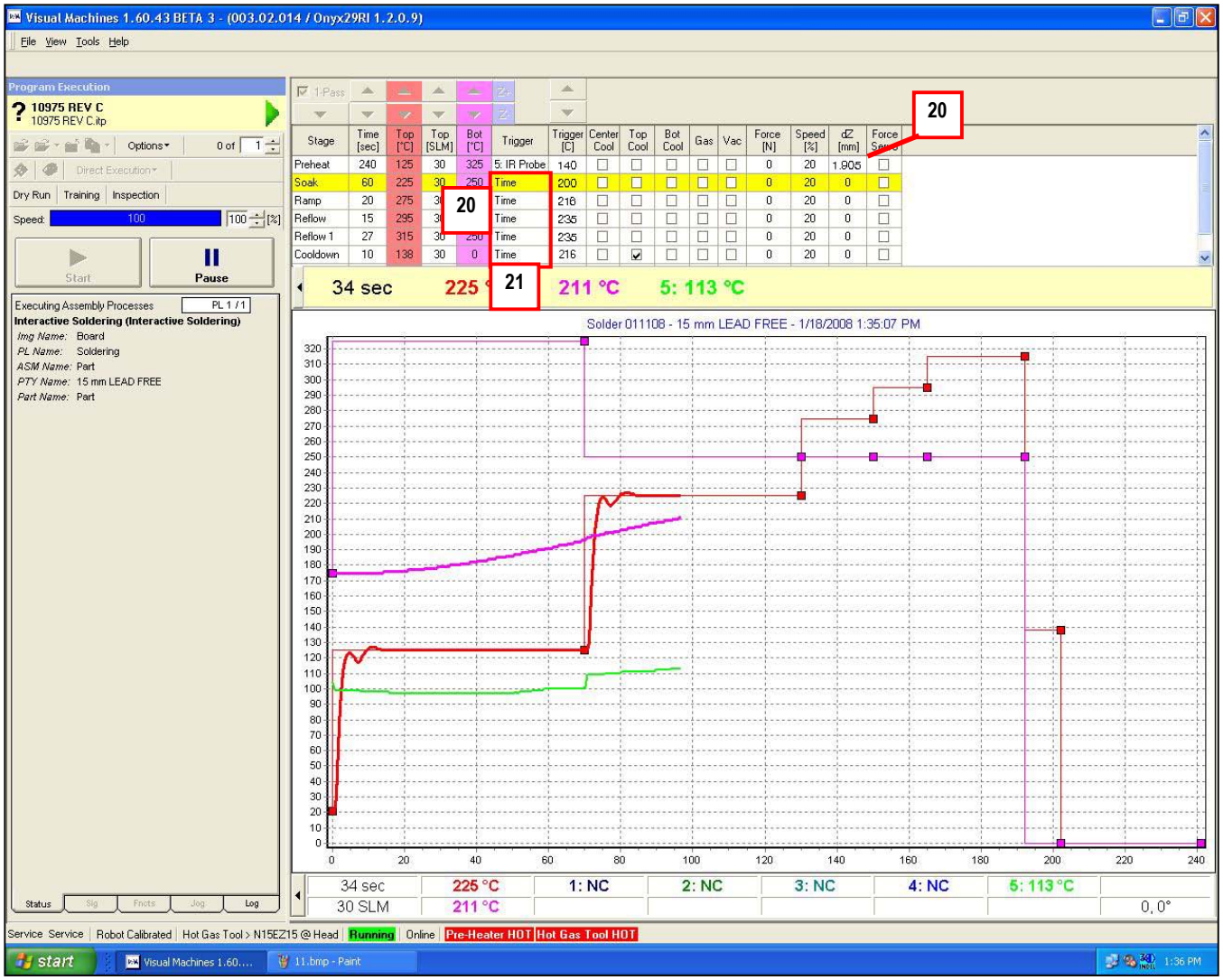




18. Resume.


Visual Machines 1.60.43 BETA 3 - (003.02.0
File View Tools Help
Manual Motion X/Y Z/VY Coarse Motion
Program Execution
10975 REV C
10975 REV C.itp
Options
0 of 1
Direct Execution
Dry Run
Training
Inspection
Speed:
100
100 [%]
position IR Sensor
18
Continue
Resume
Retry
Skip
Stop current Program Execution
Stop
Process Properties
Execution Error Control

19. The interactive soldering screen will appear and the nozzle will retract.
20. After the Preheat stage is complete, the Soak, Ramp, Reflow and Cooldown stages will execute. Note that these stages have time-based triggers as they have been automatically converted to a production profile in the Wizard.



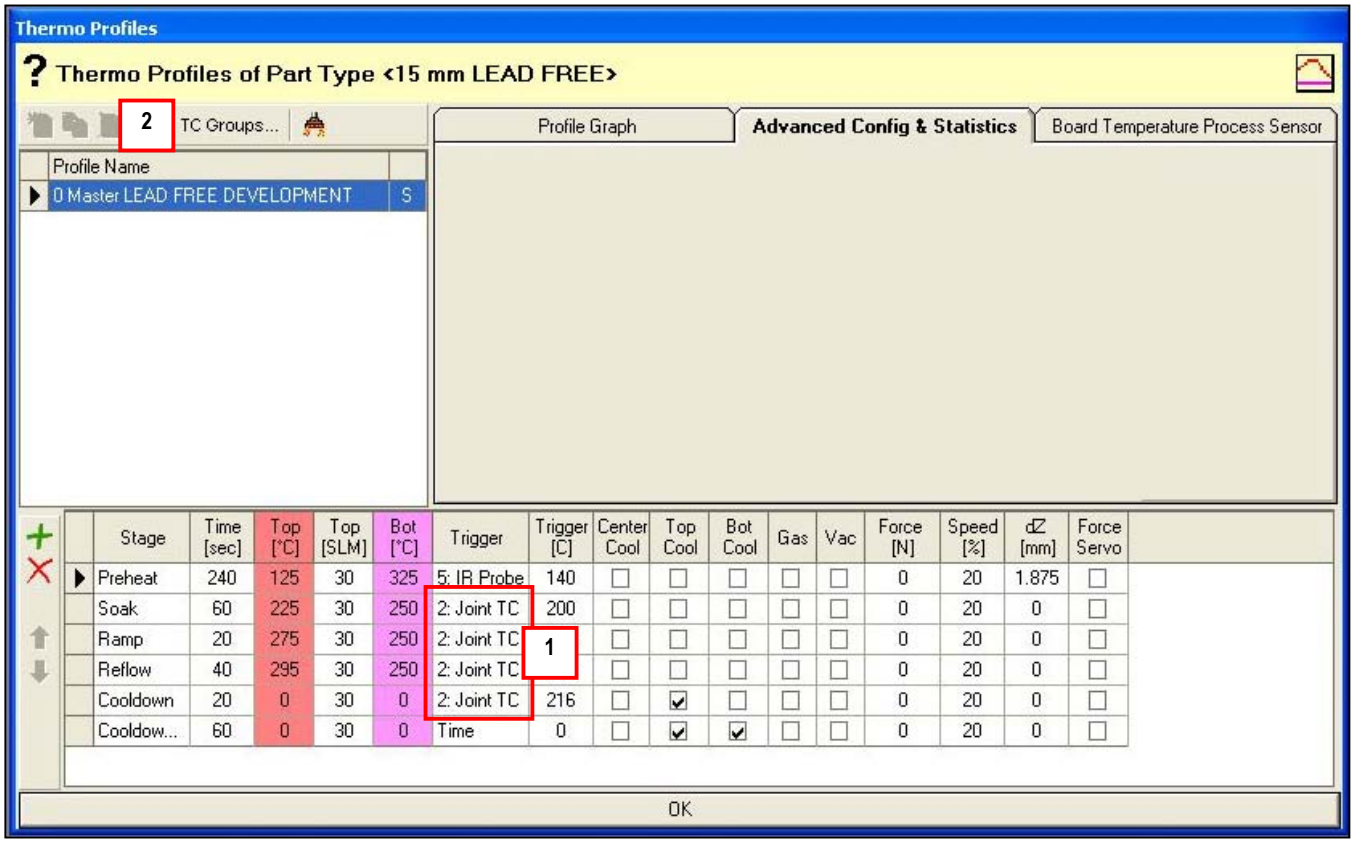
21. The nozzle retracts and the board is cooled down prior to handling.

The entire Rework Process for the new device is now complete.

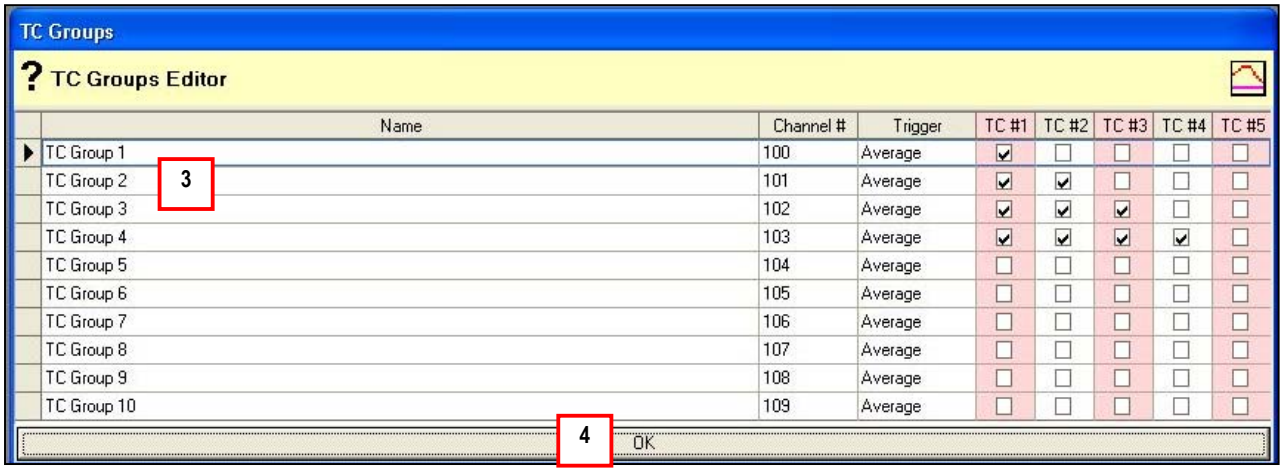
7 Advanced Features – Program Development Wizard

7.1 Using Multiple TC's to Monitor Joint Temperature & Control The Thermal Profiling Process.

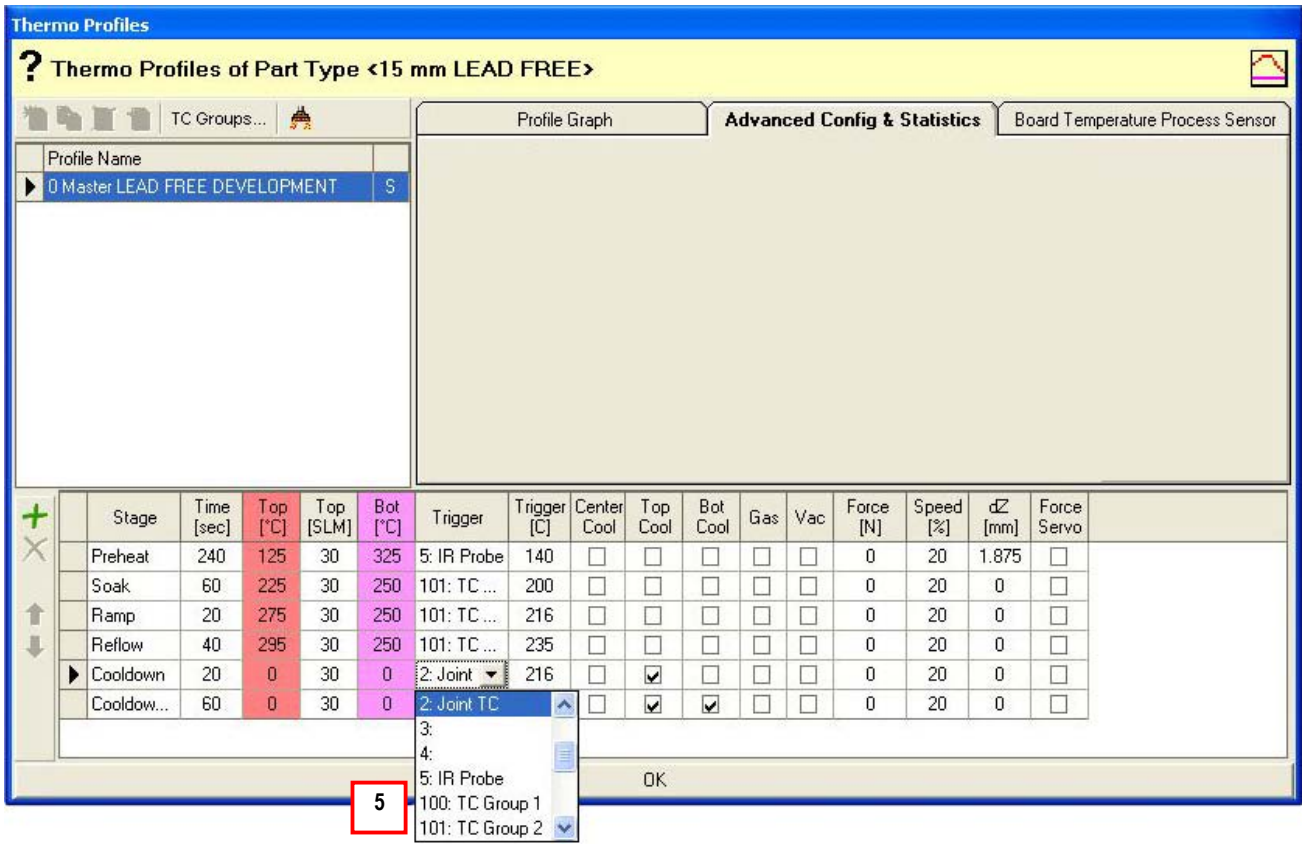
1. The default TC setup in the Wizard is for TC#2 to be attached to the joints and to control the thermal process.
2. If desired, multiple TC's can be attached to the joints and the average temperature can control the process. Click on "TC Groups".



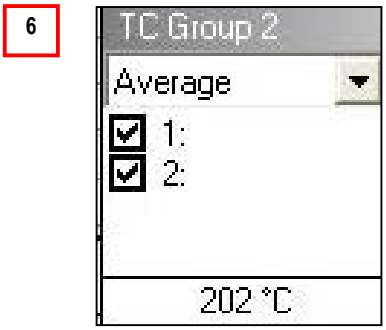
3. TC Groups 1 through 4 are preset for 1,2,3 and 4 TC's respectively. If you want some other TC configuration, you can edit a group or configure a new group.
4. Select "OK" when done.



5. Use the trigger pull down list to change the trigger to the desired TC group in the Soak, Ramp, Reflow and first Cooldown stages. In this case we will use "101:TC Group 2" which will average the TC's plugged in to Channels #1 and #2.



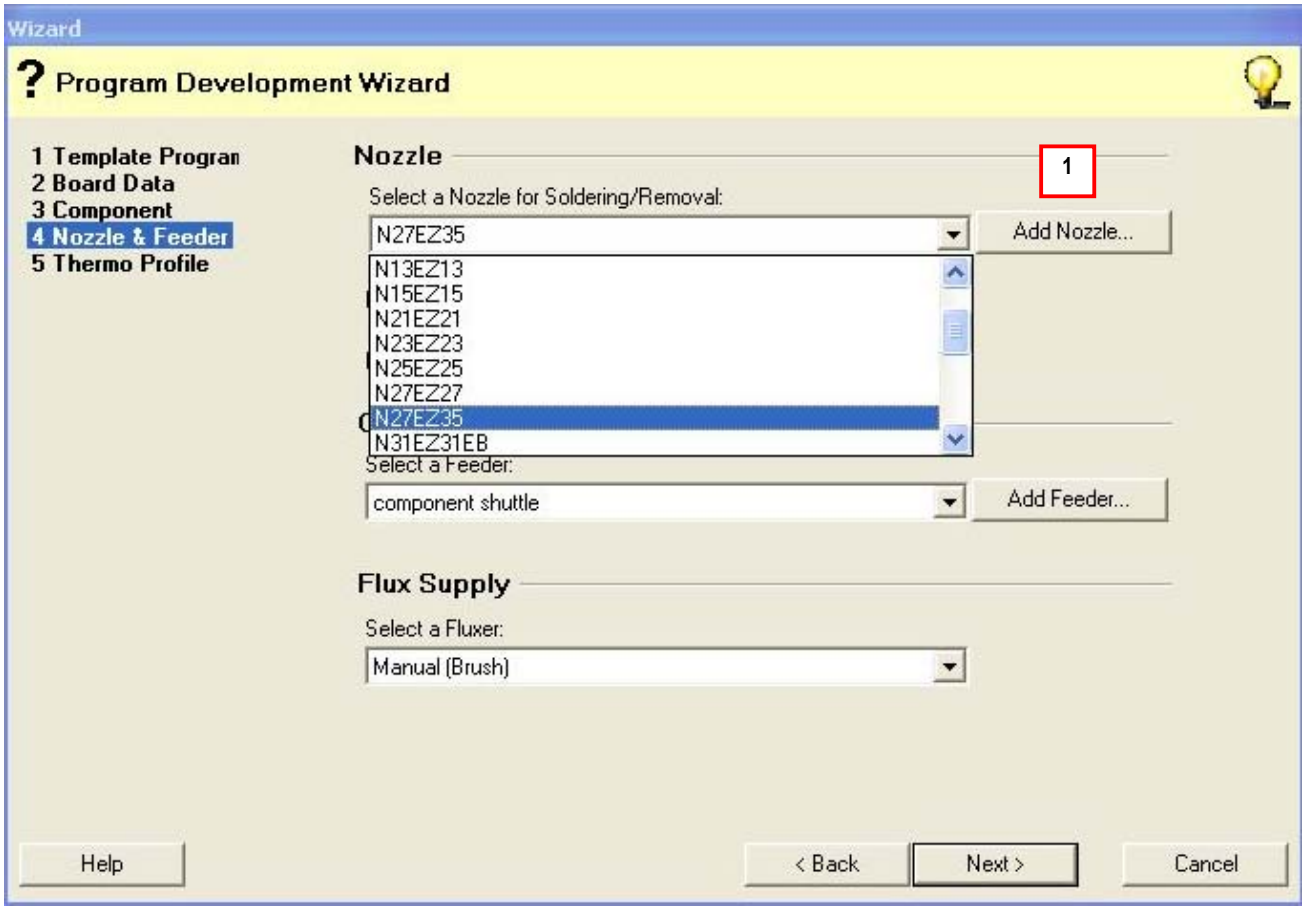
6. The multiple stage trigger TC's you selected will be displayed during Interactive Soldering at the bottom right corner of the screen.



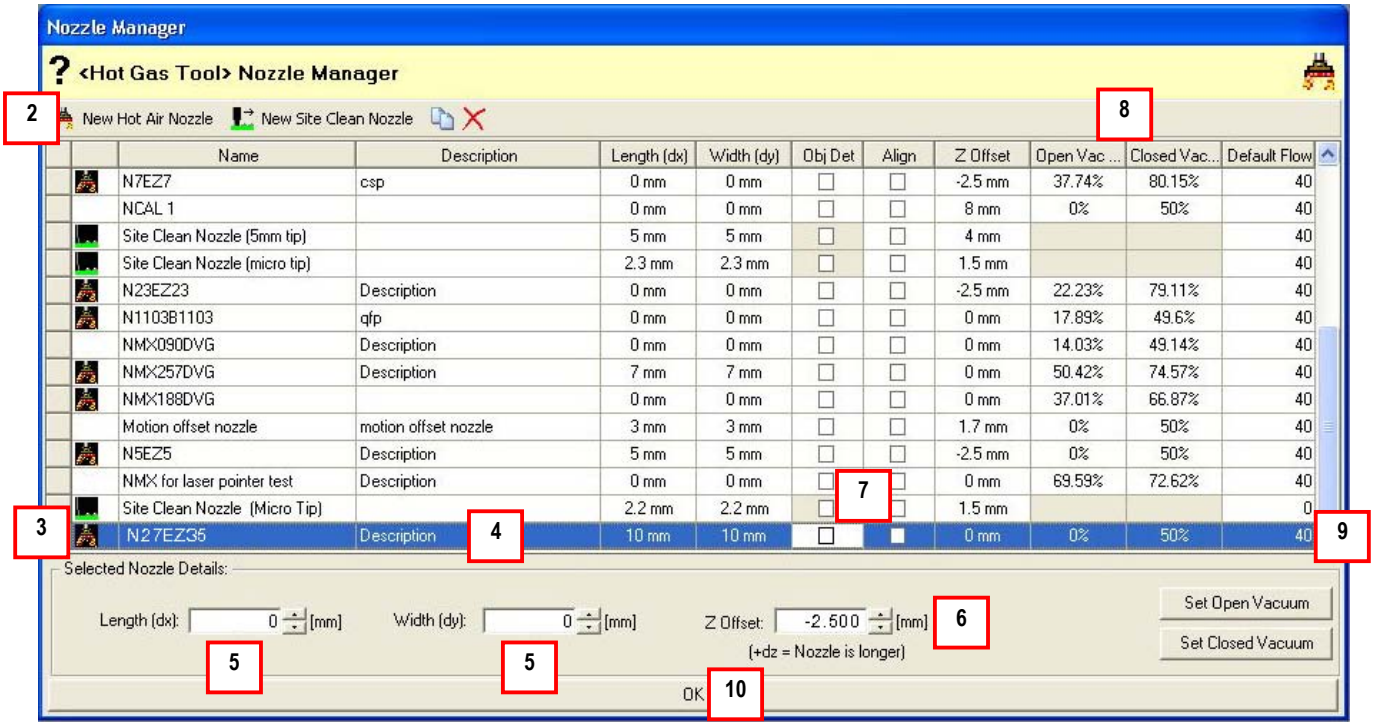
If one of the two joint TC's shorts out or appears to be reading incorrectly, simply uncheck it and it will be ignored.

7.2 Configuring A New Nozzle

1. If the nozzle you need to use for a new process is not on the pull down list, click on the “Add Nozzle” box.



2. This will take you to the Nozzle Manager. Click on “New Hot Air Nozzle”. A new nozzle will be added to the bottom of the list.



