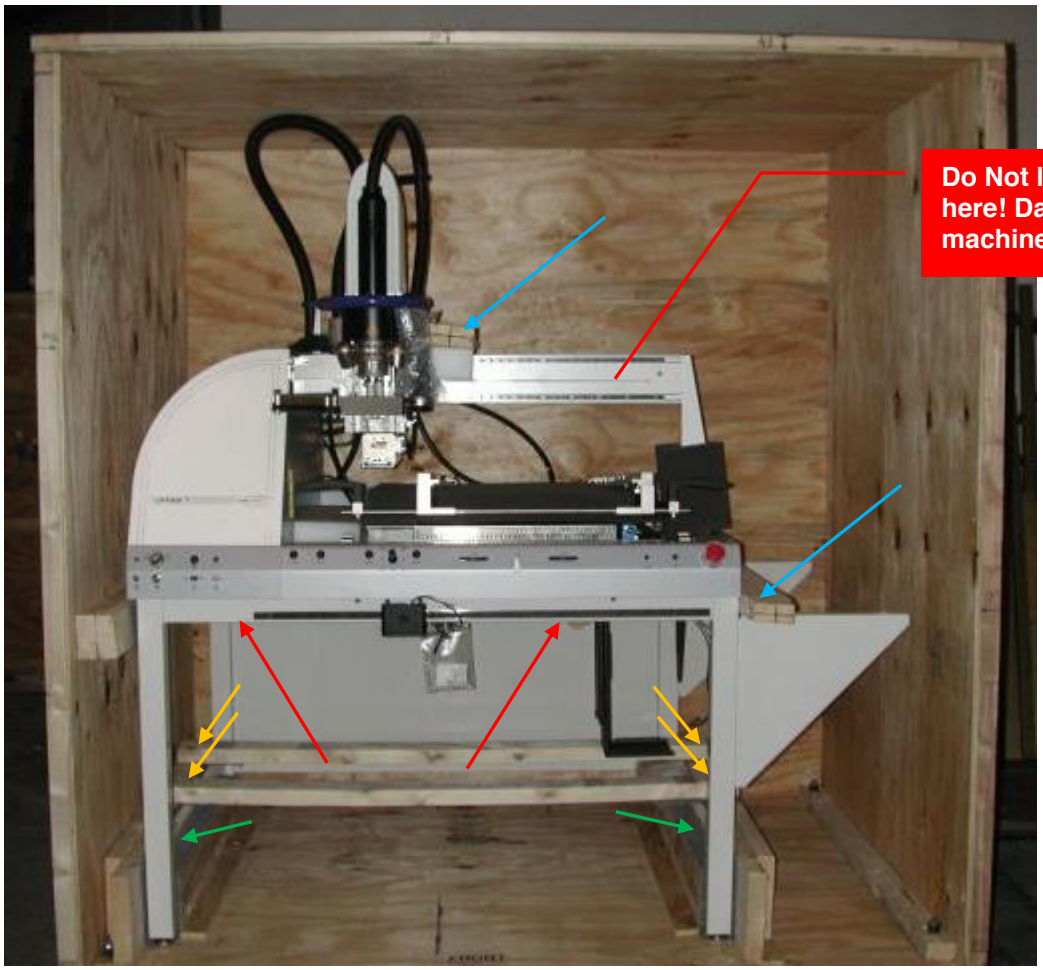
# DRS27


## Users Manual #0027.00.902


203.888.9900 | www.air-vac-eng.com

# Removing Drs 27 from crate

| | |
|---|---|
| **Product Line: Drs 27** | **Date: 9-10-20** |
| **Category: Shipping Crate** | **Distribution: WEB ☐ Work Instruction ☒** |




1. Remove the front panel bolts and screws and the top panel bolts and remove panels of the crate.
2. Remove all boxes from the crate.
3. Remove the shipping boards holding the bridge and side wings.
4. Remove the four bolts from the bottom two hold down boards.
5. Place two 2 x 4's onto the two forks of the fork lift to lift the machine out of the crate. Be aware of the power cord and the CPU holder when locating the forks under the machine.
6. Lift the machine above the supports as shown before pulling machine from crate.

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## R09.00

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# 1: Introduction/Overview

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# 1 Introduction/Overview

## 1.0 General Description

The DRS27 is a SMT Rework and Repair machine. It is designed to remove and replace surface mounted and through-hole devices on printed circuit boards. This involves heating of the PCB using a radiant panel type preheater located under the PCB and a hot gas heater / delivery system mounted over the component to be reworked to provide heat to the component solder joints. A motorized Z (vertical) axis and vision deployment system aid in reducing operator required activity and providing a level of process control through partial automation.