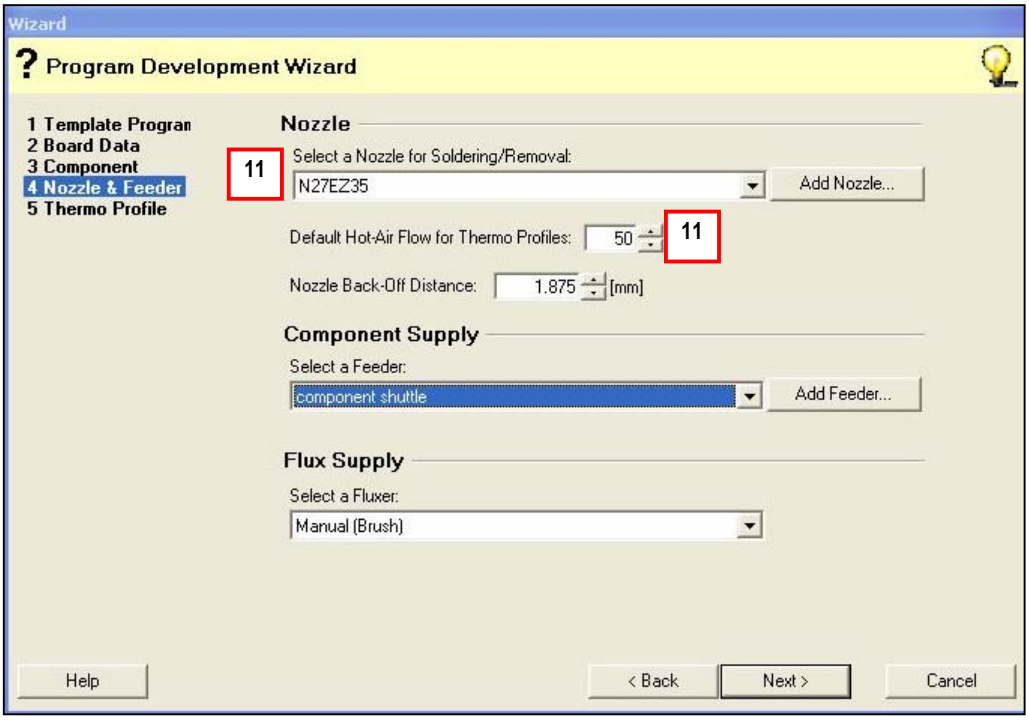
You will now need to do the following:

3. Highlight the new nozzle and then rename it (N27EZ35 in this case).
4. Add a description if desired.
5. Enter the length and width of the nozzle in mm in the boxes at the bottom of the page.
6. **IMPORTANT!** - Measure the overall length of the nozzle with calipers. The standard length nozzle is 66mm. The length of the new nozzle minus 66mm must be entered into the Z offset box at the bottom of the page. In this case, the new nozzle (N27EZ35) measures 63.5mm (typical length for EZ nozzles) so the Z offset is –2.5mm (63.5mm – 66.0mm).
7. The Object Detection and Align boxes should be blank.
8. The open and closed vacuum levels are not relevant.
9. Set the default flow for the new nozzle based on the following nozzle size chart:

Nozzle Size (mm)	**Top Heater SLM (standard liters/minute)**
Less than 10mm	25 LPM if no bypass holes (35-40 if yes bypass holes)
10-15 mm	30-35 LPM
16-26 mm	35-40 LPM
27-30 mm	45-50 LPM
31-34 mm	55-60 LPM
35-40 mm	60-65 LPM
Above 40 mm	65+ LPM
NMX Nozzles	40-60 LPM

10. Click on OK to return to the Wizard.

11. The new nozzle and default flow rate for the new nozzle are now displayed.



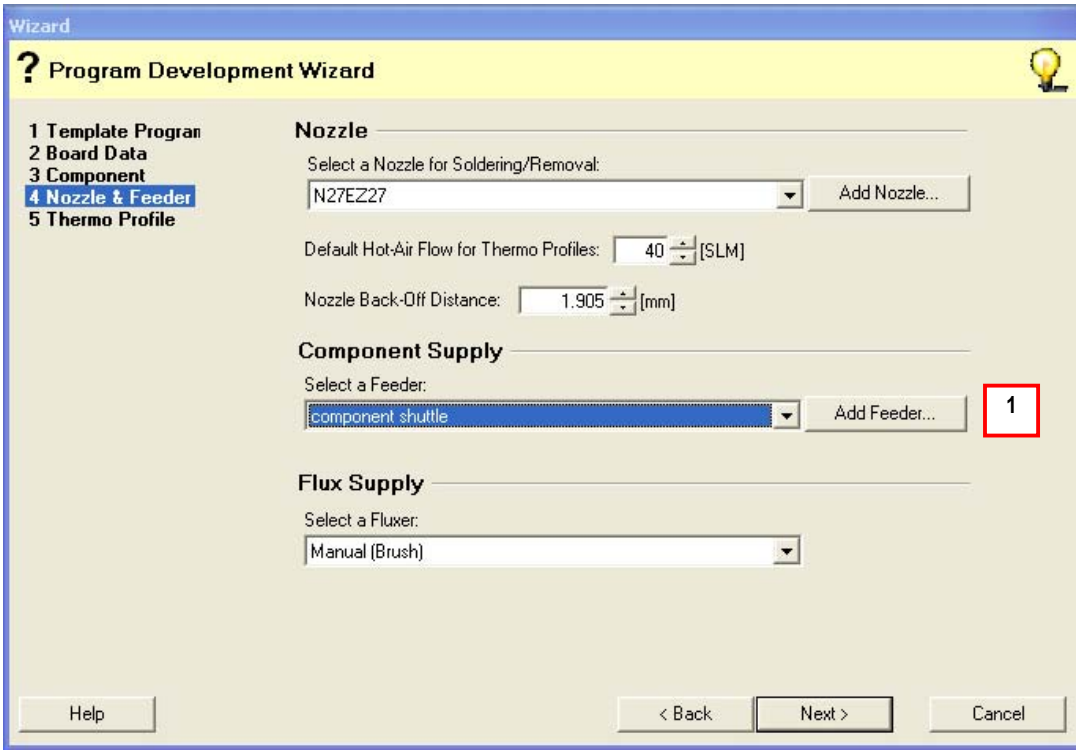
7.3 Configuring A Custom Feeder

The Component Shuttle is typically used to supply a component to the machine. The Universal Insertion Tool centers the device on the shuttle to provide accurate pick up.

However, some components may require alternate pick up methods. For example, 0402's and other extremely small devices may need to be picked directly from tape or waffle trays. In addition, the extremely small size of these parts may require vision assistance for accurate pickup, which is not possible with the shuttle. In such cases, board-level custom feeders can be created and used to accomplish this objective.

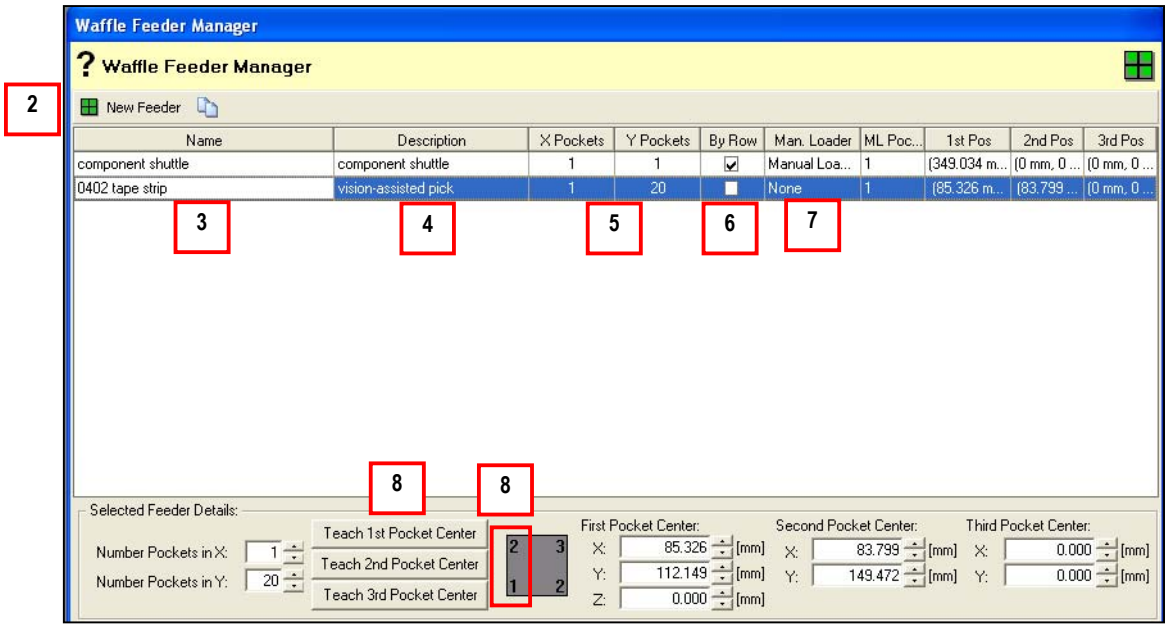
IMPORTANT:
Configuring a custom feeder is an involved process. We recommend that customers contact Air-Vac Engineering for assistance when configuring a custom feeder for the first time.

1. Select "Add Feeder"

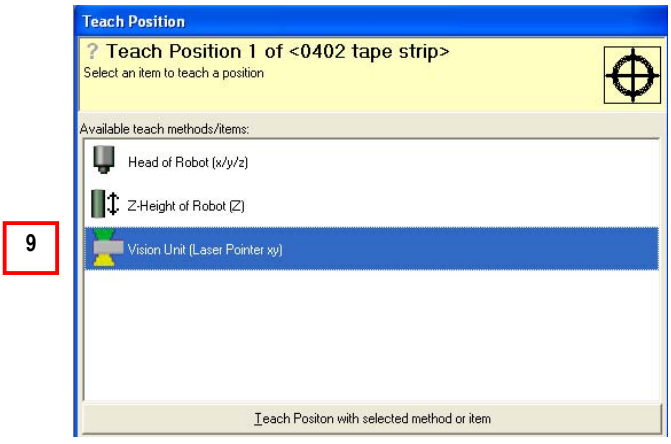


- You are now in the Feeder Manager.

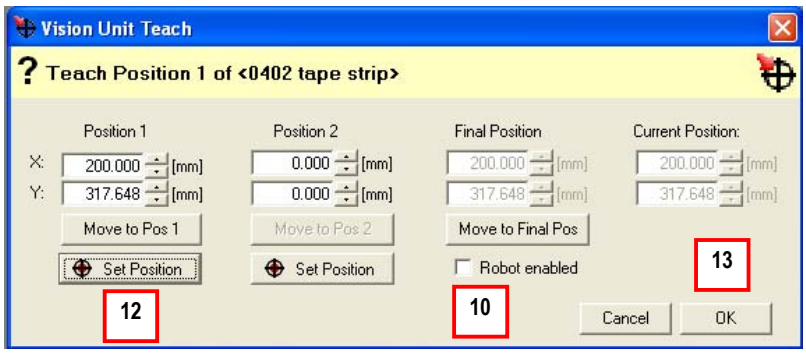
2. Click on “New Feeder”
3. Rename the New Feeder. In this case it is “0402 Tape Strip”.
4. Add a description if desired.
5. Input the number of X and Y pockets. In this case we have a single row of twenty 0402’s, therefore X is 1 and Y is 20.
6. Check “By Row” if you want to pick by row (ie. X). In our case, we only have 1 row so this is unchecked, which means it will pick by column (ie.Y).
7. Manual loader is the mechanism that controls the Component Shuttle. In this case, we will not use the shuttle so “None” is selected.
8. The corner pocket positions then need to be taught. In this case, pocket 1 will be the first 0402 and pocket 2 will be the last (20th) 0402. Click on “Teach 1st Pocket Center”.

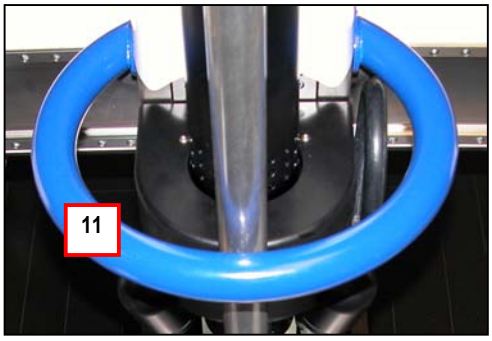


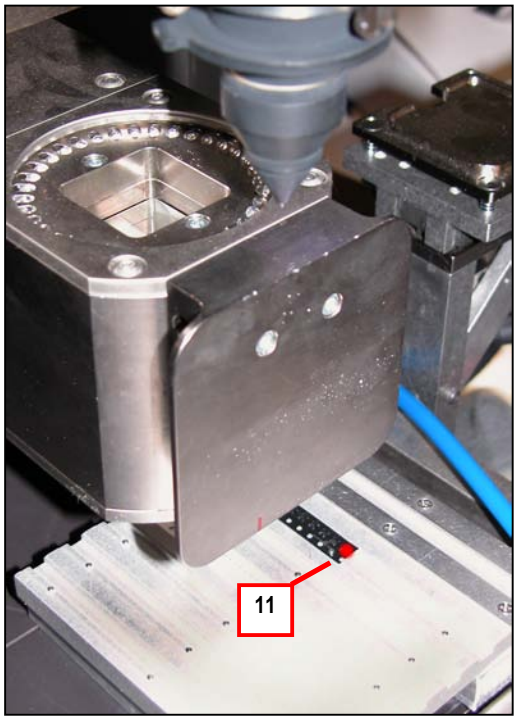
9. Double click on “Vision Unit (Laser Pointer X/Y)”.



10. Uncheck the “Robot Enabled” box to depower the robot head.
11. Use the blue ring to position the laser pointer over the center of pocket 1.
12. Select “Set Position” under position 1.
13. Select “OK”.



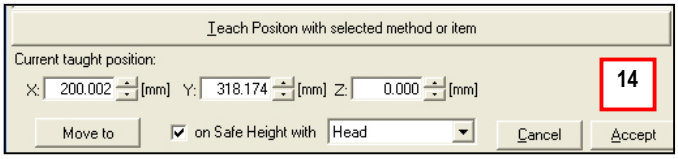




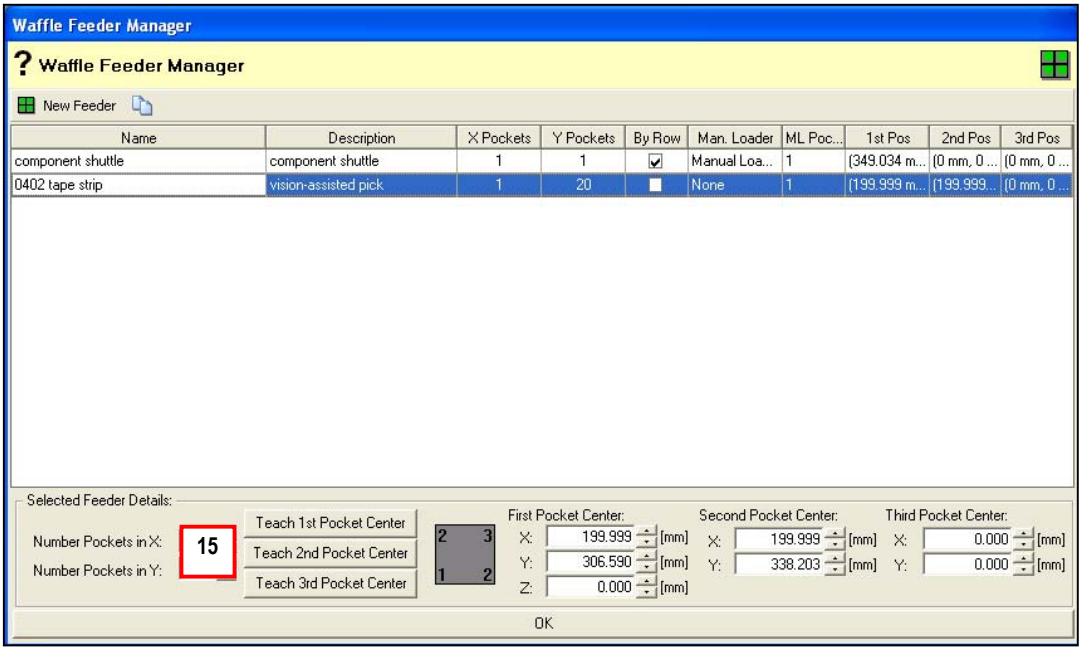
USER NOTES:

- The custom feeder should be set up in an area where no bottom heating occurs. In this example, the 0402 feeder is set up over the front right corner of the preheater. The front and right rear preheater panels will be programmed to be off for this profile.
- The custom feeder Z height should be the same height as the board.

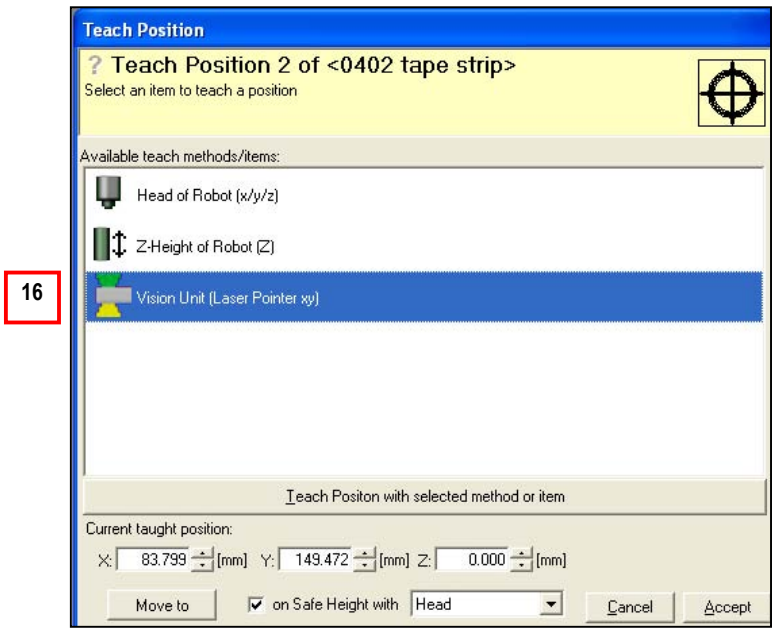
14. Select “Accept”.



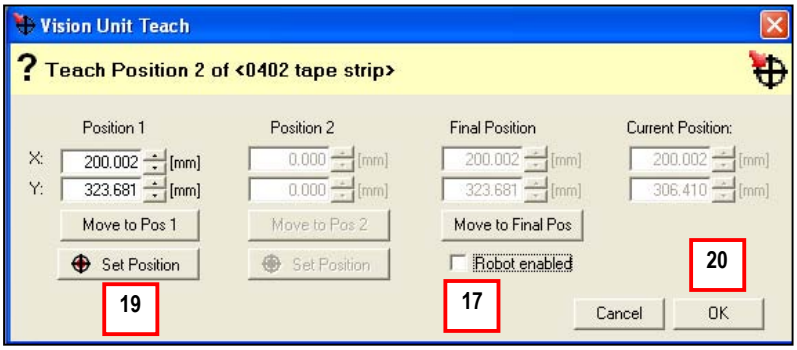
15. Select “Teach 2nd Pocket Center”

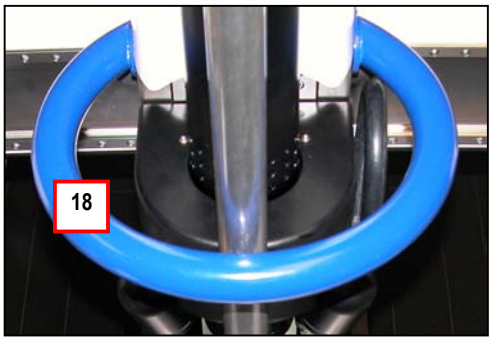


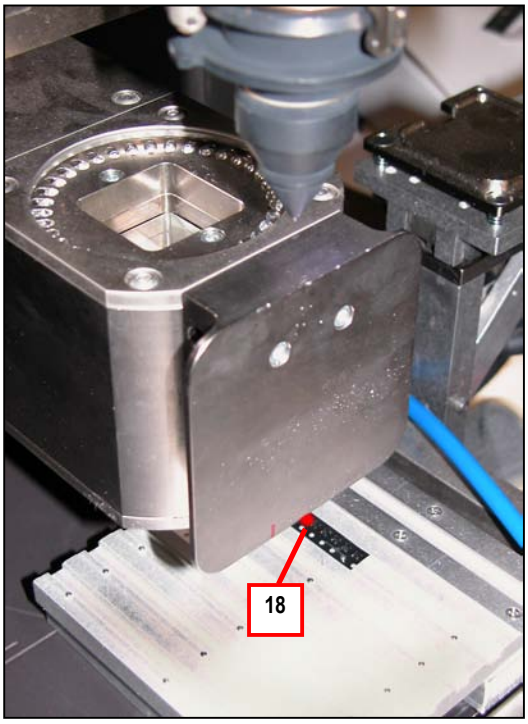
16. Double click on “Vision Unit (Laser Pointer X/Y).



17. Uncheck the “Robot Enabled” box.
18. Use the blue ring to position the laser pointer over the center of the last (ie. 20th) 0402.
19. Select “Set Position” under **Position 1** even though you are teaching Position 2. Note the Position 2 column is grayed out.
20. Select “OK”.

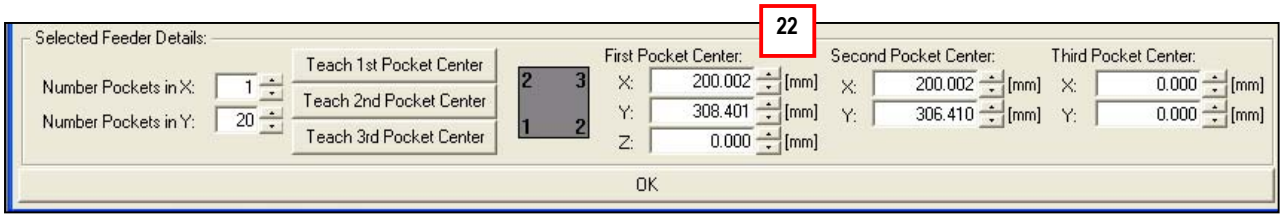




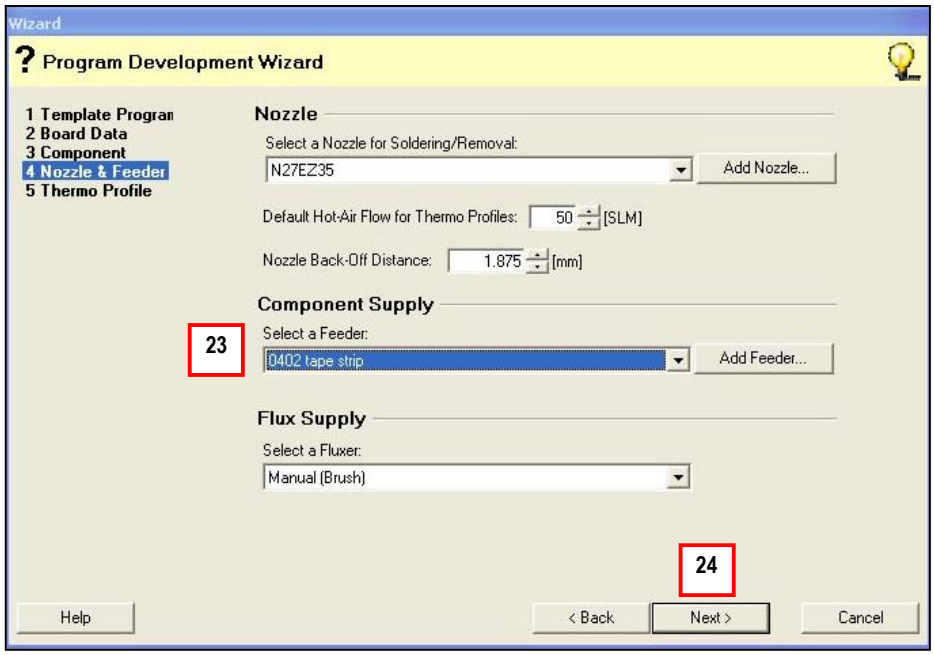


21. Select “Accept”

22. Note that the X/Y coordinates for the first pocket and second (ie. Last) pocket are now displayed below. Also note that the X position is the same for both pockets as there is only 1 row of 0402's in this case.