## 1.1 Contacts & Support

Air-Vac is always willing to assist our customers with any technical or operating questions. If you have any questions on machine parameters, correct nozzle requirements, options, procedures or maintenance, please do not hesitate to call.

**Air-Vac Engineering Company, Inc.**

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Technical Support: airvac@air-vac-eng.com

Download PDF of this manual: http://www.air-vac-eng.com/support.html

Web Support Documents: http://www.air-vac-eng.com/support.html

## 1.2 Warranty - General

Air-Vac Engineering Company warrants its equipment for a period of one (1) year from date of shipment on all parts, materials and labor costs required to repair the system except for component parts that are considered "wear and tear" items that are warranted for ninety (90) days. These include, but are not limited to, heaters, belts, lights, vacuum cups and tubing.

Air-Vac agrees to repair or replace any or all such equipment that may prove to be defective within the warranty period, without expense, excluding shipping to the owner. This warranty shall not apply to any products that have been repaired or altered except by Air-Vac Engineering. Services under warranty shall not affect an extension of the warranty period, nor will a new warranty period be granted for the parts, which were replaced/repaired. The title of the replaced parts will automatically pass to Air-Vac.

Air-Vac reserves the right to reject replacement under this warranty where, in the sole opinion of Air-Vac, the defect is due to obvious misuse and/or improper maintenance of the module or any part thereof. The express and/or implied warranty of Air-Vac is limited to the replacement and/or repair of any item defective in material and/or workmanship. Other damages, if any, direct or consequential are expressly excluded from this warranty.

Air-Vac shall be liable under this warranty only if 1) Air-Vac receives notice during the appropriate warranty period (90 days or 1 year as applicable); 2) The products are operated in accordance with the supplied documentation; and 3) Such products are, to Air-Vac's satisfaction, determined to be defective.

When contacting Air-Vac for warranty inquiries, please provide the *Order Number that the parts were shipped, Model and Serial Number of the product and the Reason for Warranty.* Products cannot be returned to Air-Vac without authorization – please call for an RMA #.

## 1.3 Heating Element Limited Life Warranty

Air-Vac Engineering Company warrants the heating elements for a period of ninety (90) days from date of shipment. Air-Vac agrees to repair or replace any or all such equipment that may prove to be defective within the warranty period, without expense, excluding shipping to the owner. This warranty shall not apply to any products that have been repaired or altered except by Air-Vac Engineering. Services under warranty shall not affect an extension of the warranty period, nor will a new warranty period be granted for the parts, which were replaced/repaired. The title of the replaced parts will automatically pass to Air-Vac.

Air-Vac reserves the right to reject replacement under this warranty where, in the sole opinion of Air-Vac, the defect is due to obvious misuse and/or improper maintenance of the module or any part thereof.

> *Heating element life is affected by several factors, temperature, airflow, condition of incoming air (water and oil contamination) and overall process cycle. These products are considered a "consumable" item. The length of useful service will vary based on the conditions under which they are run. Higher temperatures and/or lower flows will cause shortened life.*

The express and/or implied warranty of Air-Vac is limited to the replacement and/or repair of any item defective in material and/or workmanship. Other damages, if any, direct or consequential are expressly excluded from this warranty.

Air-Vac shall be liable under this warranty only if 1) Air-Vac receives notice during the warranty period; 2) The products are operated in accordance with the supplied documentation; and 3) Such products are, to Air-Vac's satisfaction, determined to be defective.

When contacting Air-Vac for warranty inquiries, please provide the *Order Number that the parts were shipped, Model and Serial Number of the product and the Reason for Warranty.* Products cannot be returned to Air-Vac without authorization – please call for an RMA #.

## 1.4 Safety System

The DRS27 system was designed with safety of the operator in mind. The operation and maintenance of the system must be performed cautiously due to the nature of the hot surfaces and the hazardous chemicals involved in the assembly and rework of printed circuit cards.

**DANGER**

- *SAFETY HAZARD. DO NOT* modify this equipment, or disable or bypass safety interlocks. Such actions may expose personnel to highly hazardous and possibly lethal conditions.

**WARNING**

- Only skilled and experienced Air-Vac Engineering trained personnel should perform service and maintenance on this equipment.
- If toxic gases/chemicals are used with the equipment, the experienced personnel must also be familiar with the applicable local, state and federal codes on handling such gases or chemicals and be trained accordingly.

***NOTE: When operating the AIR-VAC DRS27 system, follow all local codes for safe operation of the machine. Disposal of materials used in the processing of Printed circuit boards must be done in compliance with each Manufacturers recommendation in accordance with local codes.***

**Other safety mechanisms include:**

- A latching Emergency Off. This removes power from all machine functions and devices. The PC and monitor will remain powered. To reset, rotate the EMO knob to unlatch. Turn the key switch all the way to the right and release to restart. Restart the DRS27 software.
- Operator safety warning labels and markings are employed.
- Gas nozzle handling tools has been included and should be used when handling hot nozzles.

### 1.4.1 General Safety

Machines and tools of Air-Vac can only be used with maximum efficiency and safety by well trained personnel. **Do not attempt to operate or maintain this system without proper training from qualified personnel.**

**Personnel**

- Wear protective gloves when working with hot boards or gas nozzles. Solder can contain tin and lead, which are hazardous materials.
- Use caution if wearing loose clothing while operating this machine as loose clothing can fall into the work area. This is a fire hazard as well as an entanglement hazard in moving axis. Always secure or remove loose clothing before operating this equipment.
- Never eat, drink, or smoke while working on or near the machine.
- Only trained operators and technicians should work on this equipment.
- Hot surfaces will cause severe burns. Use extreme caution when operating this equipment. Heat resistant gloves are recommended particularly when handling hot components of the machine like nozzles, circuit boards and during maintenance if hot surfaces are being handled.
- Report any problem to supervisor.

**Equipment**

- Flux vapors result from soldering or desoldering. Fresh air must be provided. A venting system or fume extraction system is recommended.
- Keep all covers on. Do not open machine covers unless you are at the Main Menu Screen for basic maintenance, or to verify machine voltage (authorized personnel only).
- Keep hands clear of moving parts. Do not reach into the machine while it is moving.
- Do not override safety interlocks.
- Check area for any loose parts or tools that could cause mechanical interference.
- Do not place anything on the top of the machine.
- In the event of an emergency, press the Red Emergency Off button located on the front of the machine. Locate this Emergency Off button before operating this machine.
- Shut off electrical power and unplug machine when servicing any area of the machine.
- If a malfunction should arise, depress the Emergency Off button to stop operation.
- Wear protective gloves when working with hot boards or gas nozzles.
- Refer to material safety data sheet of solder, flux, or any other product used in conjunction with the machine. Follow all warning labels and instructions.
- Follow proper handling and disposal instructions for the materials as supplied by their vendors.

**Machine Operation**

- Both the top and bottom heating elements can be programmed to reach high temperatures. Use caution near heated surfaces including the nozzle and the bottom heater.
- Hot surfaces are noted with labels but exposure to hazards is inevitable due to the nature of the process. Do not touch hot surfaces. Proper training is essential. Contact Air-Vac for additional training sessions if required.
- Always use the gas nozzle handling tool when installing or removing nozzles.
- The nozzle and vision systems are powered by motors and are programmed to move during operation. Use caution near these two moving areas.
- Observe the legal and specific national regulations concerning accident prevention and protection of the environment.
- Observe the general safety regulations concerning working with solder and flux. Fume extraction should be seriously considered.

**Maintenance** (see Maintenance Chapter of Manual)

### 1.4.2 Additional Safety Precautions

- Upper heater housing protects the upper heating element - marked with hot label.
- Bottom heater plate surface can be hot – protective covers are marked with hot label.
- Flux vapors can be hazardous to operators - fume extraction should be employed.
- Flux liquid is flammable and hazardous to operator health and safety.
- Nozzle and vision motion can cause injury to the operator.
- Sound levels are below 70 dba levels except for use of the nozzle cold air bypass at 100% flow (75 dba) and the optional bottom spot heater at high flow (78 dba). These are intermittent items that can be a small percentage of actual on time. If these are used they should be evaluated against local regulation to determine if any additional noise protection is required.

### Handling of Hazardous Solder and Flux Products

AIR-VAC does not supply the solder or flux products with the DRS27 system. The end user of the DRS27 system should follow proper handling and disposal instructions for the materials as supplied by their vendors.

### Nozzle Changeover: Safety Equipment Requirements

When changing out the part-specific gas nozzle, use the special nozzle removal tools (GNT1, GNT4 ) that are supplied in the tool kit of the system whenever handling a hot nozzle.