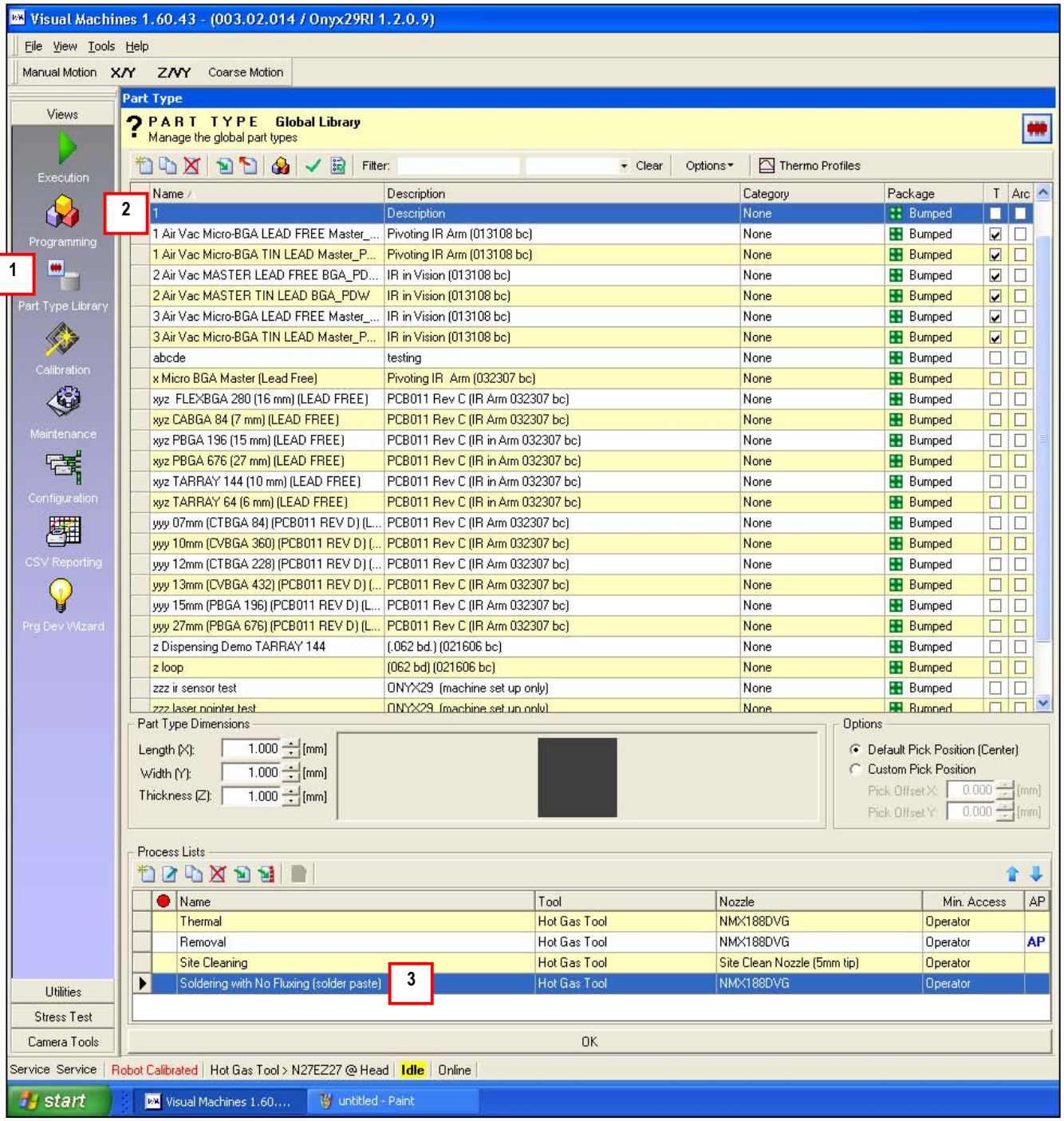


23. The new feeder is now displayed.
24. Select "Next" to continue in the Wizard.



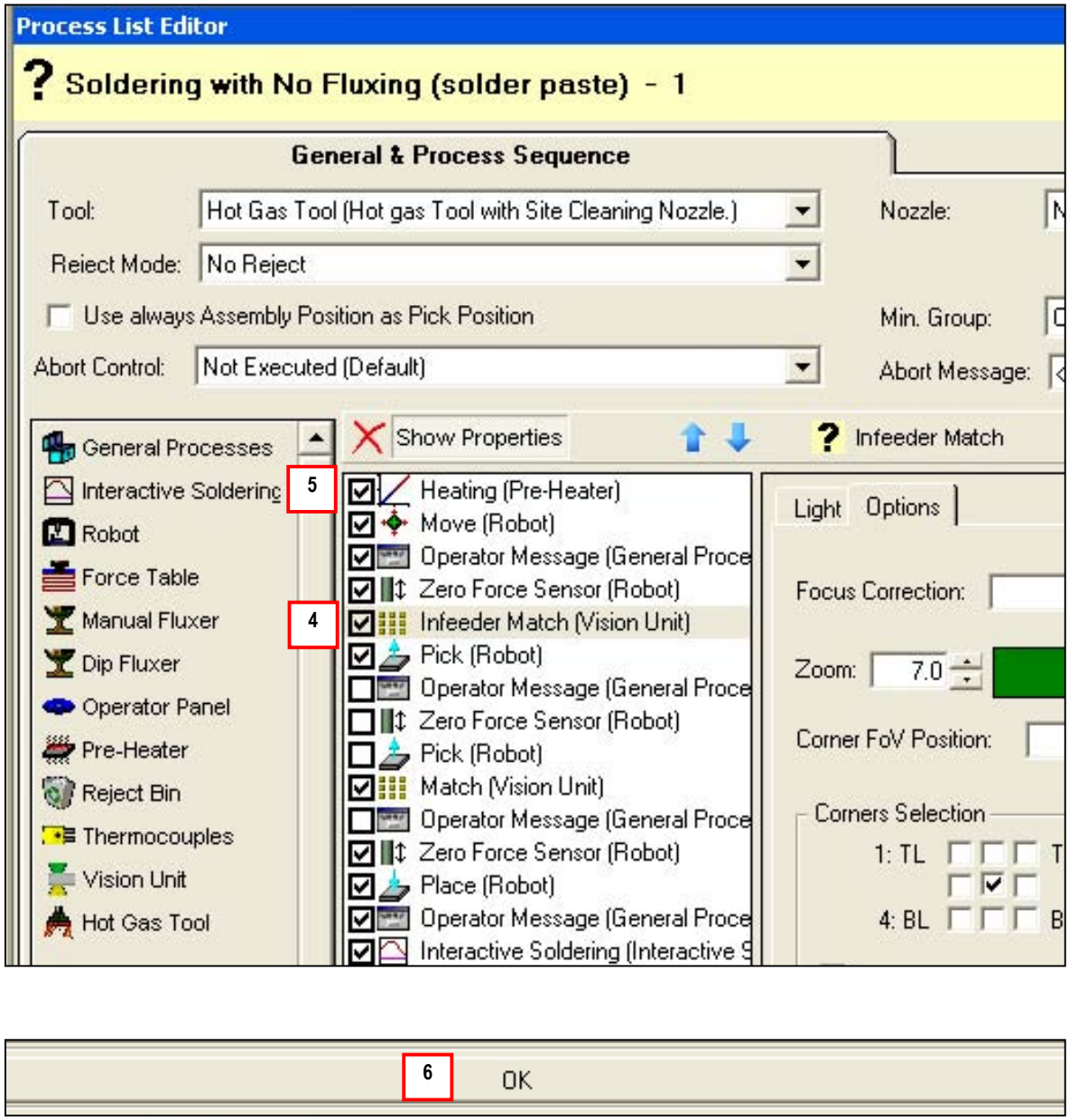
7.4 Vision Assisted Custom Feeder Pick-Up

1. To add vision-assisted pick up for picking parts from the new feeder, go to the Part Type Library after completing the Wizard.
2. Highlight the new part type.
3. Double click on the Soldering Process List.



4. Check the Infeeder Match (Vision Unit) block to activate it.
5. Click on the Heating (Pre-Heater) block. Uncheck Preheater sections #2 (front right) and #4 (rear right).
6. Select “OK” to return to page 1 of the Part Library.
7. Select “OK” to exit the Part Library.

USER NOTE:
The change is saved automatically.



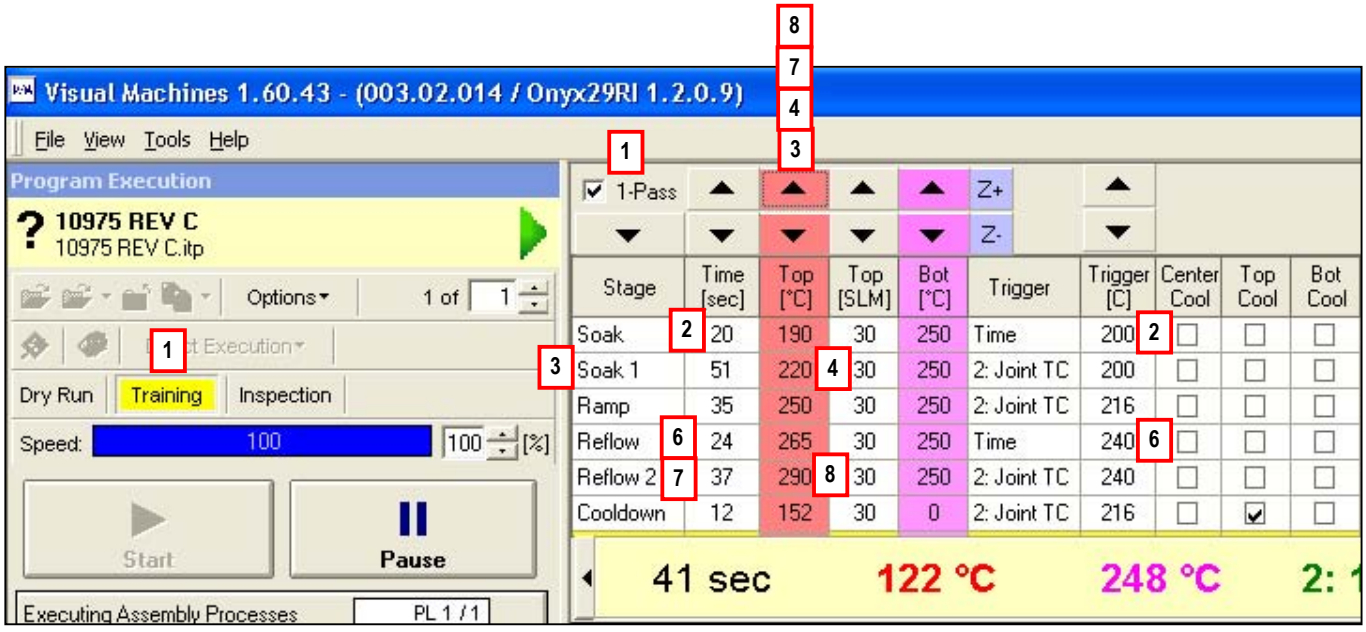
8 Advanced Features – 1-Pass Thermal Profiling

1-Pass is a powerful tool that provides on-the-fly thermal profiling adjustment capability.

1. To activate 1-Pass, click on the “Training” box during Interactive Soldering. The “Training” box should be yellow and the 1-Pass check box will activate.

The following are examples of how 1-Pass can be used:

2. After 20 seconds in the Soak Stage, it became obvious that TC#2 (Joint) was not going to reach its target temperature (200C) in a reasonable amount of time (45-75 seconds).
3. A single click on the top heater Up arrow creates a second Soak Stage named Soak 1.
4. Six additional clicks on the Top Heater Up arrow increased the top heater by 30 degrees (5 degrees per click) from 190 to 220C).
5. The total Soak Stage time is now the sum of the initial Soak Stage (20 seconds) plus the user-added Soak Stage (51 seconds) or a total of 71 seconds.
6. After 24 seconds in the Reflow Stage, it was apparent that TC#2 would not reach its target (240C) in a reasonable time (45-75 seconds).
7. A single click on the Top Heater Up arrow created a new Reflow Stage named “Reflow 2”.
8. Five additional clicks on the Top Heater up arrow increased the temperature by 25 degrees (5 degrees per click) from 265 to 290.
9. The total Reflow Stage time is now the sum of the initial Reflow Stage (24 seconds) plus the user added Reflow Stage (37 seconds) or a total of 61 seconds.



USER NOTES:

- 1-Pass allows the user to change all the parameters in Interactive Soldering, however Air-Vac recommends the following:
    - Increase/Decrease top heater temperature as the Primary means for making profile changes on the fly. The recommended temperature range change is +/- 10-25 degrees.

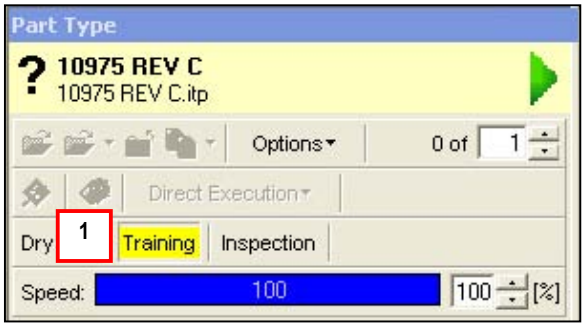
      IMPORTANT: Decreasing top heater temperature by more than 10 degrees is not recommended as this will create a non-linear heating curve which may not yield optimal soldering results. If the original temperatures are too high, Air-Vac recommends stopping, editing the parameters and re-running.

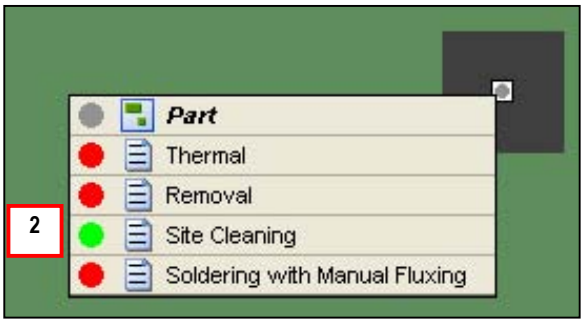
    - Increase/decrease top heater flow rate (slm) as a secondary means for making profiling changes on the fly. The recommended flow rate change is +/- 5 LPM.
    - Changing bottom heater temperature is not recommended due to slower response time of the bottom heater.
    - The trigger temperature can be changed if necessary. The recommended maximum change is +/- 5 degrees.

9 Advanced Features – Site Cleaning

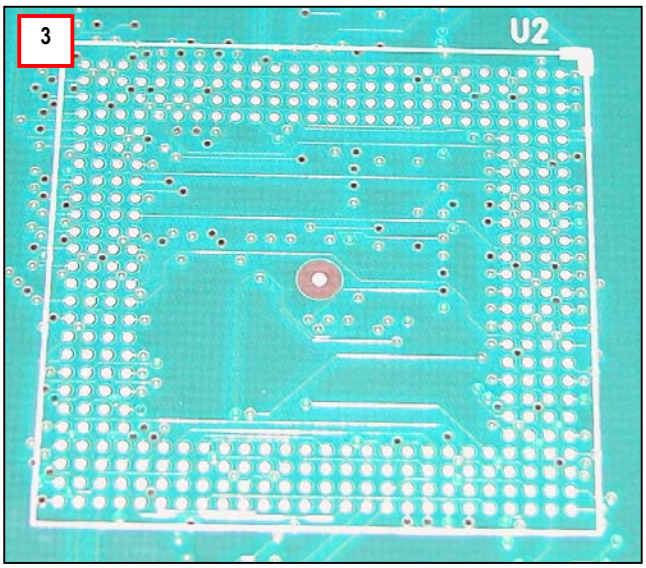
Site cleaning parameters can be modified if required for specific applications.

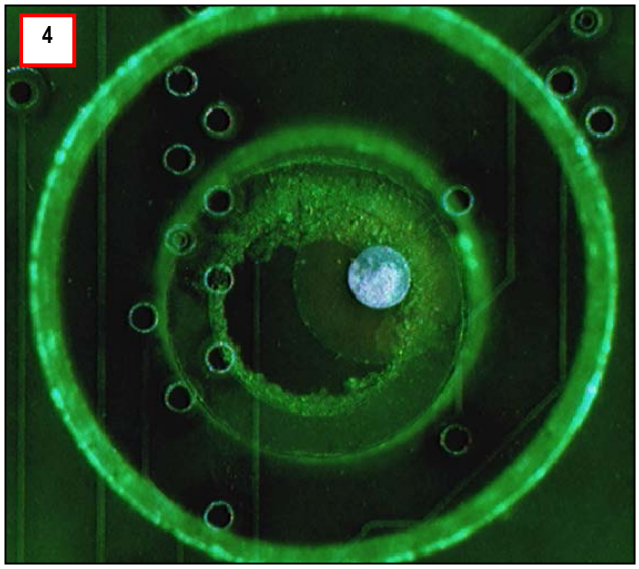
1. Activate Training mode (yellow highlight)
2. Activate the Site Cleaning process



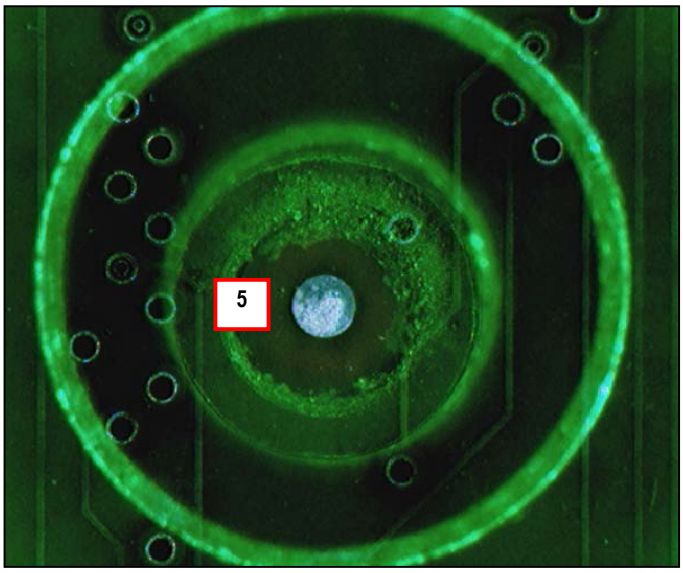


3. This is a 35mm perimeter-only site with no center pads.
4. The photo below indicates that centroid of the 35mm site is not centered under the Site Clean nozzle.



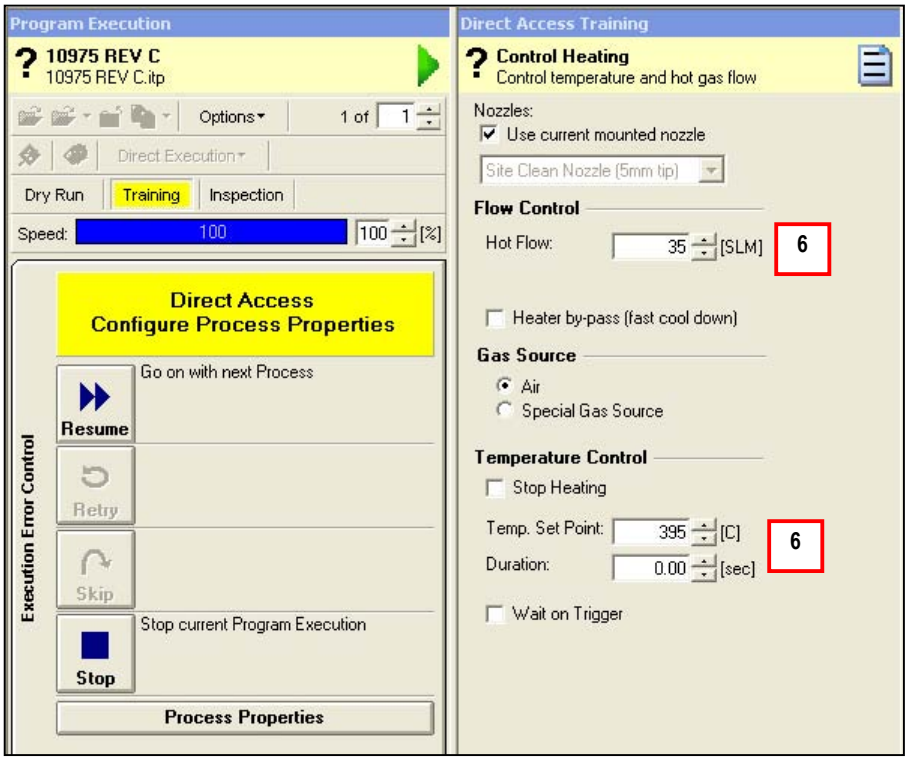


5. Use the X/Y wheels to center the site clean nozzle over the centroid of the site as shown below.

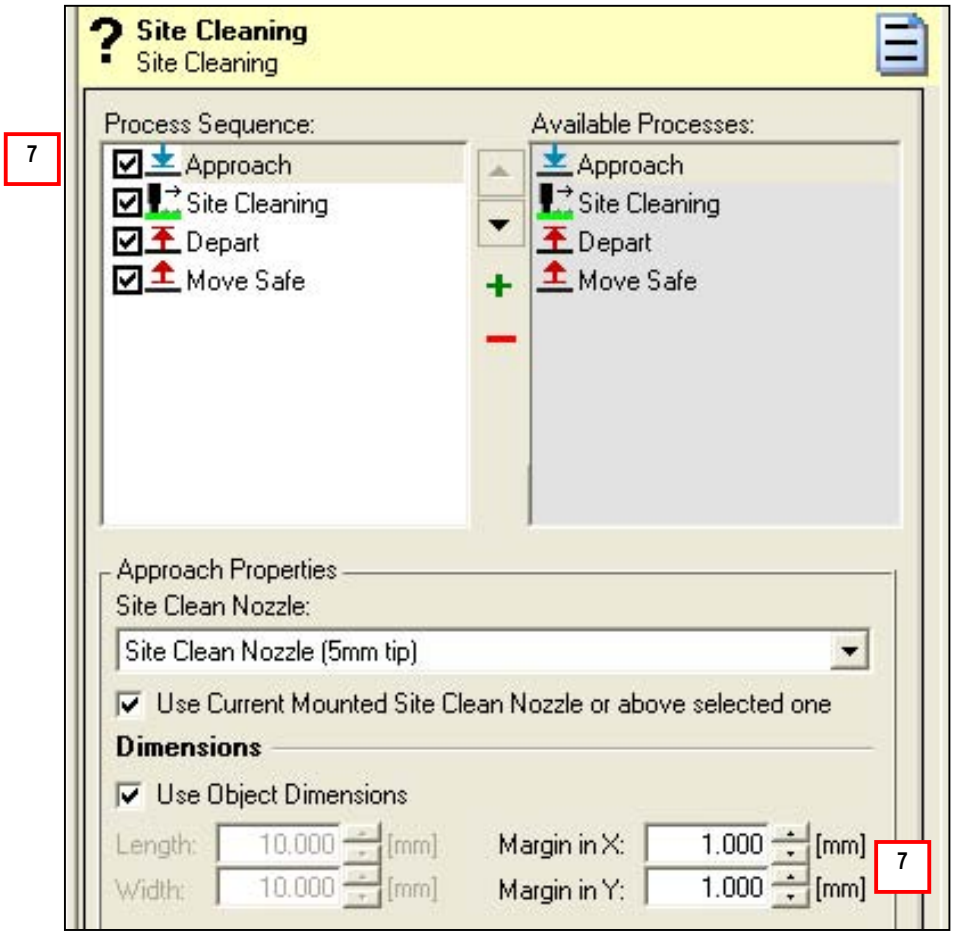


- You have access to all key site clean parameters because “Training Mode” was selected.