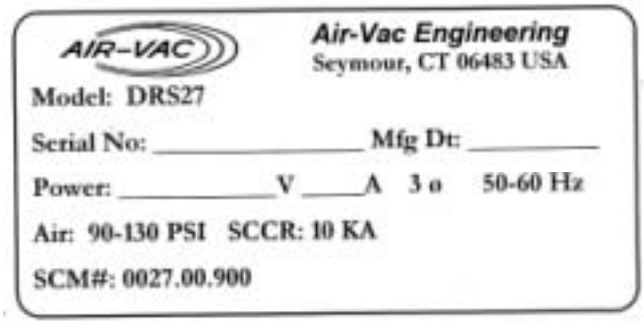
### Removing a nozzle:

- Hold the hot nozzle with the nozzle removal tool and pull out of nozzle locking jaws.
- With the hot nozzle held firmly in the removal tool, place the nozzle in a container that can handle the heat of the nozzle.

***To install a nozzle, reverse the above procedure.***

## 1.4.3 Label Description and Placement

The following metal placards are affixed to the DRS27 system: This label describes the electrical and air requirements for the system. The overall system requirements can be found in the facilities section of this manual.




## 1.4.4 Machine warning labels

| *Label* | *Indication* |
|---|---|
| **CAUTION – HOT SURFACE** | The Caution - Hot Surface labels found on the DRS27 system are intended to prevent injury to the operators and users of the system. The top heater and preheater of the system are required to reach temperatures well above 60°C. Labels are found on the covers of each heated surface as well as next to heated surfaces.<br>Skin contact with these surfaces would result in a burn reaction and therefore presents an inherent potential thermal danger to the operators. |

| | |
|---|---|
|  | This label indicates hot surfaces well above 60 $^0$C.<br>The hot gas head and the pre-heater are required to reach temperatures well above 60 $^0$C. Hot surface warning labels are found on the covers of each such heated surface as well as next to heated surfaces.<br>Skin contact with these surfaces would result in a burn reaction and therefore presents an inherent potential thermal danger to the operators. |
|  | This label indicates the presence of a Laser diode module with a Class 2 Laser.<br>Do not stare into the beam. Direct viewing into the beam or reflected beam can cause permanent eye damage.<br>(Po = 1 mW, _ = 650 nm) |
|  | This label indicates the presence of an area that presents a pinch point hazard when motion occurs. Keep hands and all objects clear of this area. |
|  | This label indicates there are static sensitive components inside. Appropriate handling should be used. |
| **CAUTION HIGH VOLTAGE**<br>**DISCONNECT POWER BEFORE OPENING** | High power warning labels advise personnel of potential shock issues when the machine covers are opened. |

### 1.4.5 DRS27 System Alarms

The following alarms to the DRS27 system will halt the process until the problem has been corrected and the alarm is cleared:

This alarm type occurs when one of the following conditions is detected:

Machine Hardware Alarms

```
*     SerialPort_Failure
      Z_Axis_Motor_Comm_Restart
      Vision_Axis_Motor_Comm_Restart
      Nozzle_TempControl_Comm_Restart
      Left_Preheat_TempControl_Comm_Restart
      Right_Preheat_TempControl_Comm_Restart
      Center_Preheat_TempControl_Comm_Restart
      DeviceIO_Communication_Restart
      Low_Pressure_Air_Regulator
      Low_Pressure_N2_Regulator
```

Process Alarms

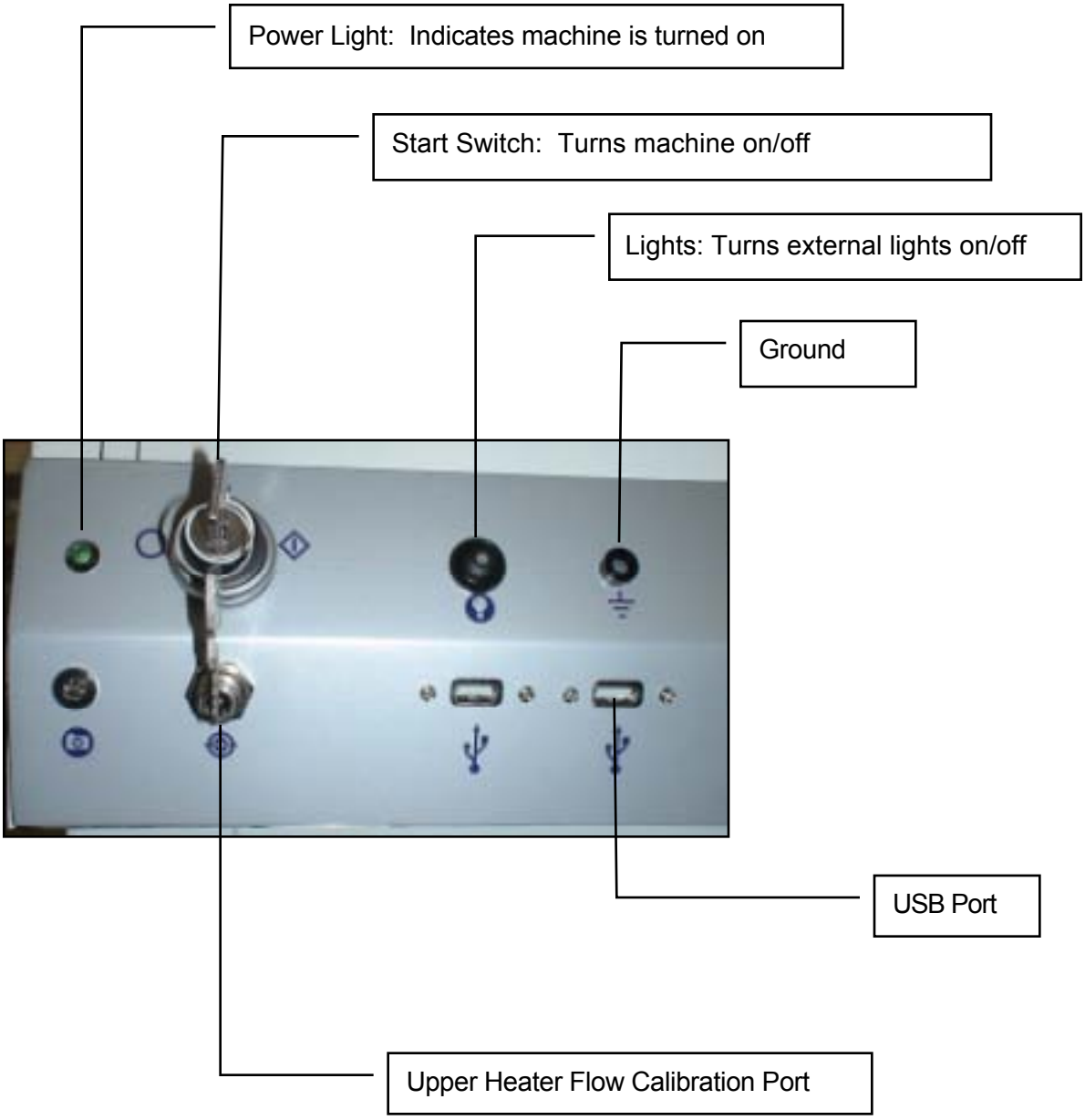
```
      Nozzle_Temperature_Limit,
      Nozzle_TC_Error,
      Left_Preheater_Temperature_Limit,
      Left_Preheater_TC_Error,
      Right_Preheater_Temperature_Limit,
      Right_Preheater_TC_Error,
      Center_Preheater_Temperature_Limit,
      Center_Preheater_TC_Error,
      Below_Minimum_Nozzle_Flow_Rate,
      Nozzle_Flow_Sensor_In_Position_Failed,
      Exceeded_Max_FootSwitch_Delay,
      Exceeded_Max_TC_Control_Delay,
      TC1_Not_Connected,
      TC2_Not_Connected,
      TC3_Not_Connected,
      TC4_Not_Connected,
      TC5_Not_Connected,
      TC6_Not_Connected,
      TC7_Not_Connected,
      TC8_Not_Connected,
      Site_Clean_Tool_Clogged
```

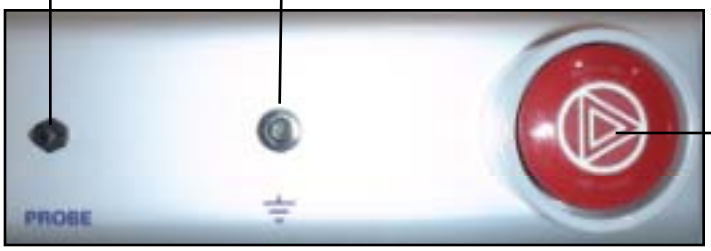
* Computer must be rebooted to clear.

The various alarms are explained in further detail in the Software section.