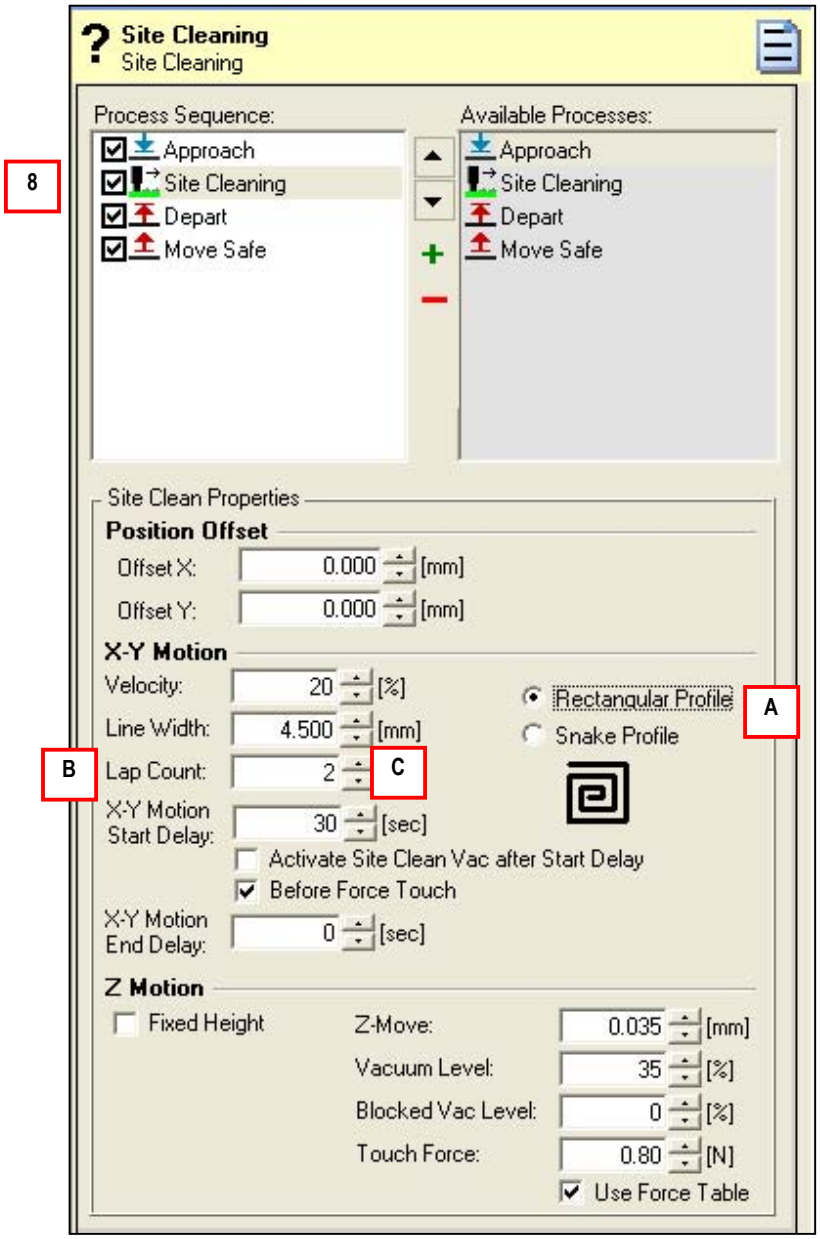
6. The heater temperature and flow can be adjusted if required.



7. In Site Cleaning Approach, the X/Y margin of 1mm can be changed to zero. Do this if there are discretes very close to the site. This will reduce the size of the site clean pattern to the exact component size entered in the Wizard.

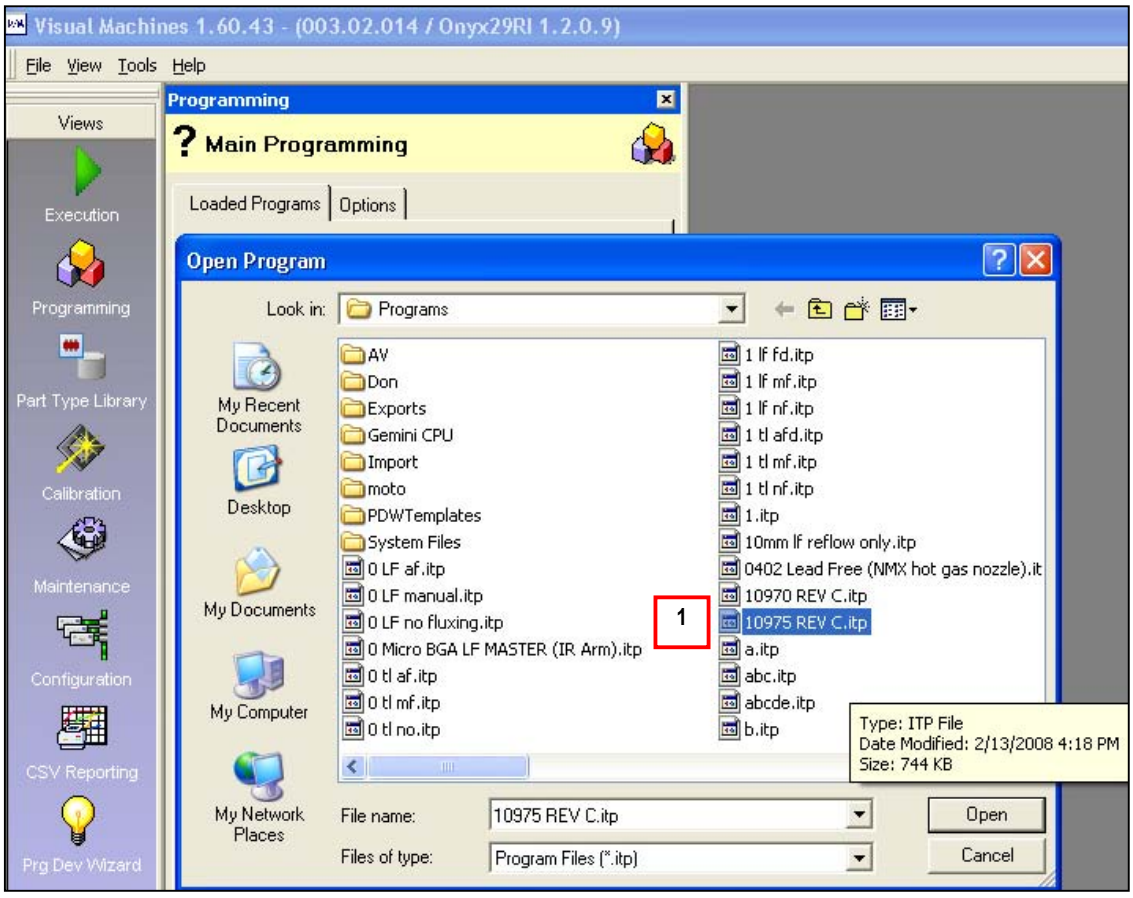


8. Under Site Cleaning, **A** - we will change the pattern from snake (cleans entire site) to rectangular. **B** -This change activates the “Lap Count Box”. **C** – Change the Lap Count from zero to 2. These changes will result in a rectangular site clean pattern. After the first rectangular pass is complete, the site clean nozzle will index inward 4.5mm (line width) and make a second pass. Custom site clean patterns can also be created using the pattern generator. Contact Air-Vac Engineering for further assistance on site cleaning.

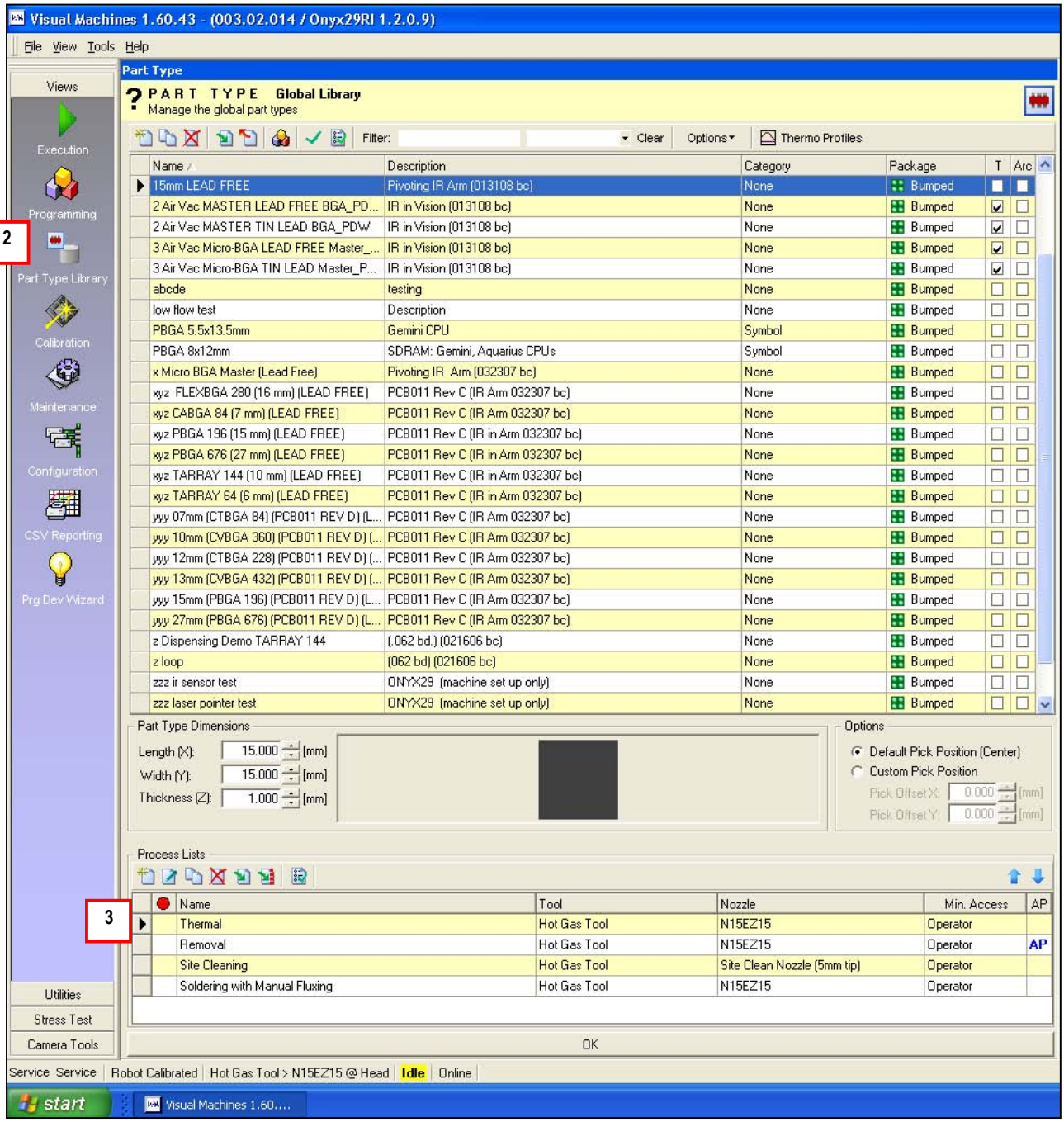


10 Details of Automatic Program Creation

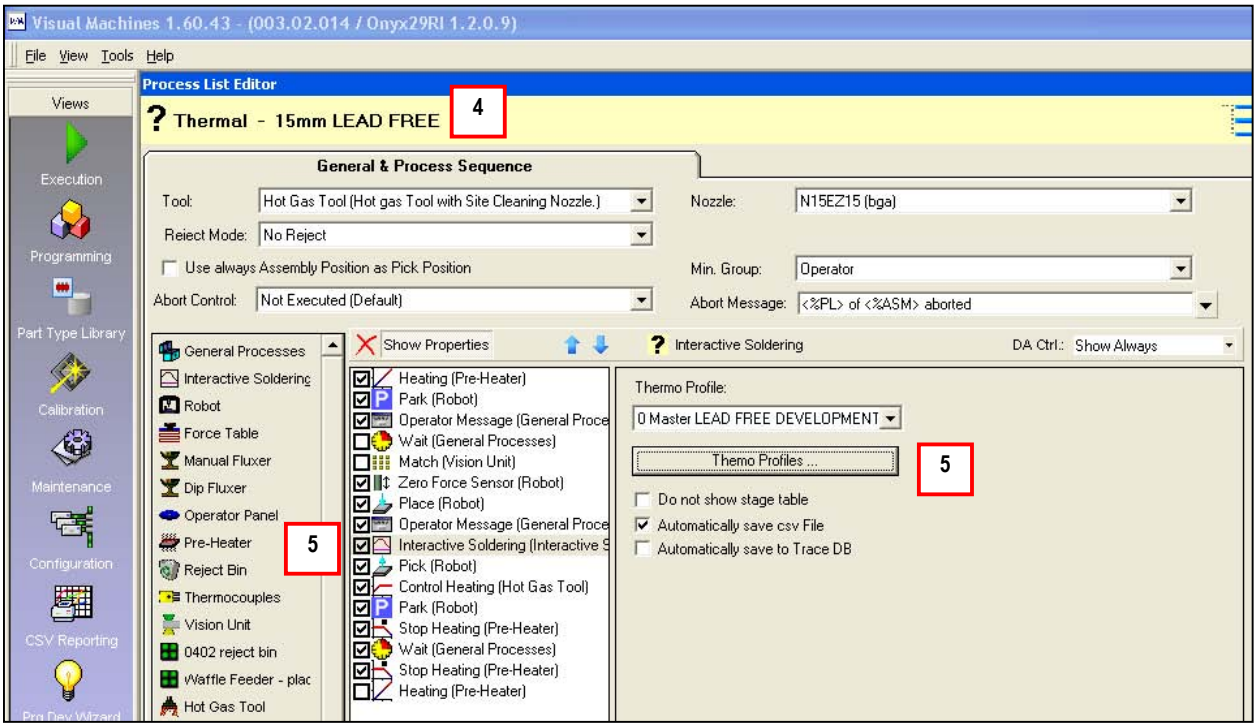
1. The Wizard has automatically created a program based on user input. In this case we named the program “10975 Rev C”, based on the board name. The program can be found in the Programming view.



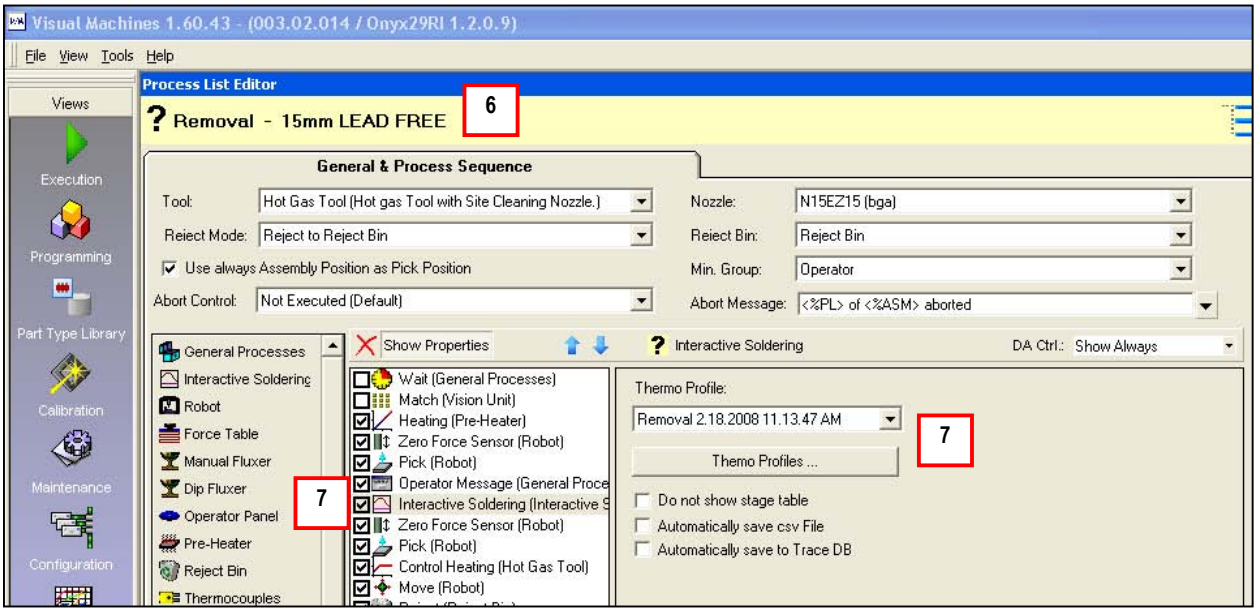
2. The Wizard has also automatically created a new part type named “15mm LEAD FREE” based on our input. The new part type is stored in the part type library.
3. The new part type has Thermal, Removal, Site Cleaning and Soldering Processes. Double click on the Thermal Process List.



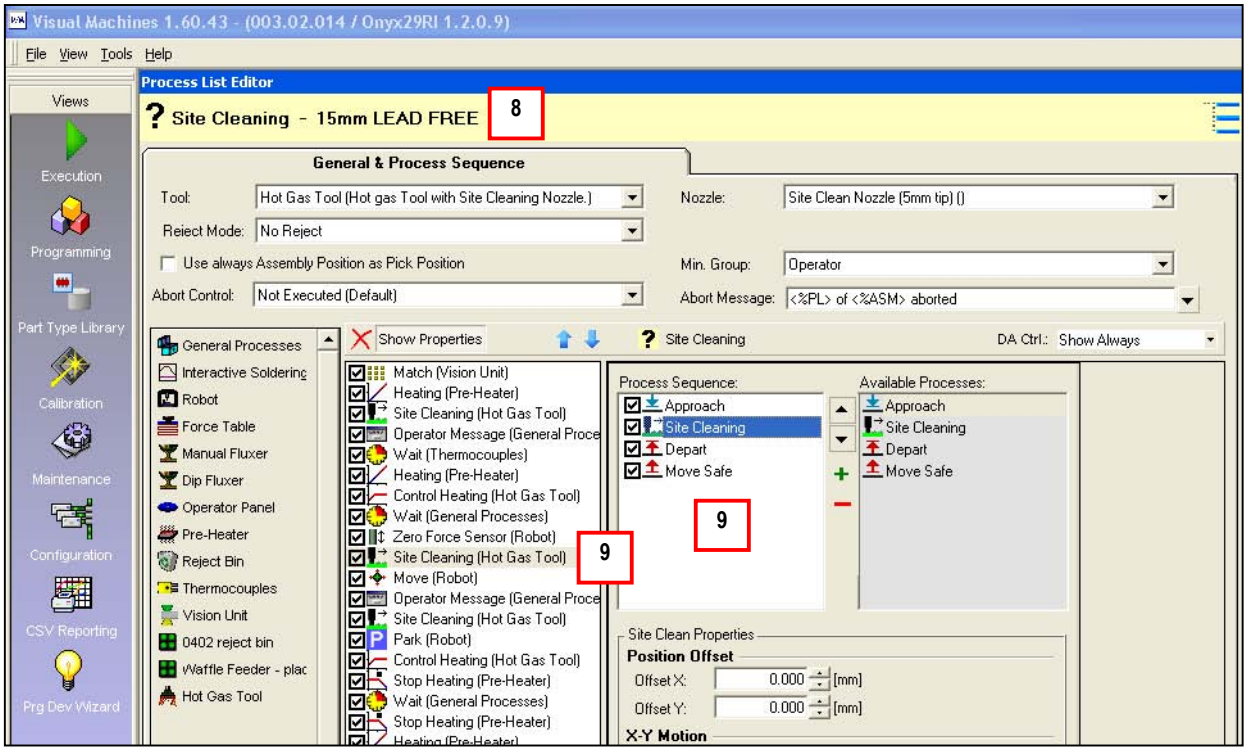
4. The process steps for “Thermal” are displayed.
5. Click on any block to see the details.



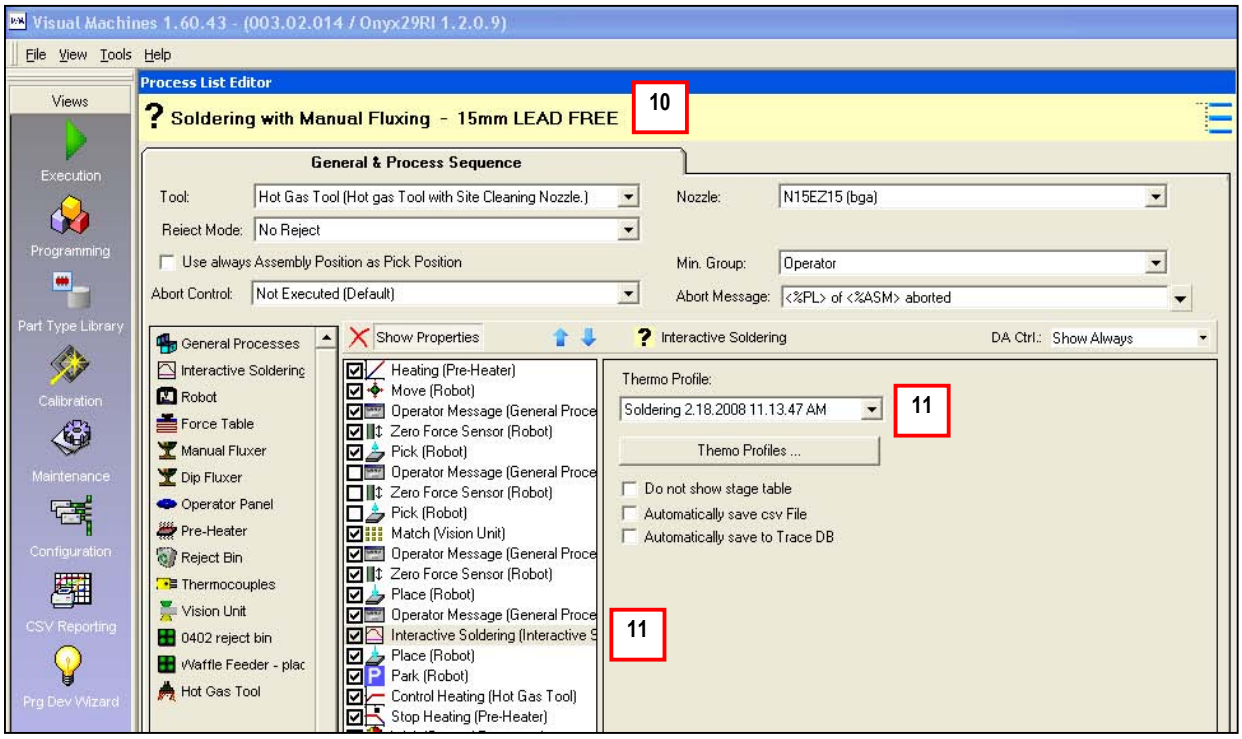
6. Removal process steps.
7. Automatic creation of production-based removal profile for 15mm Lead-Free device shown here.