# 1.5 Machine Overview

## 1.5.1 Front Panel Controls


Power Light: Indicates machine is turned on
Start Switch: Turns machine on/off
Lights: Turns external lights on/off
Ground
USB Port
Upper Heater Flow Calibration Port



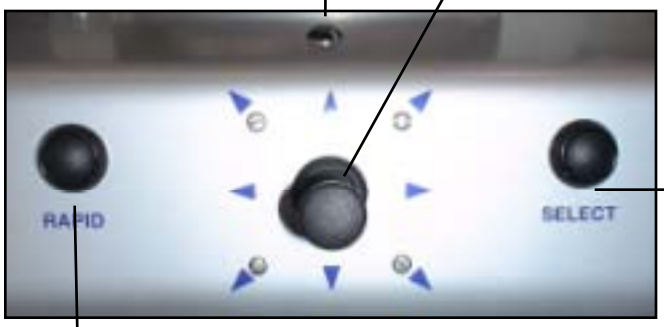

Probe Vacuum Port

Ground

E-Stop

Joy Stick Pilot Light:
Off - Indicates joy stick is not active
On - Indicates joy stick is active\
Blinking – Indicates Rapid function is activated

Joy Stick Control: Controls positioning of x/y-axis, z-axis, theta, and zoom mode, determined by select button.




Select: Sets joystick control of:

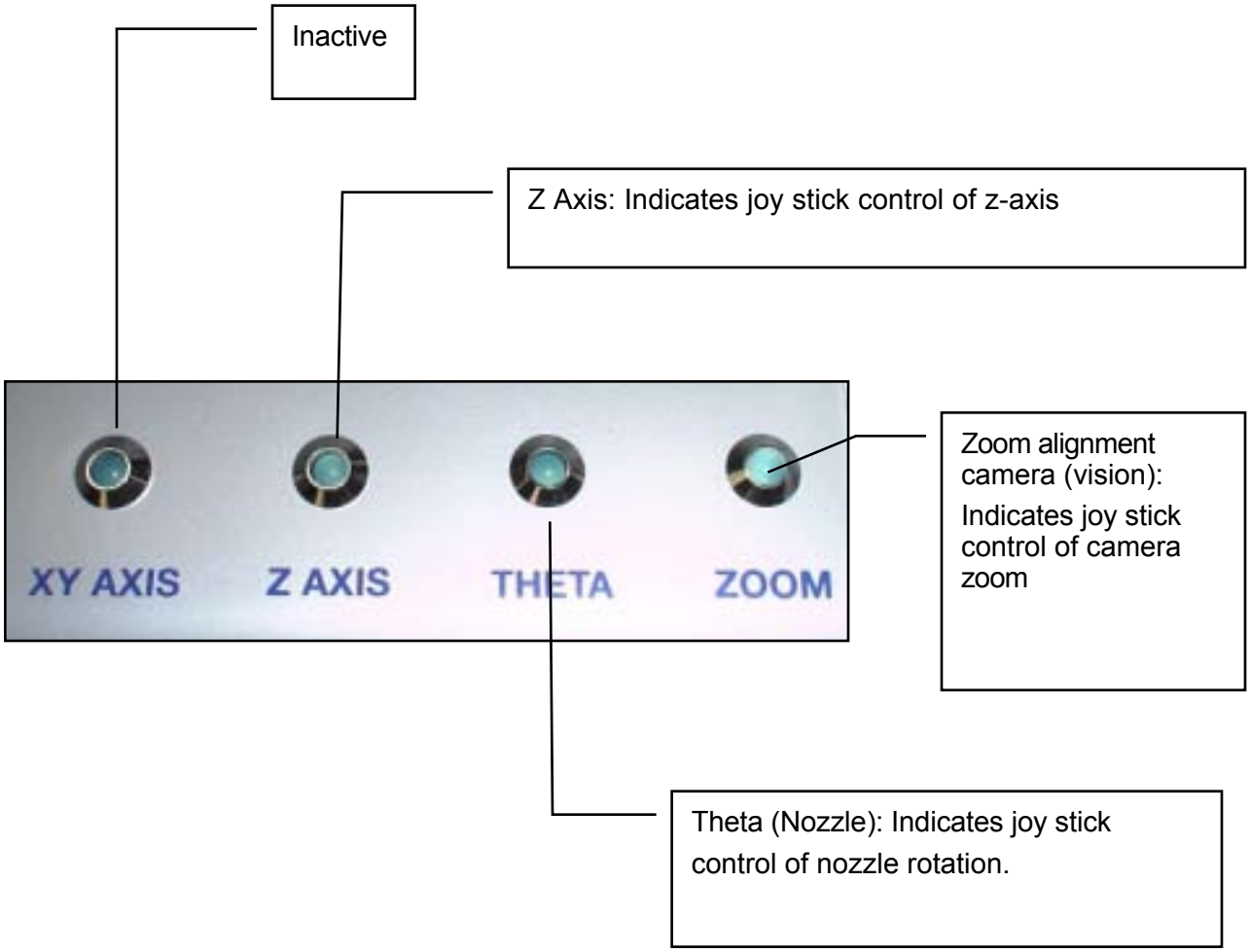
X/Y-axis: vision alignment camera control, corners, edge and center positioning