8. Site cleaning process steps.
9. Site cleaning details.



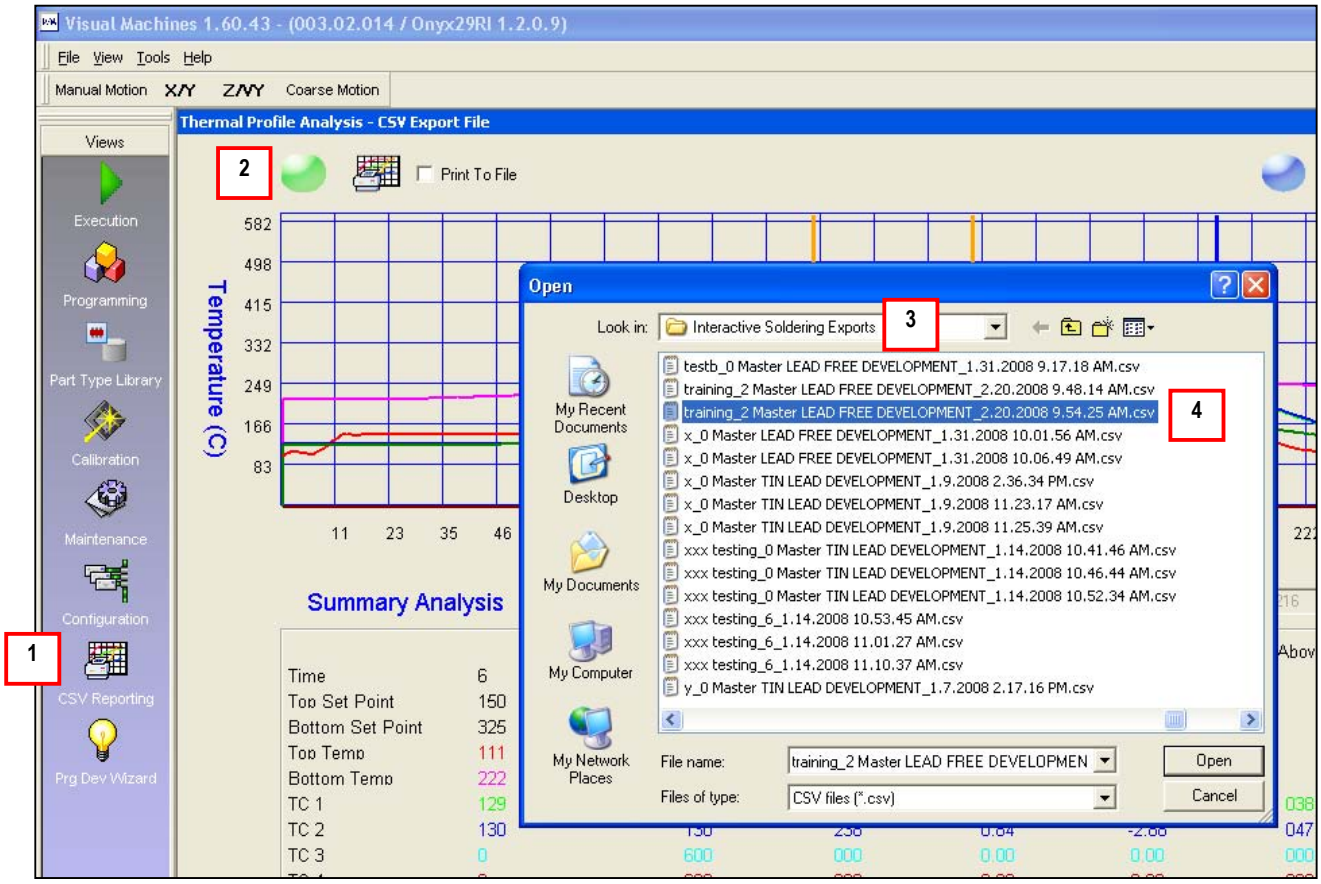
10. Soldering process steps.
11. Automatic creation of production-based soldering profile shown here.



11 Thermal Profile Analysis & Printing

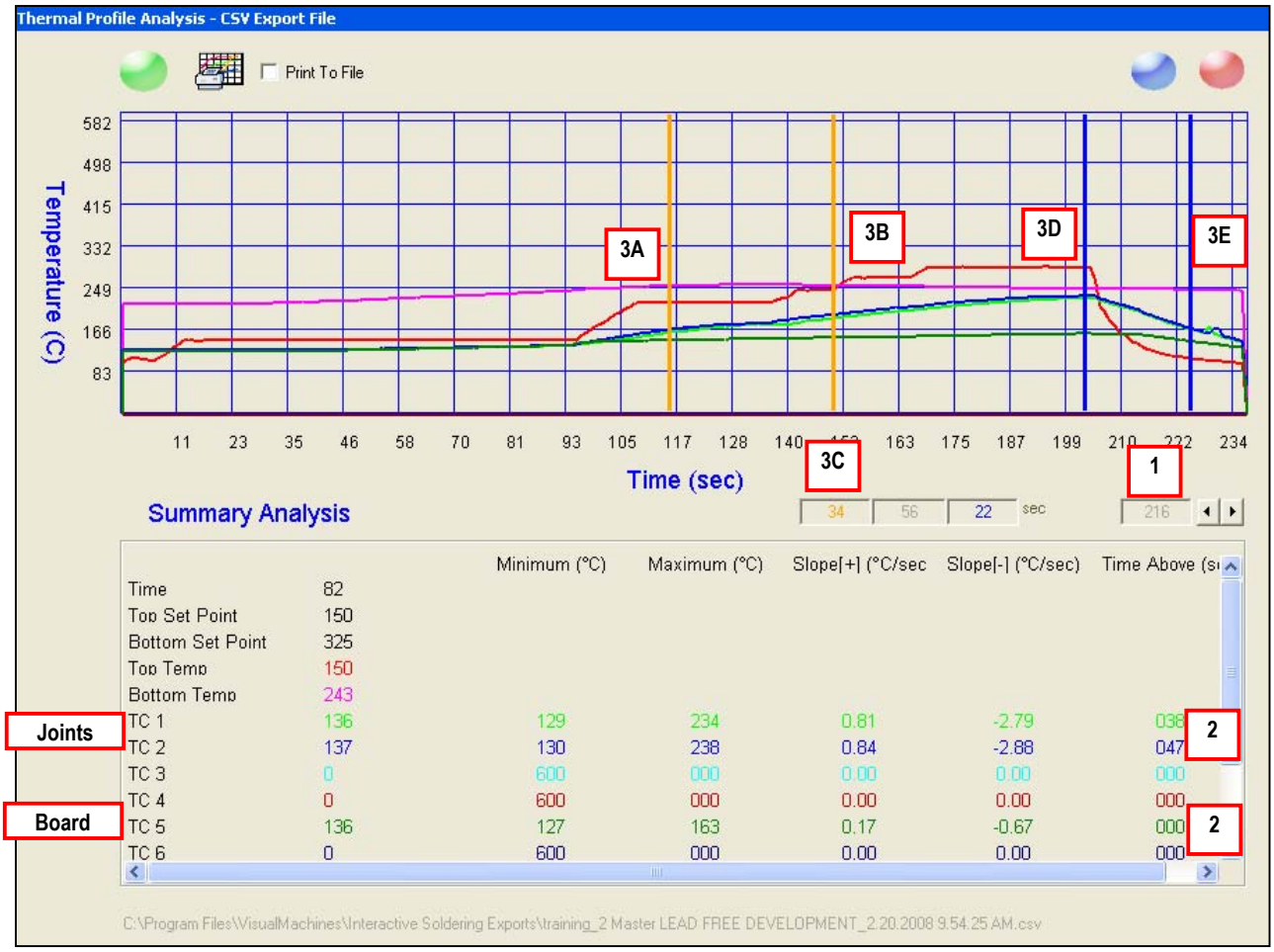
Any Thermal Profile that is saved can be analyzed and printed for documentation purposes.

1. Click on the “CSV Reporting” icon under Views.
2. Click on the green ball at the top of the page.
3. If necessary, change the look in directory to “Program Files/Visual Machines/Interactive Soldering Exports”. Scroll through until you find the file that you want (look for the board name at the beginning of the export file name and the date/time at the end of the file name.
4. Double click on the desired export file to open it.



In this case, TC#1 and #2 are the joints (user defined) and TC#5 is the board (IR Sensor).

1. Change the “Time Above (seconds)” box to 216 as this is a Lead-Free profile (ie. Reflow starts at 217).
2. The time above 216 for all TC’s will be automatically displayed.
3. Use the yellow bars to determine the length of the Soak Stage.
   - **A -** Position the first yellow bar where the average joint temperature is 170 (start of Lead-Free Soak).
   - **B -** Position the second yellow bar where the average joint temperature is 200 (end of Soak).
   - **C -** The time in Soak will be displayed in yellow. In this case 34 seconds.
   - **D -** Position the first blue bar (use right side of mouse) at the end of the Reflow Stage.
   - **E -** Position the second blue bar (use right side of mouse) near the end of the profile.

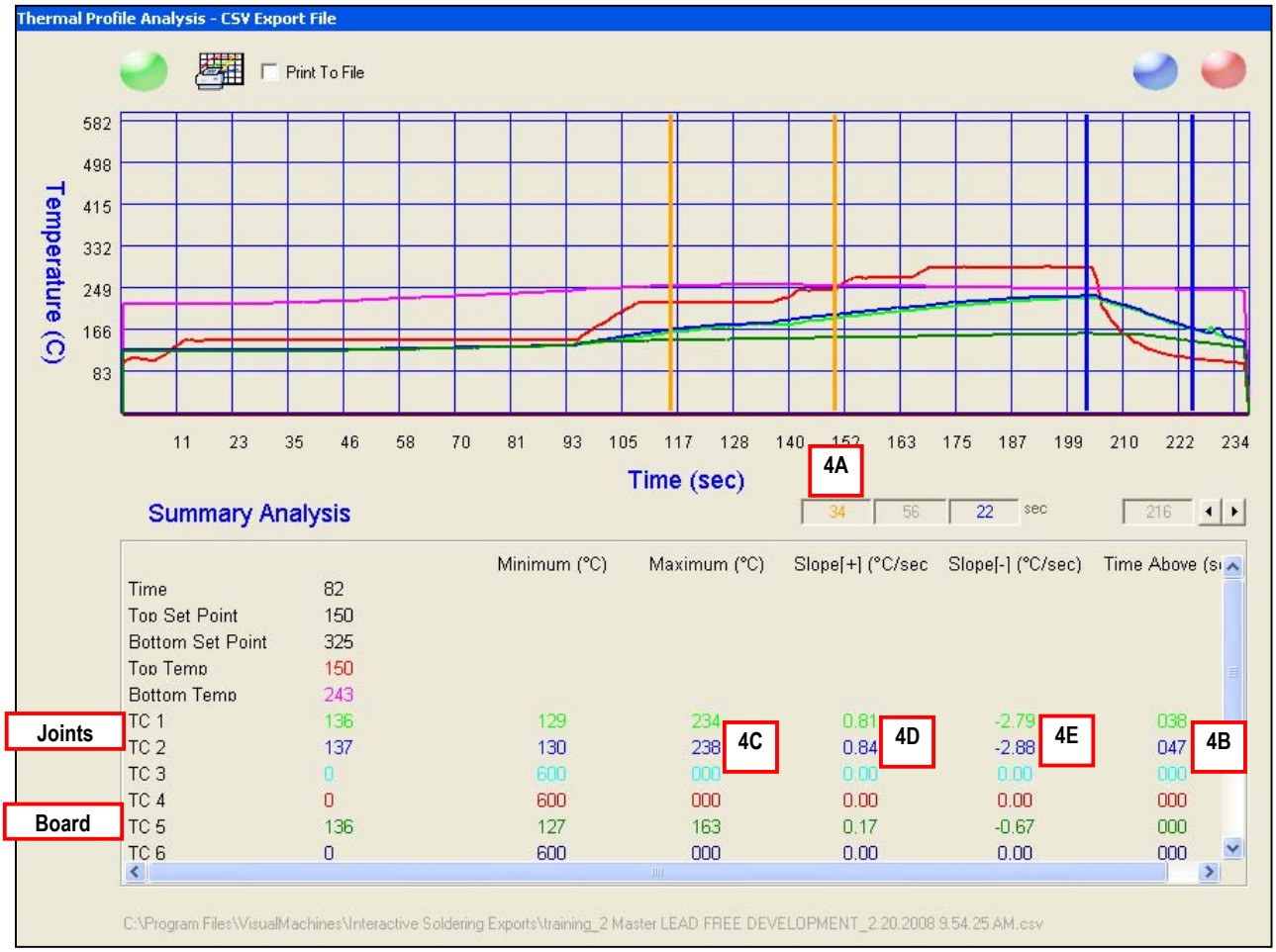


4. Thermal profile analysis.

	Target	Actual
• A – Time in Soak Stage	45-75 seconds	34 seconds
• B – Time over Reflow	45-75 seconds	38-47 seconds
• C - Maximum Joint Temperature	235-240C	234-238C
• D - Heating Slope	<3°/sec	.81°-.84°/sec
• E – Cooling Slope	<-5°/sec	-2.79° to –2.88°/sec

Although the profile achieved targeted maximum joint temperature and the heating/cooling slopes met the targets, the time in both the Soak and Reflow stages were less than the minimum targets.

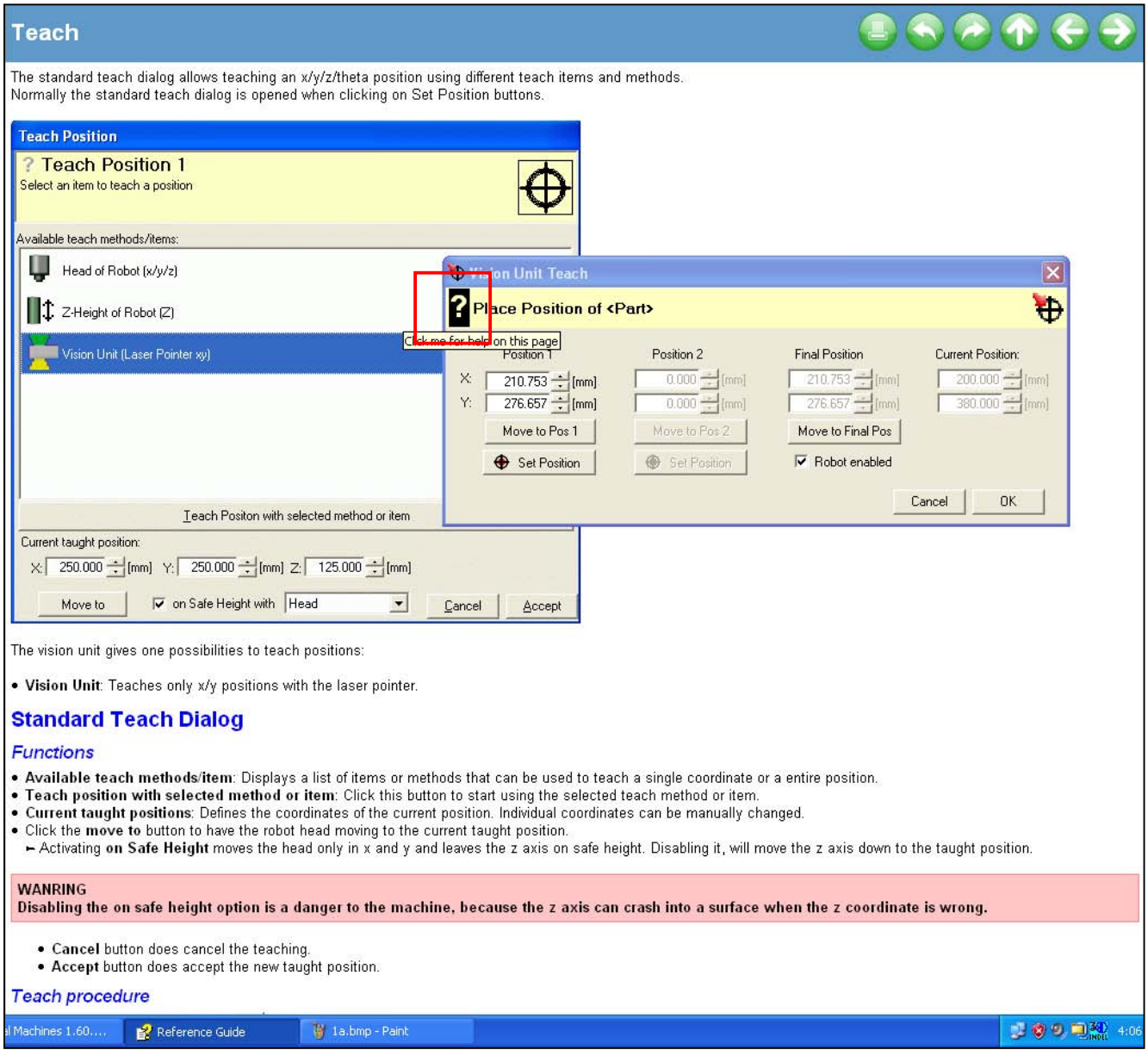
In this instance, Air-Vac recommends re-running the Thermal Profile. Lower the top heater temperature in both the Soak and Reflow stages by approximately 15-20 degrees, which will extend both the Soak and Reflow time, in an effort to meet targeted duration times.



12 Miscellaneous

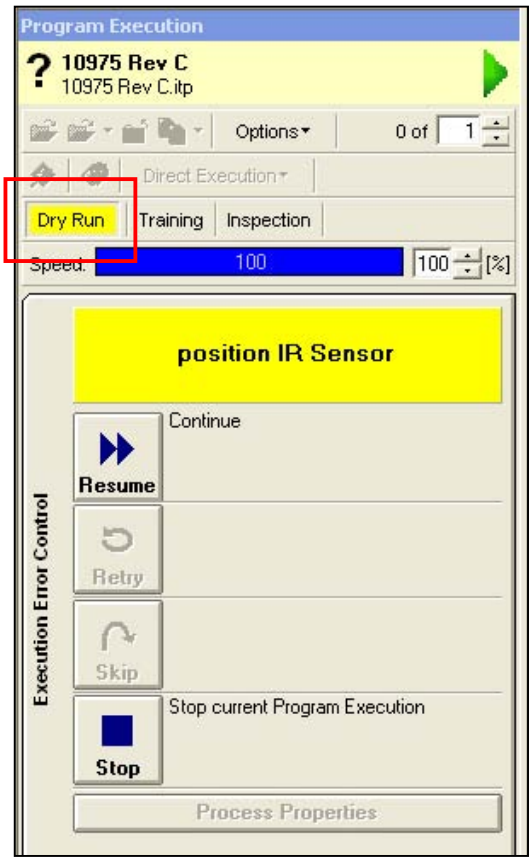
12.1 Online Help

Online help is available any time a black question mark is visible on the screen.



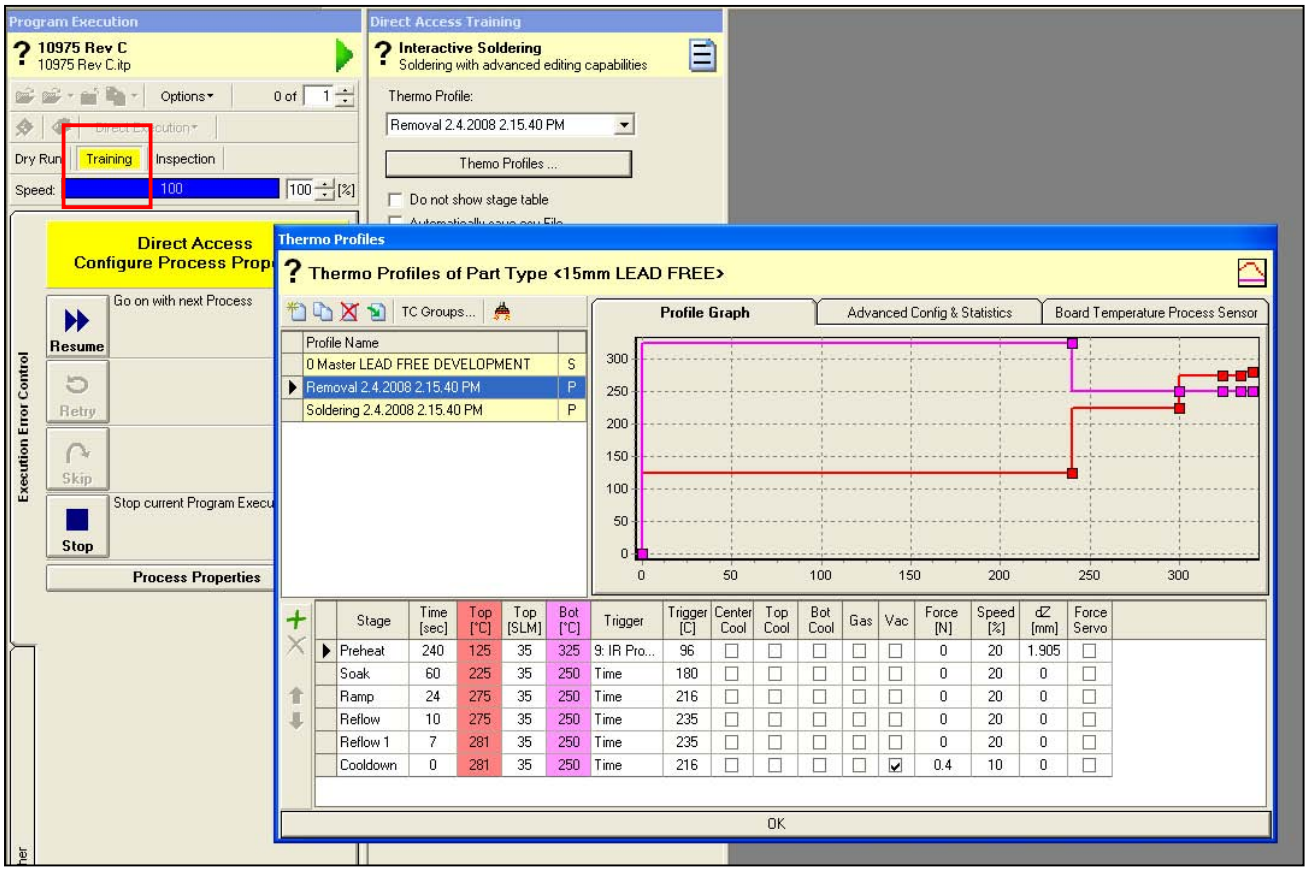
12.2 Dry Run Mode

If the “Dry Run” mode is activated (yellow highlight), the robot will execute all movements, however, no heat will turn on. This is an excellent way to test a program.