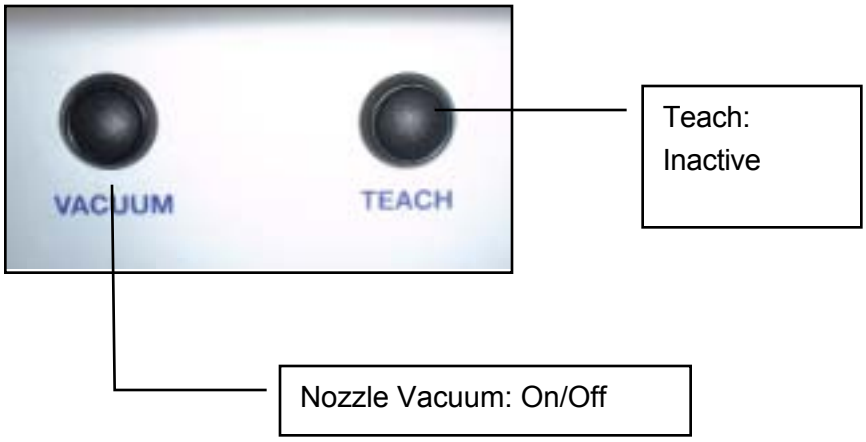
Z-axis: nozzle control, up, down positioning

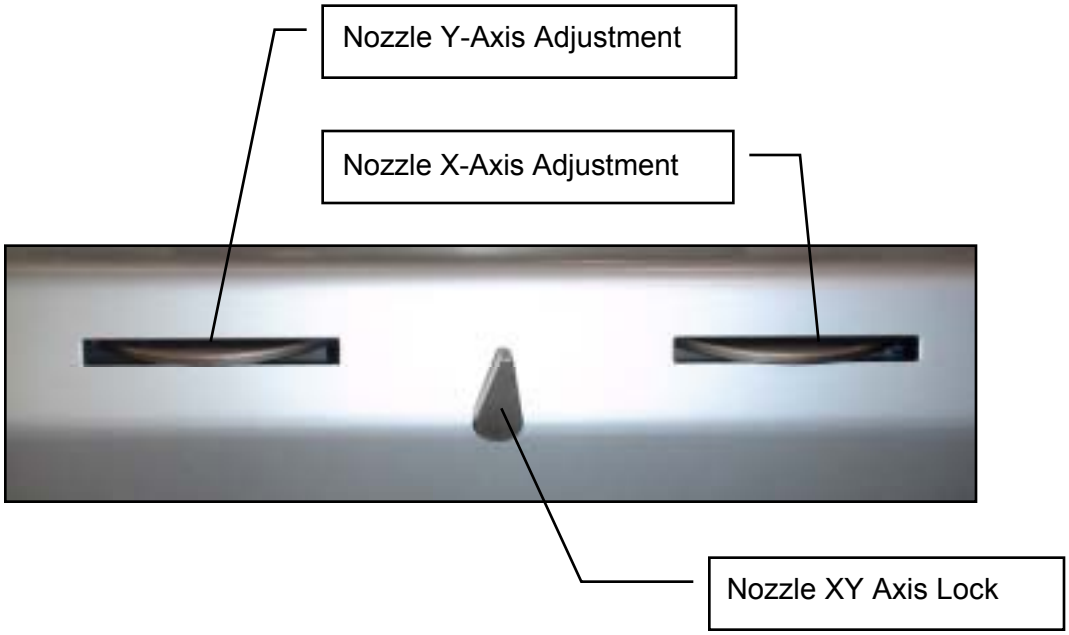
Theta: nozzle control, clockwise, counterclockwise positioning