12.3 Training Mode

If the “Training” mode is activated (yellow highlight), the user has real-time access to the process parameters. Operators should not have access to the Training mode. Restricting operator access can be done via setup of operator login and password. Please contact Air-Vac Engineering for further information.



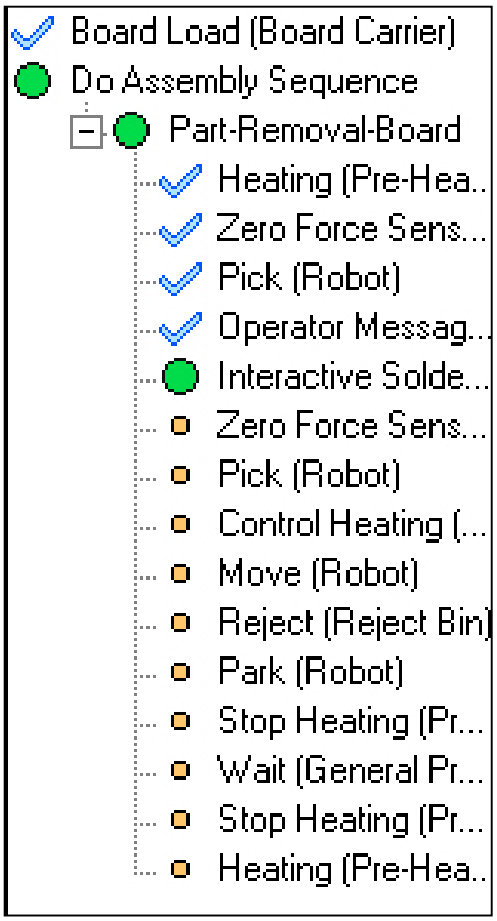
12.4 Program Status Indicator

The current position in the program is always displayed during execution.


- Indicates completion


- Indicates current location


- Indicates to be done



12.5 Z-Height “Stackup”

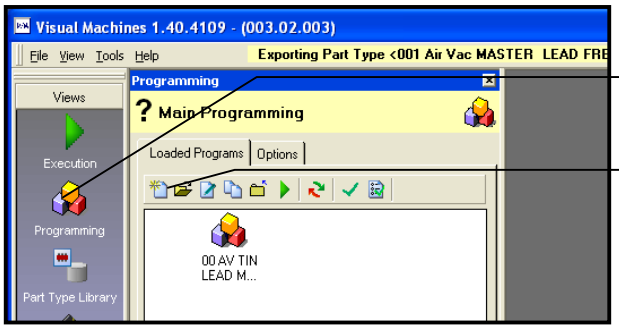
The nozzle should never contact the device or the board prior to force placement. Three parameters determine the “Z” height stackup:

- Nozzle Length
- Component Height
- Board Thickness

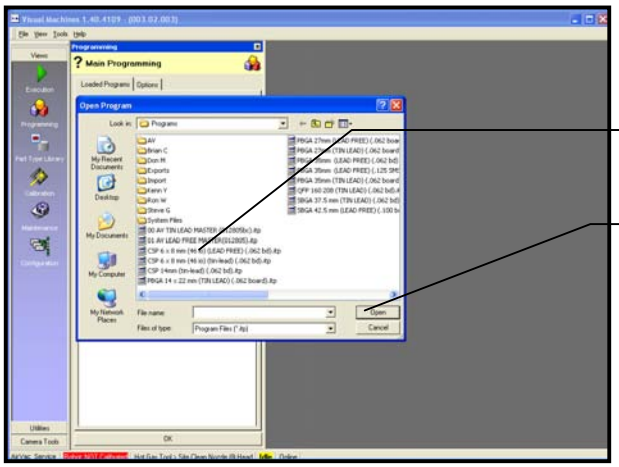
If the nozzle contacts the device or board prior to force placement, one or more of these three parameters is incorrect. Contact Air-Vac Engineering for further assistance.

12.6 Saving/Backing Up/ Transferring Programs

Saving Programs

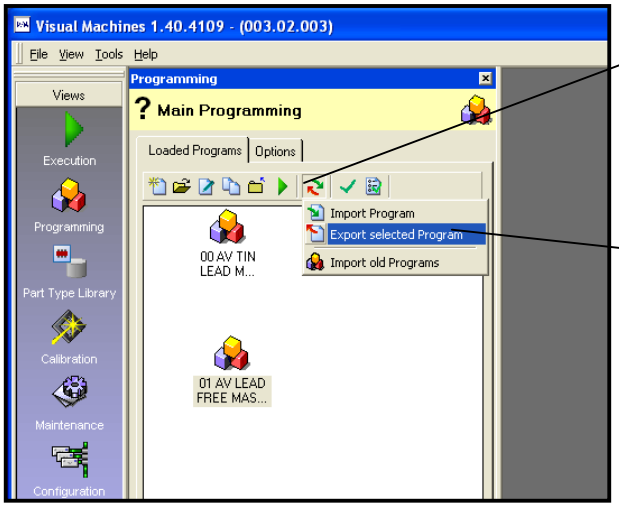


Go To Programming



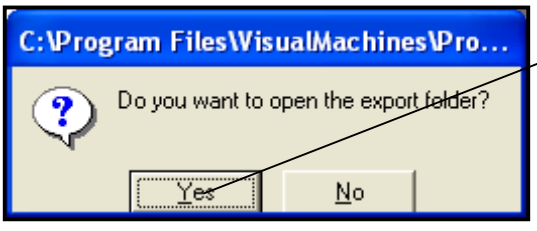
Highlight program to copy

Click on Open (or double click on program.



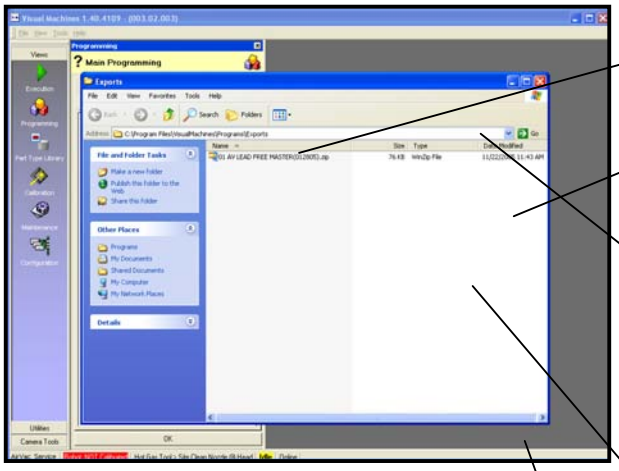
Click on Import and Export Program Icon.

Click on Export selected Program.



Click on Yes to “Do you want to open the export folder?”.

Saving Programs



Highlight program(s) to copy.

Right click mouse and select copy.

Use arrow of Address bar to locate and select drive to be used to transfer program(s).

Use Pull down arrow to find Part/component in Part Type Library. IF needed.

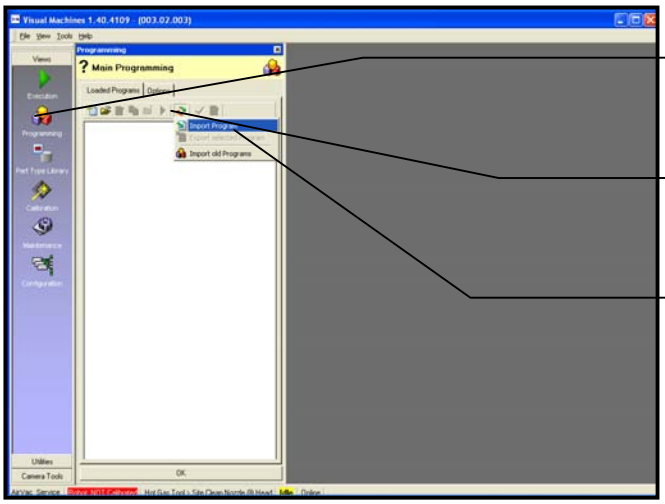
For thumb drive, Go to “Safely Remove Hardware” at bottom right side of screen.

Click on Stop.

Remove thumb drive or disk when finished.

Click on Close. Then Ok.

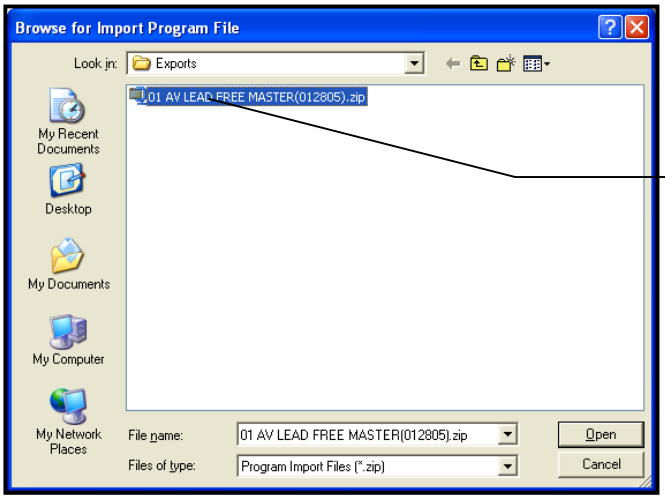
Transferring Programs



Go to Programming View.

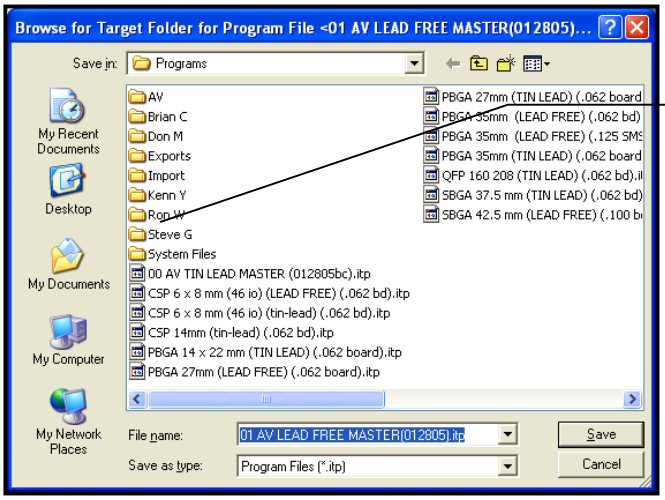
Click on Import and Export Program Icon.

Select Import Program.



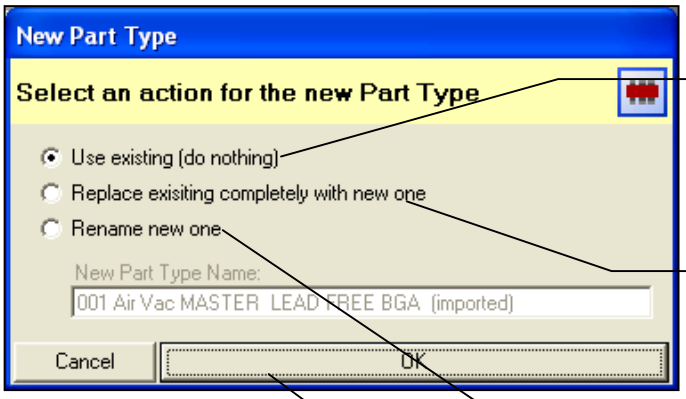
Highlight program to transfer.

Double click on program or click on Save.



Select folder to copy into.

Transferring Programs

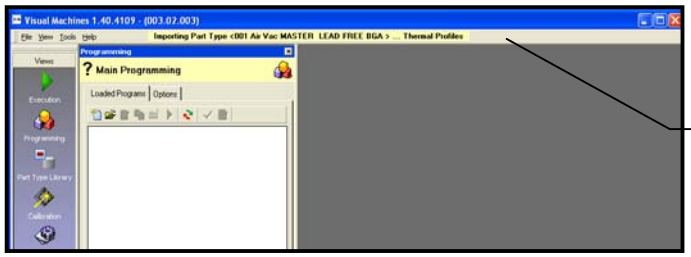


Select part type to copy into. Preferred Path.

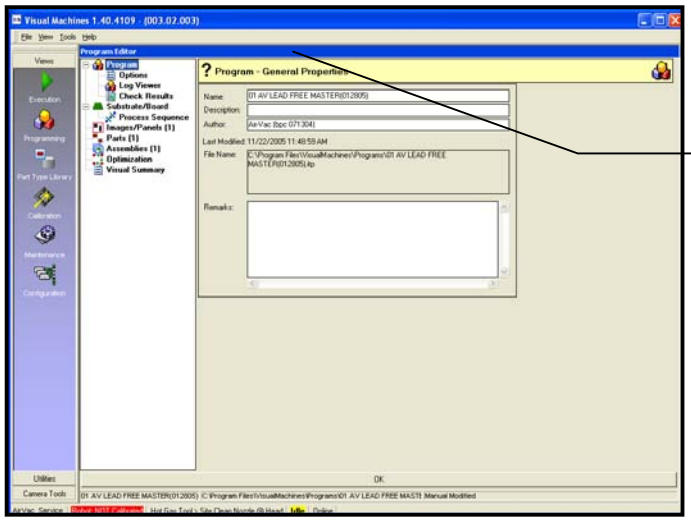
Select if you wish to write over part type with same name.

Select if you wish to save with a different part type name.

Click Ok.



Program will be imported.

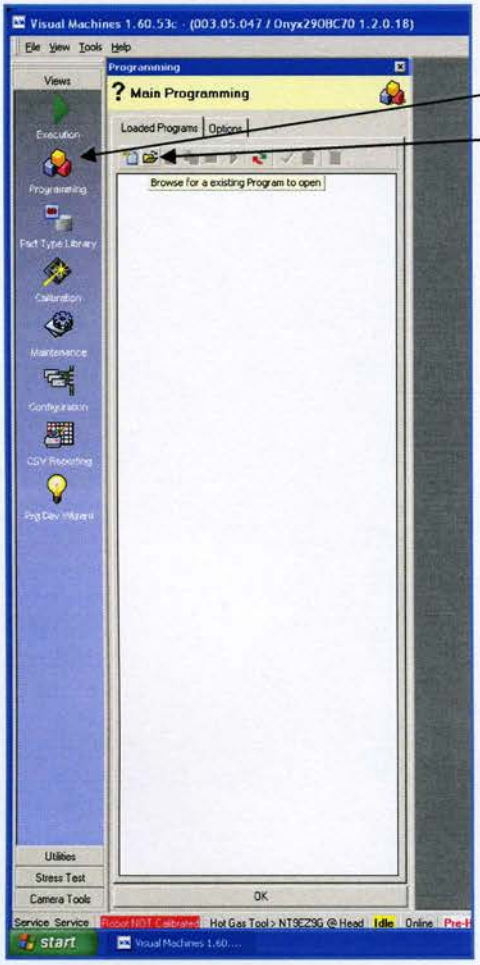


The program will be loaded to the Program Editor of the Programming View.

Creating Multi-Component/ Multi-Panel Programs

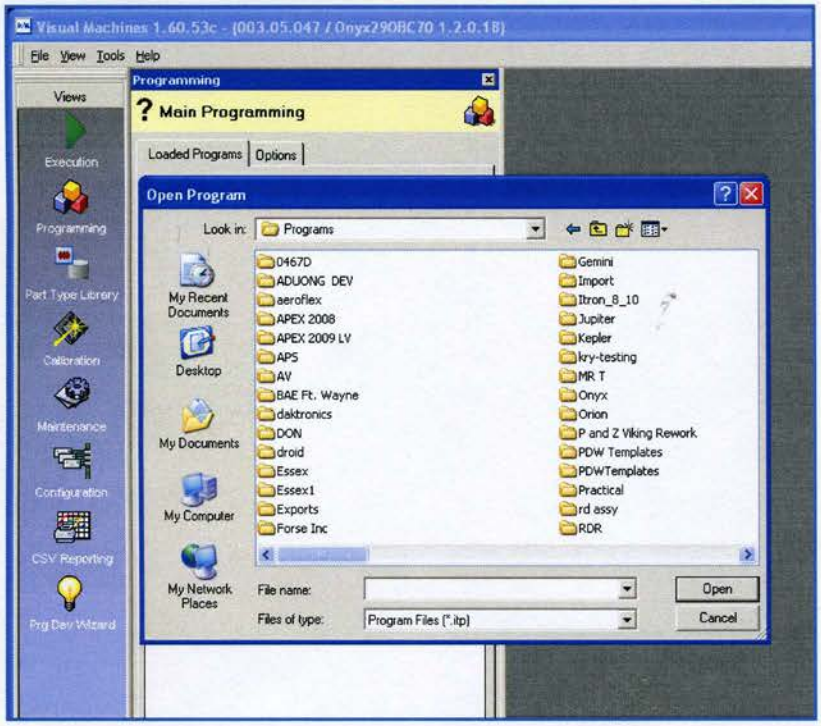
Use PDW (Process Development Wizard) to create Programs (thermal, removal, site cleaning and replacement) for first component. BZF can be taught at this time.

Creating the Multi-Component, Multi-Panel Assembly

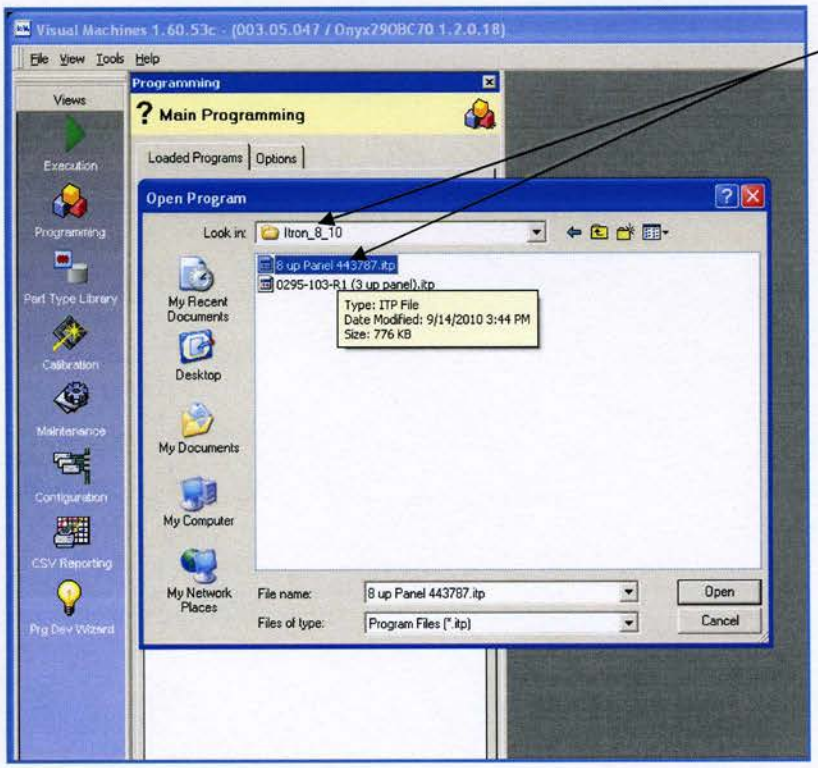


Go to the Programming View

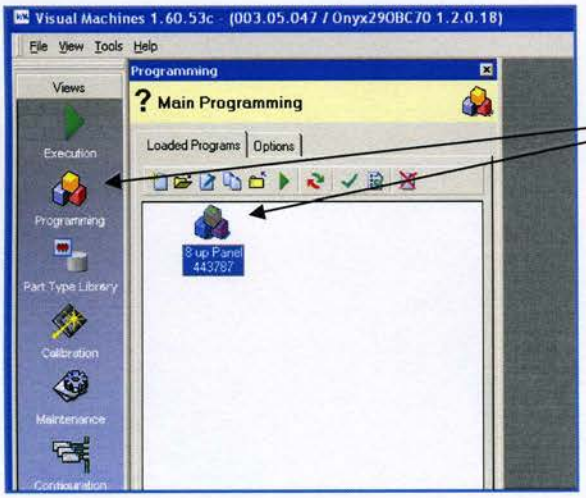
Click on Browse to view the created Programs.



All saved programs will be shown. We will save the all components taught for the multi-component assembly (Placed in the Part Type Library). We will delete all but the first program to create one program with multiple components.



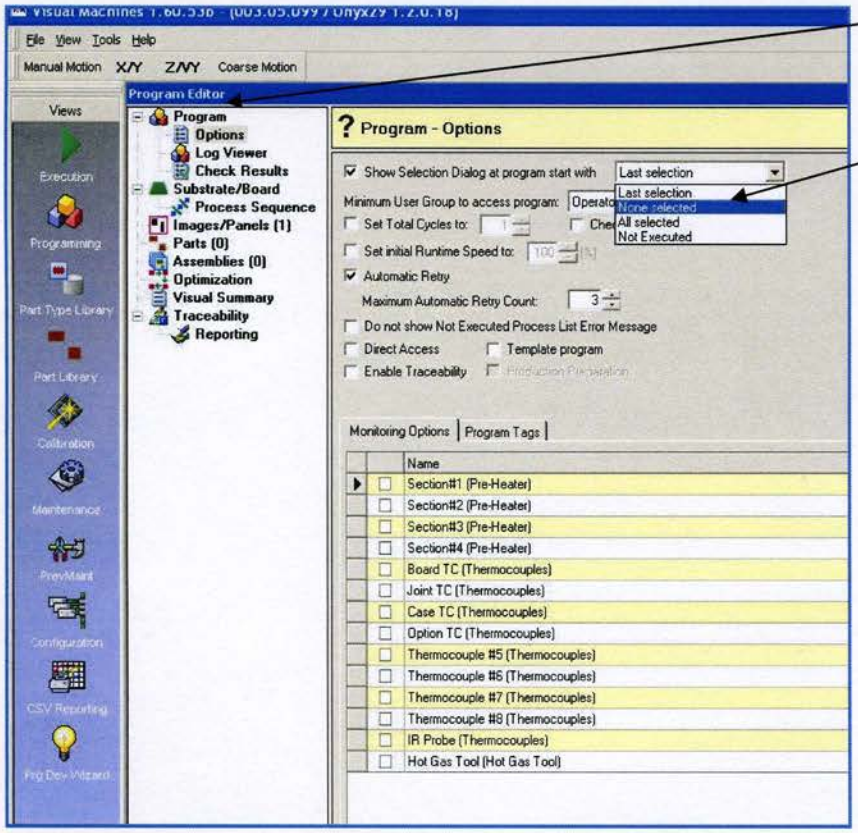
Select the first program taught.



The program will be shown in the Programming View.

Click on the Program Icon.

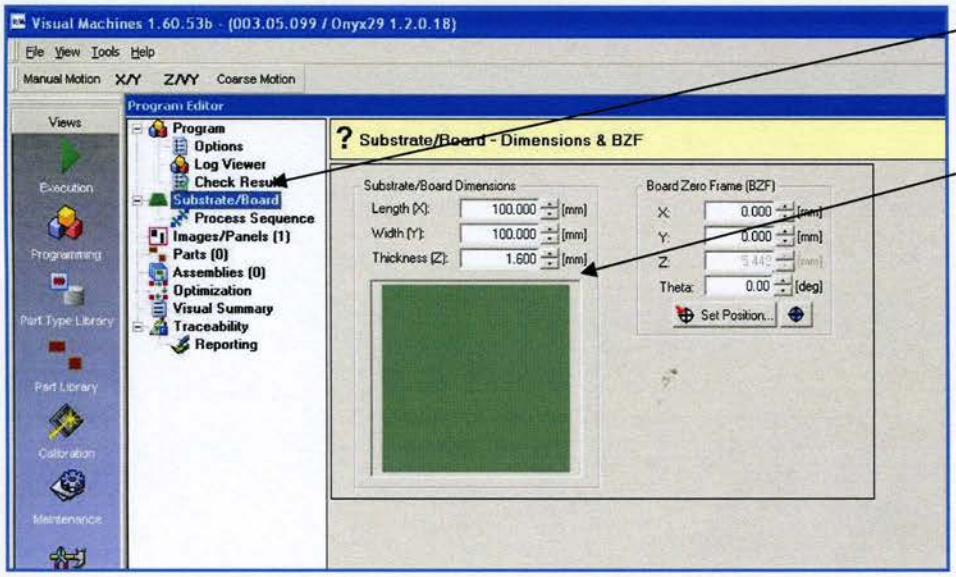
The programming view-detail will be shown.



Under program/options

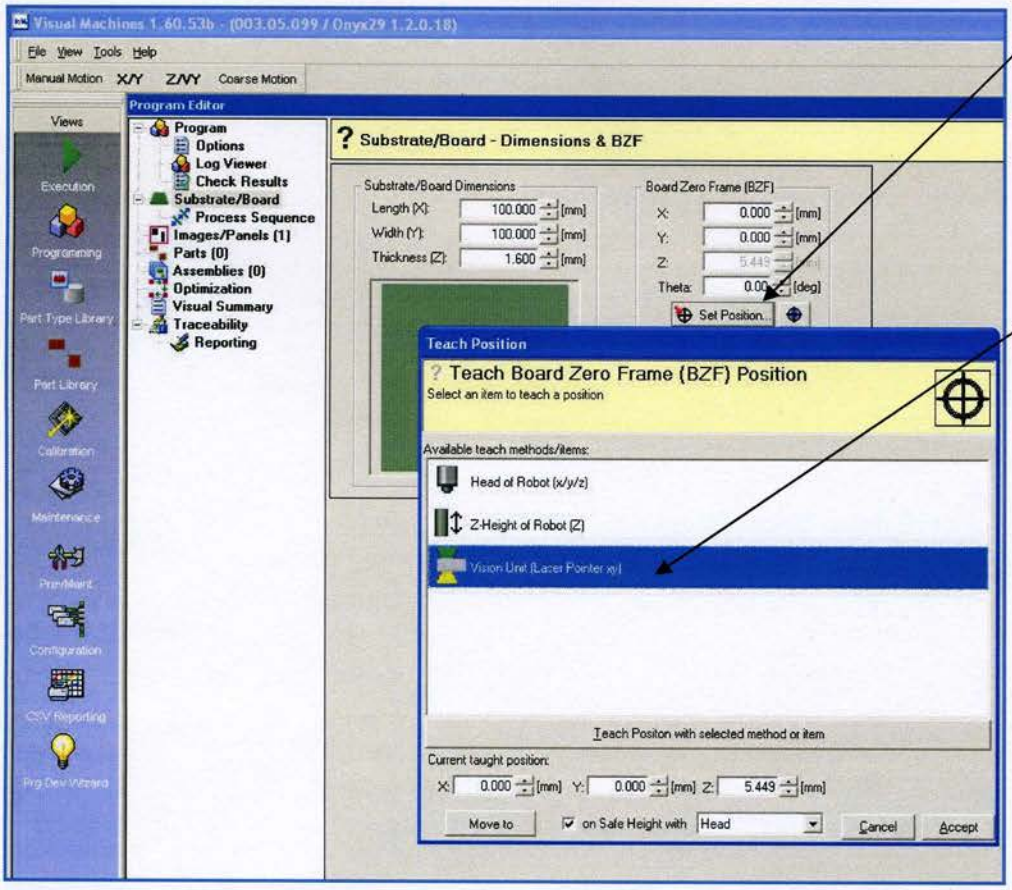
The show selection dialog at program start with should have "last selection" choosen.

(Because we have assemblies with shields over them.)



Go to Substrate/Board

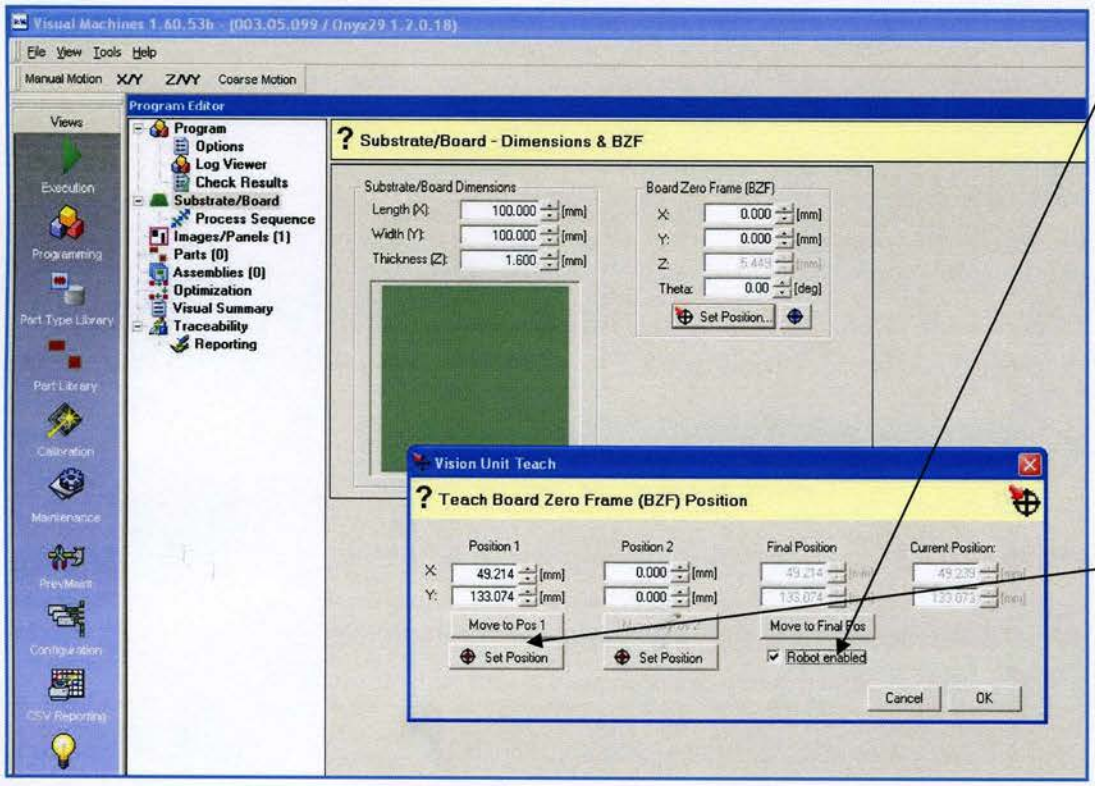
Enter the panel x and y dimensions



Click on Set Position under Board Frame (BZF) to set the BZF.

Select Vision Unit (Laser Pointer xy). Double Click.

The vision unit will extend and the laser light will be activated.



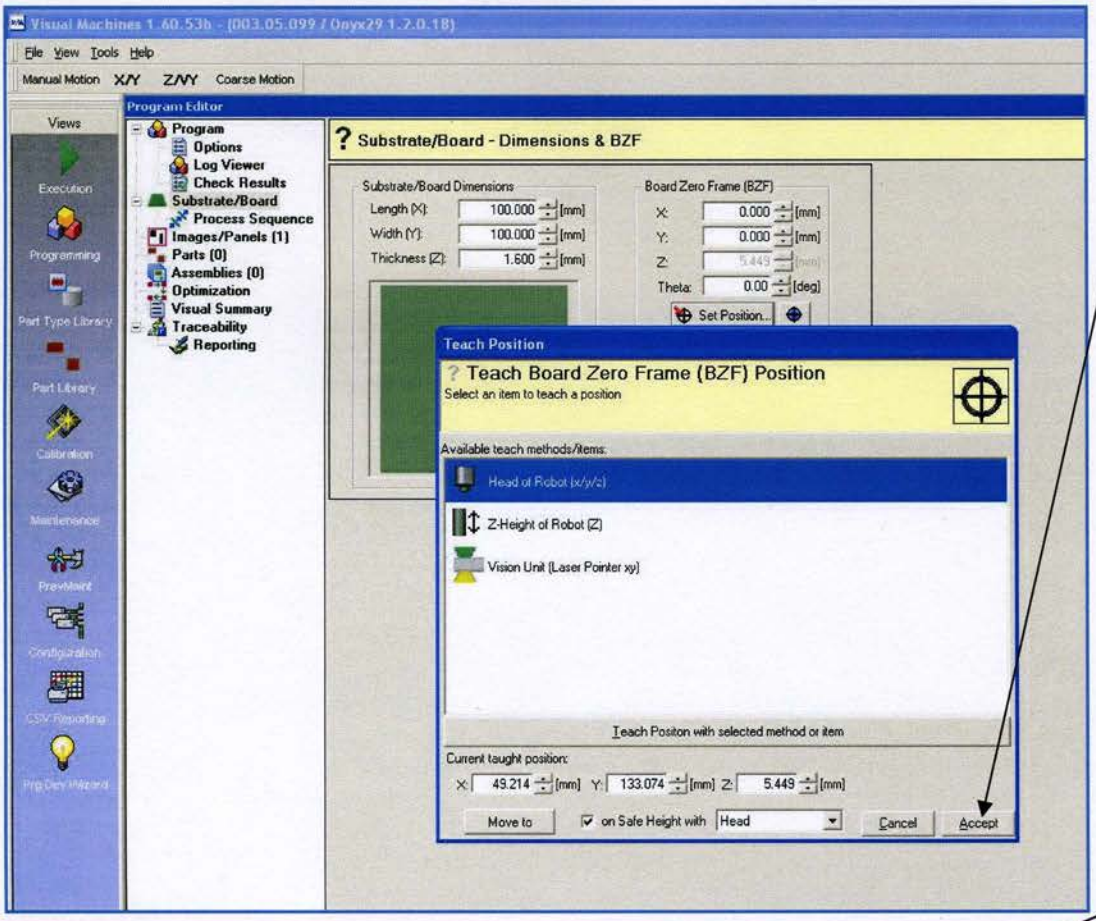
Uncheck Robot enabled.

Move the laser light to the spot for the the BZF. Care must be taken to center the cross-hair in the center of the location as all the components will be taught referencing this.

Click on Set Position to reccord.

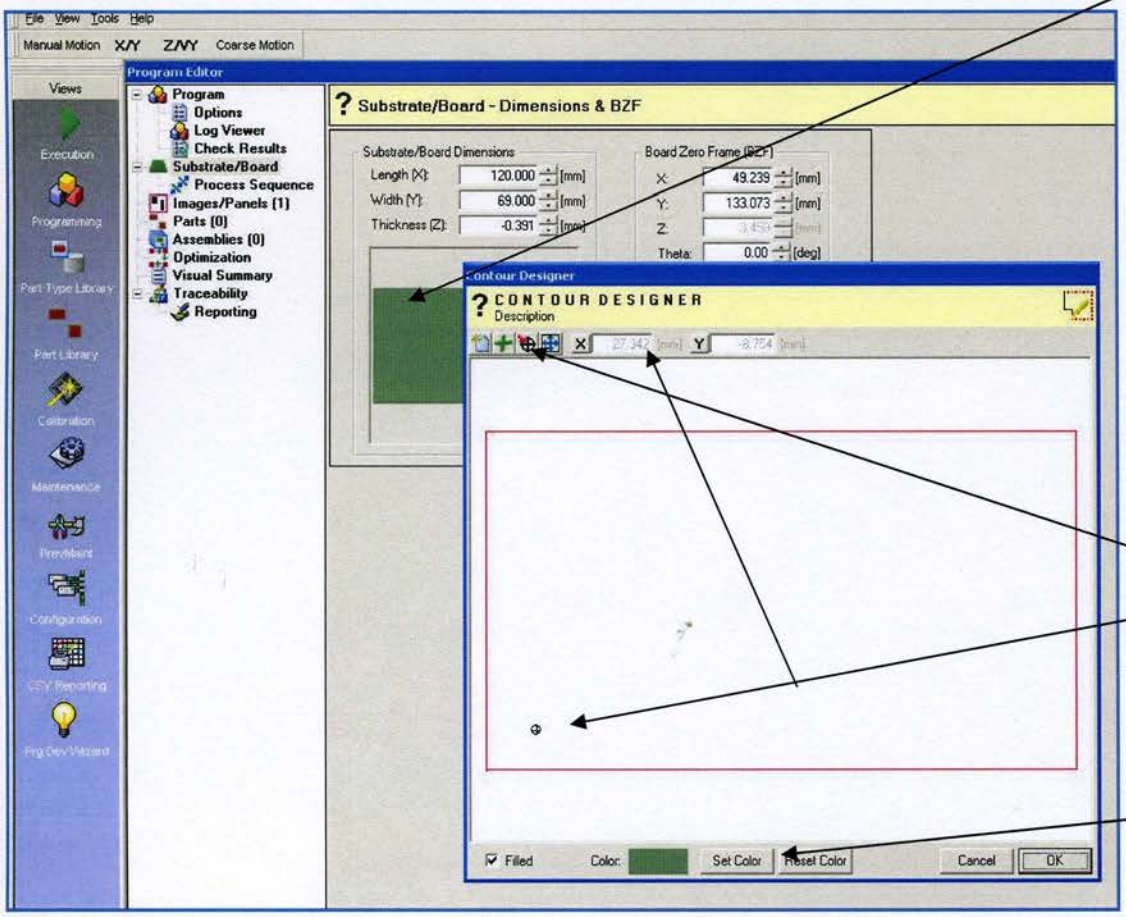
To check, recheck Robot enabled and click on Move to Final Pos. The laser light cross-hair should be in the center of the taught location.

Click on Ok.



Click on Accept to save the Set Position.

Do not right click the mouse. The Head of Robot position will be saved.



To modify the panel color and BZF location for picture double click on the picture of the panel.

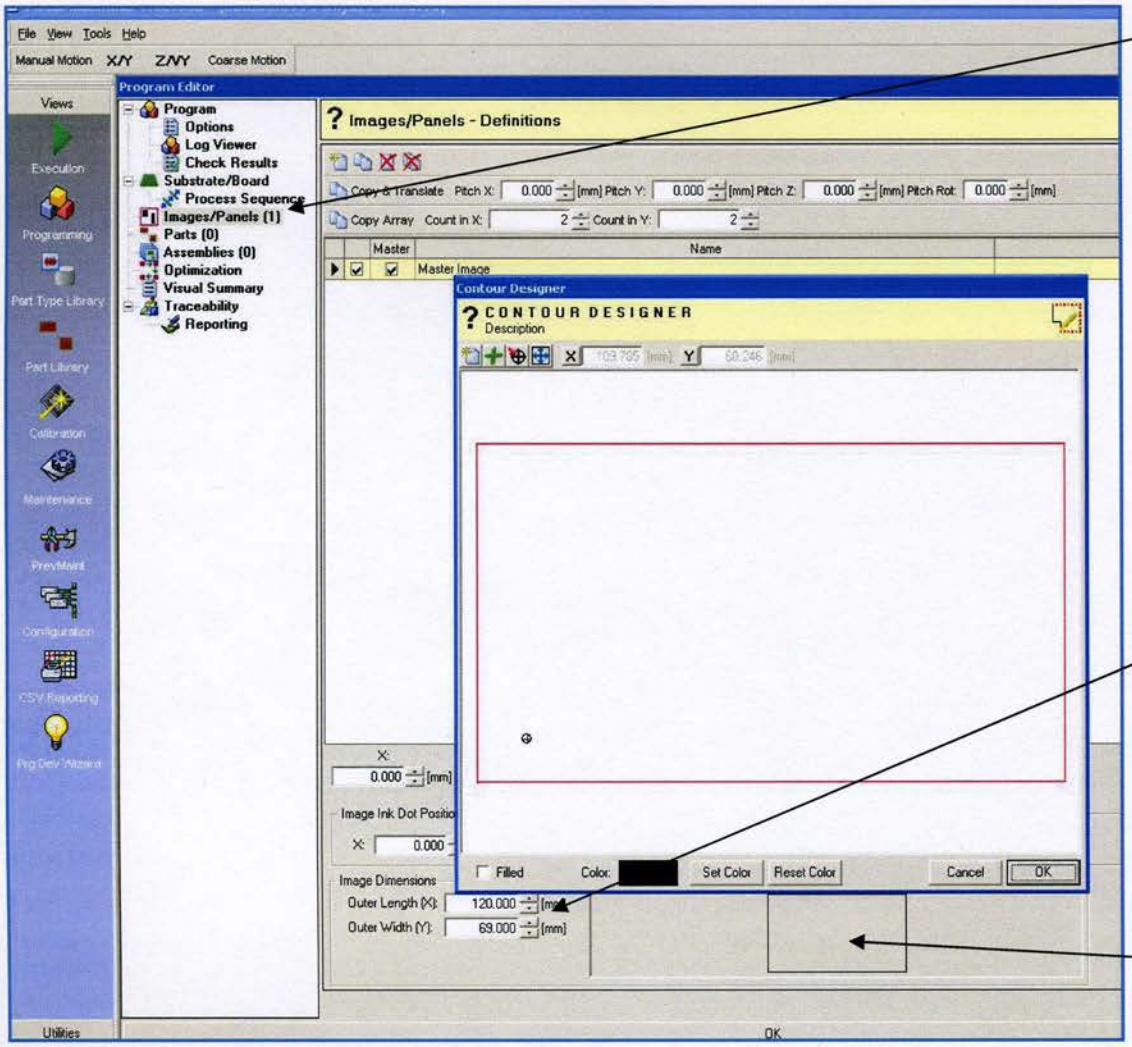
To change BZF on picture, measure center of BZF to edge of board with calipers and record x and y dimension.

Click on BZF icon.

Drag BZF until the x and y dimension matches actual dimension.

To change color, click on Set Color

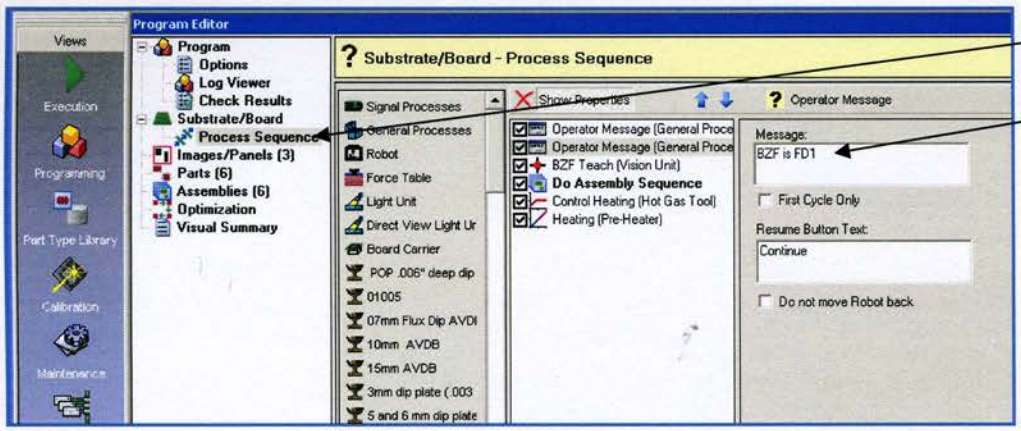
Click on OK



Go to Images/Panels

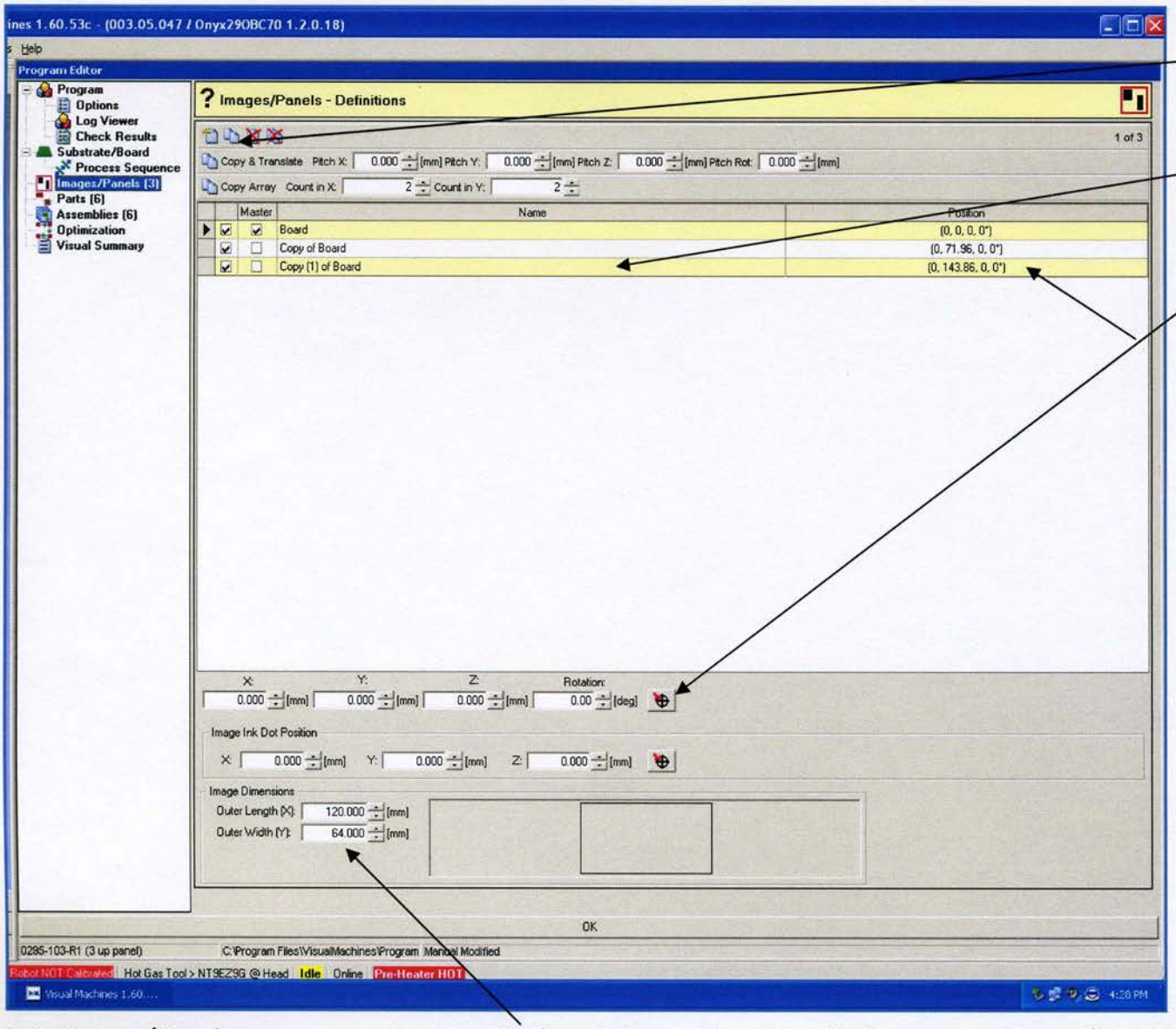
Change the Image Dimension x and y to match the dimensions in the Substrate / Board screen.

Click on the Image and correct the BZF location as previously done.



Go to Process Sequences

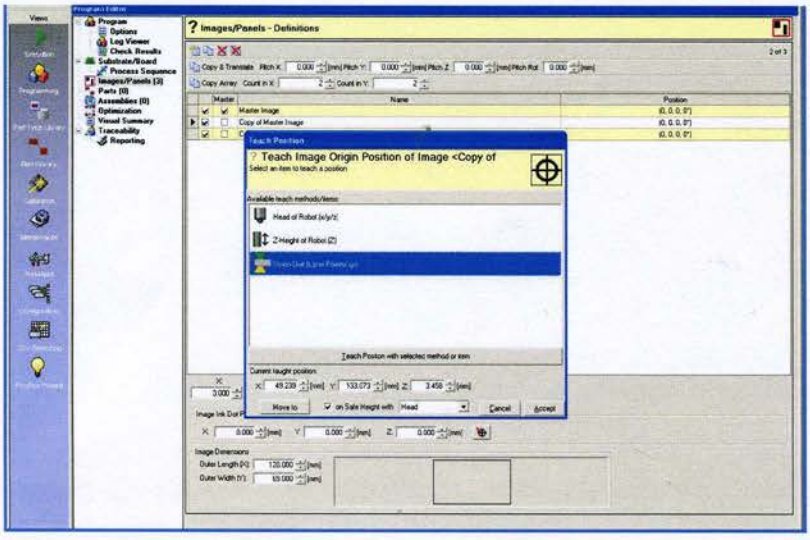
Correct the Operator Messages (2) to reflect the new BZF location.

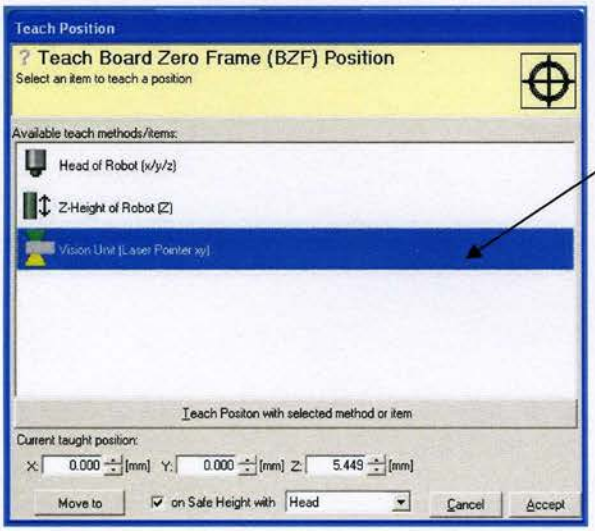


Go to Images / Panels

Confirm these coordinates match the same as substrate/board Dims.

1. **Copy the master to create panels as per pallet.**
2. **The new panels will be shown. Rename.**
3. **Click on the BZF panel Icon to create the BZF for each panel. See next page.**

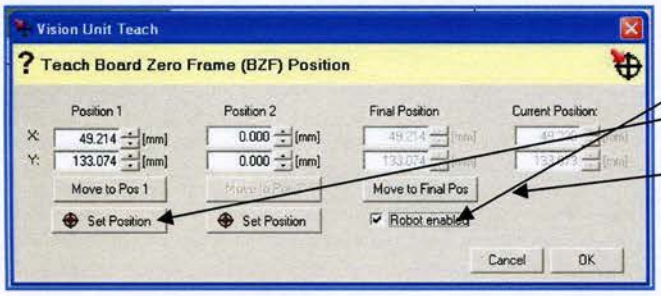




Select Vision Unit (Laser Pointer xy). Double Click.

The vision unit will extend and the laser light will be activated.

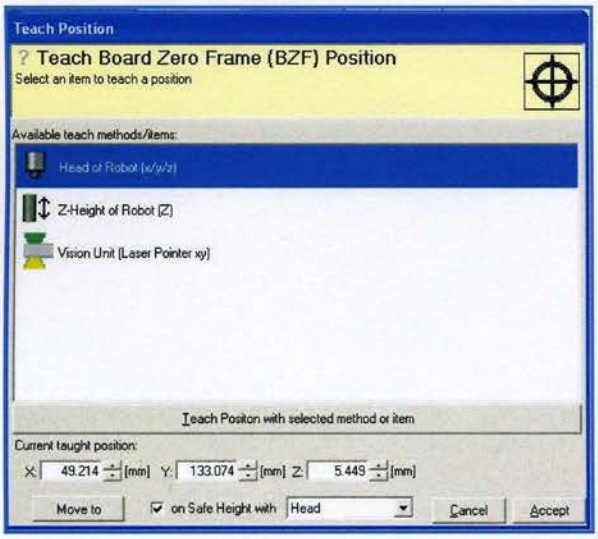
Move the laser light to the spot for the the BZF. Care must be taken to center the cross-hair in the center of the location as all of the components will be taught referencing this. Use the Direct View camera as an aid.



Uncheck Robot enabled.

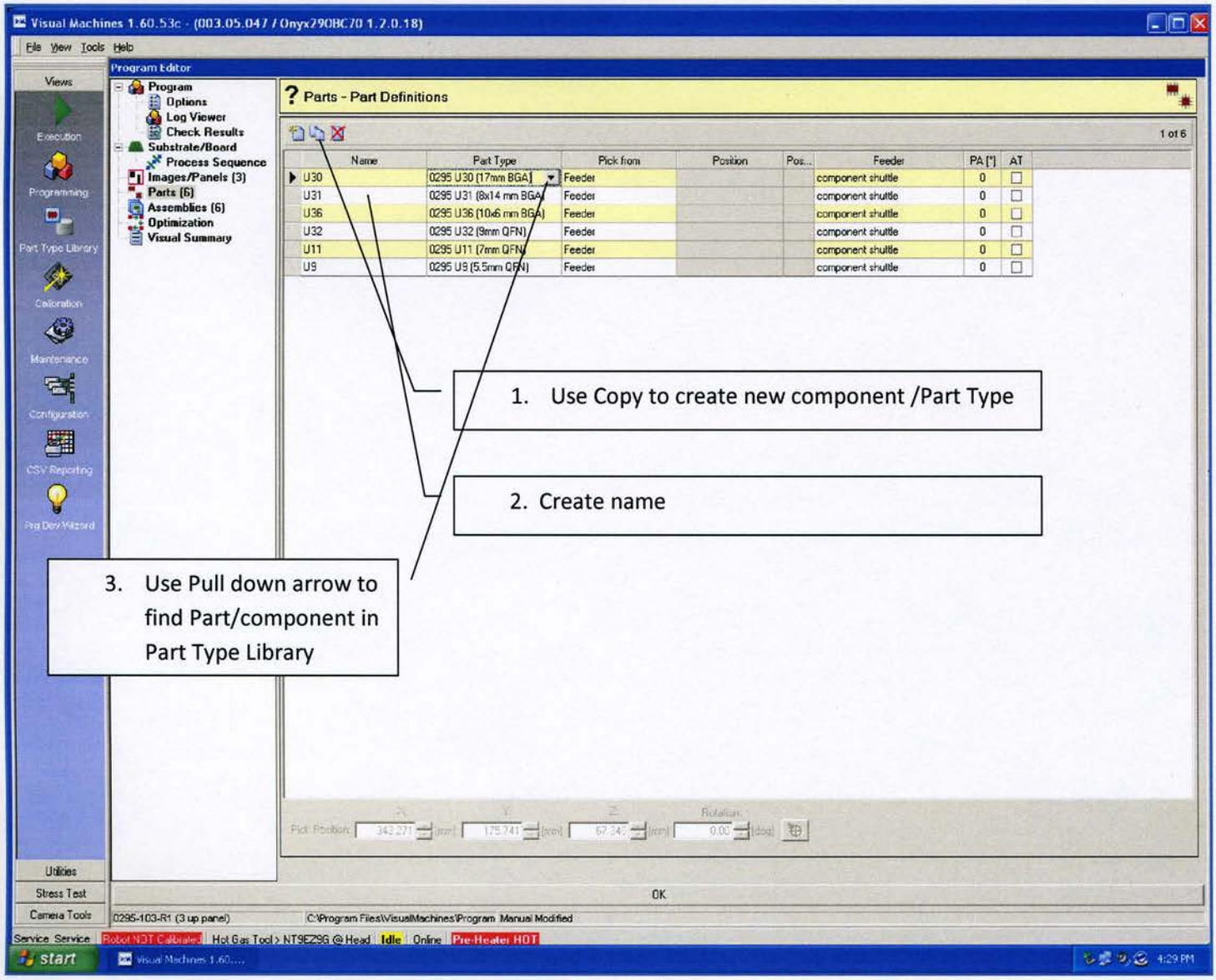
Click on Set Position to reccord.

To check, recheck Robot enabled and click on Move to Final Pos. The laser light cross-hair should be in the center of the taught location.



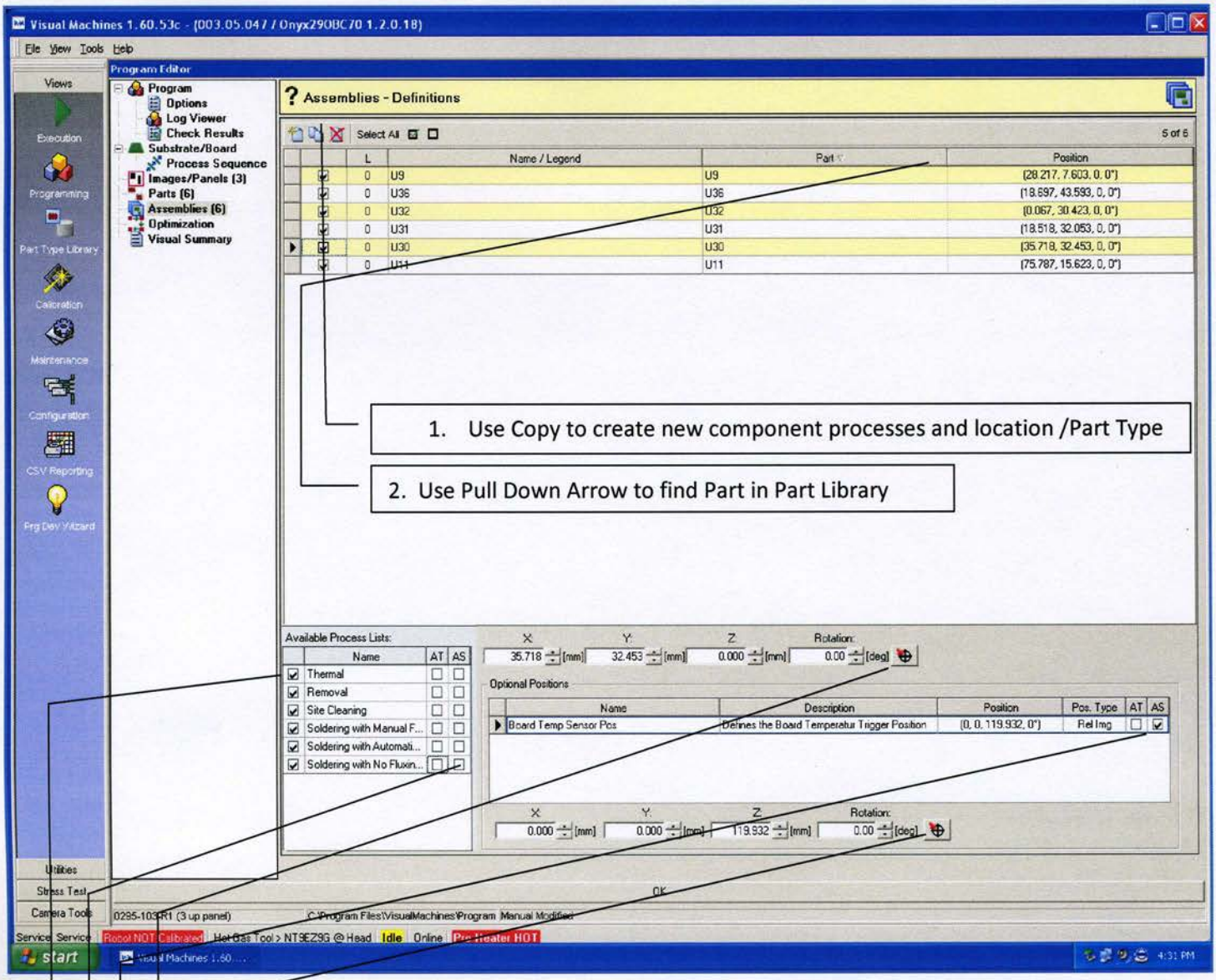
Click on Ok.

Click on Accept to save the set position. Do not right click the mouse as Head of Robot position will be saved.



After Parts (components) have been created.

Insert Part Type from Part Library.



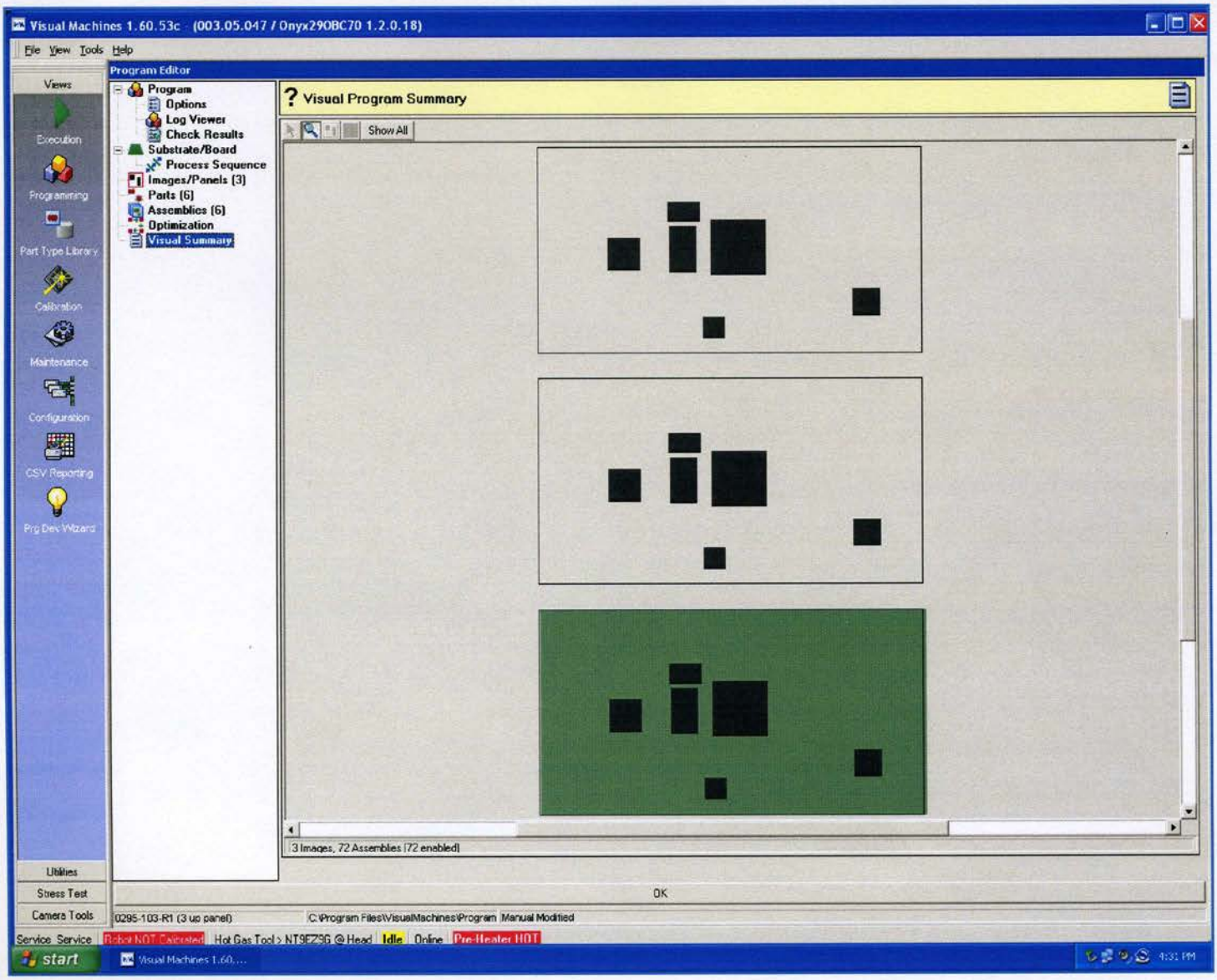
3. Use Vision System to teach each component location relative to each panel BZF.

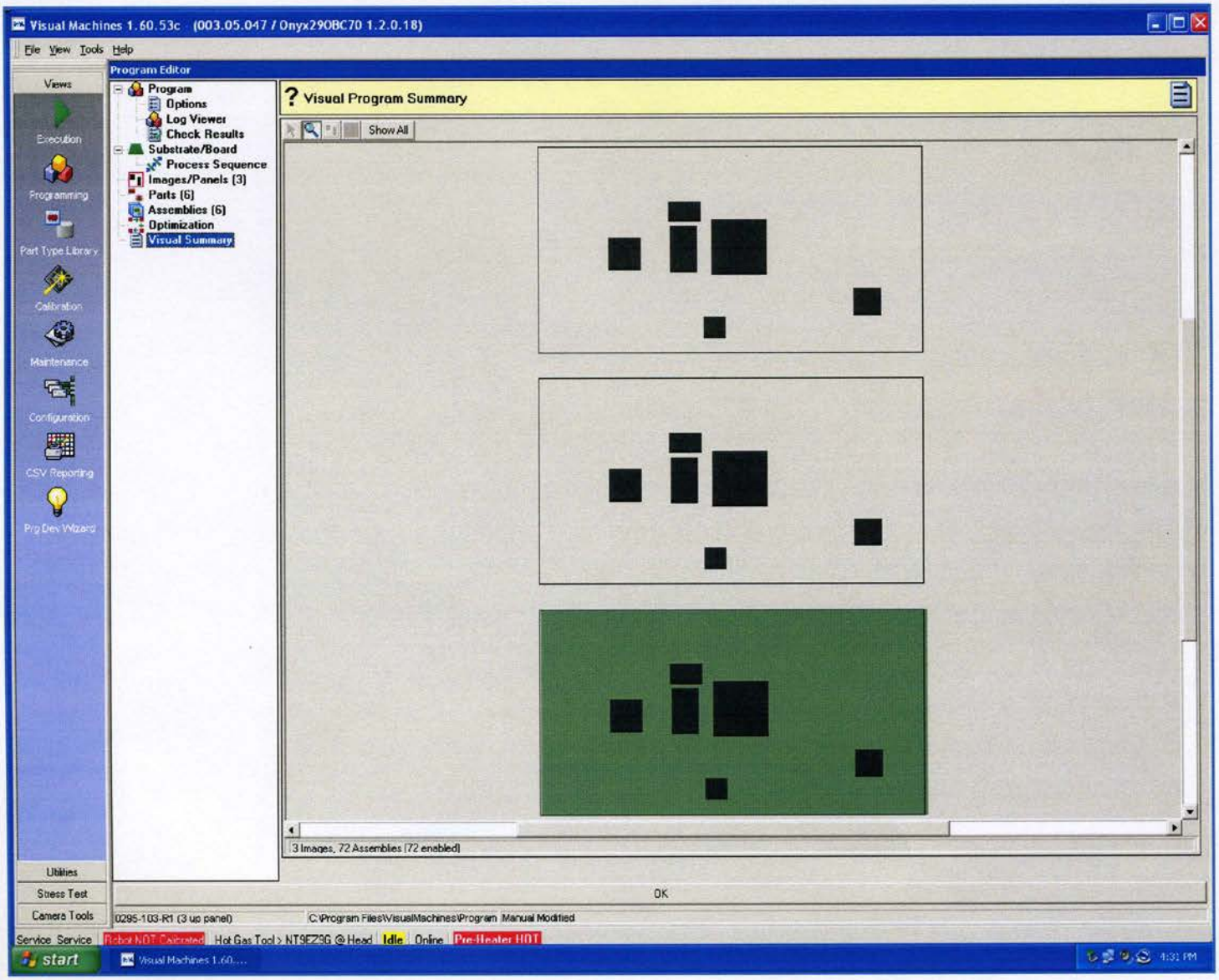
4. Use Vision System to teach each IR board temperature sensor position relative to each panel BZF .

5. Make sure that AT (always teach) is NOT checked and AS (always save) is checked.

6. Make sure that AT (always teach) and AS (always save) is NOT checked.

7. Unchecking the first column makes the process (Thermal) unavailable to the operator.


Visual Machines 1.60.53c - (003.05.047 / Onyx290BC70 1.2.0.18)
File View Tools Help
Views
Execution
Programming
Part Type Library
Calibration
Maintenance
Configuration
CSV Reporting
Prg Dev Wizard
Utilities
Stress Test
Camera Tools
Service Service
Program Editor
Program
Options
Log Viewer
Check Results
Substrate/Board
Process Sequence
Images/Panels (3)
Parts (6)
Assemblies (6)
Optimization
Visual Summary
? Visual Program Summary
Show All
3 Images, 72 Assemblies (72 enabled)
OK
0295-103-R1 (3 up panel)
C:\Program Files\VisualMachines\Program
Manual Modified
Robot NOT Calibrated
Hot Gas Tool > NT9EZ9G @ Head
Idle
Online
Pre-Heater HOT
start
Visual Machines 1.60,...
4:31 PM


Visual Machines 1.60.53c (003.05.047 / Onyx290BC70 1.2.0.18)
File View Tools Help
Views
Execution
Programming
Part Type Library
Calibration
Maintenance
Configuration
CSV Reporting
Prg Dev Wizard
Utilities
Stress Test
Camera Tools
Service Service
Program Editor
Program
Options
Log Viewer
Check Results
Substrate/Board
Process Sequence
Images/Panels (3)
Parts (6)
Assemblies (6)
Optimization
Visual Summary
? Visual Program Summary
Show All
3 Images, 72 Assemblies (72 enabled)
OK
0295-103-R1 (3 up panel)
C:\Program Files\VisualMachines\Program Manual Modified
Robot NOT Calibrated
Hot Gas Tool > NT9EZ9G @ Head
Idle
Online
Pre-Heater HOT
start
Visual Machines 1.60....
4:31 PM