Zoom: vision alignment camera magnification control

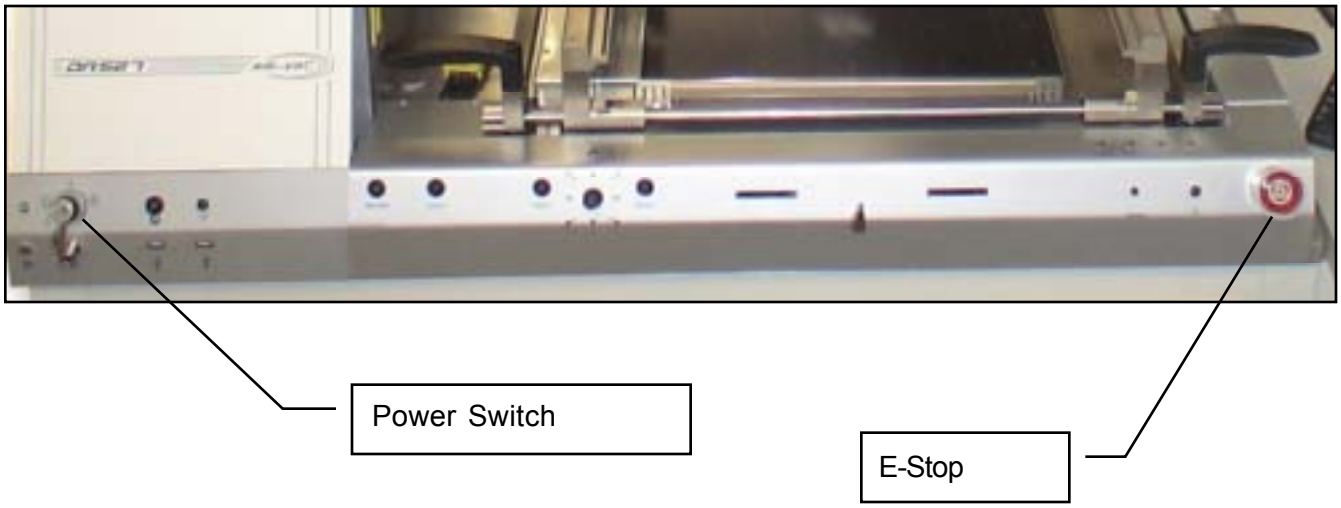
Rapid: Used to select rapid function of joystick. Default=off. When pressed, joystick pilot light will be blinking.


Inactive
Z Axis: Indicates joy stick control of z-axis
XY AXIS
Z AXIS
THETA
ZOOM
Zoom alignment camera (vision):
Indicates joy stick control of camera zoom
Theta (Nozzle): Indicates joy stick control of nozzle rotation.


VACUUM
TEACH
Teach:
Inactive
Nozzle Vacuum: On/Off


Nozzle Y-Axis Adjustment
Nozzle X-Axis Adjustment
Nozzle XY Axis Lock

### 1.5.2 Power Start Up/Power Down Controls




**Power Start Up**

1. Turn on PC .
2. Release E-stop
3. Turn Power key on/off switch.
4. Boot software.
5. Enter operator name. Click on the Thumbs Up icon.
6. Enter password.

**Power Down**

1. Exit DRS27 software.
2. Turn off computer.
3. Turn power key off.

## 1.6 Options Overview

### 1.6.1 Site Cleaning System (0029.03.012)

Objective

- Fully automated removal of residual site solder without damaging the pads or solder mask. Eliminates the need for traditional solder iron/solder wick process and associated issues (ie. manual intervention, mechanical contact of pads).

How It Works:

- Hot gas reflows the residual solder on the pads.
- While viewing through the microscope, the operator moves the board with the x/y adjustment wheels to clean the pads on the site.
- A vacuum sensor continuously adjusts the height of the composite vacuum tip to provide non-contact site cleaning.

Notes Of Interest:

- Non-contact site cleaning will become critical for lead-free rework due to the significantly higher temperature required to reflow the residual site solder.
- Small, medium and large composite vacuum tips provided.
- Custom designs available for hard to access areas.

### 1.6.2 Pivoting IR Probe with Laser Pointer (0029.11.043)

Objective

- Provides process repeatability by insuring that the board is at the exact same target temperatures each time before localized reflow begins.

How It Works:

- Operator is instructed to position the sensor head at the beginning of the process.
- The non-contact temperature sensor monitors topside board temperature and automatically triggers the localized reflow process once the target temperature is reached.

### 1.6.3 Direct View Camera

Objective

- Provide operator viewing on computer screen for component alignment or reflow at board level.

How it works:

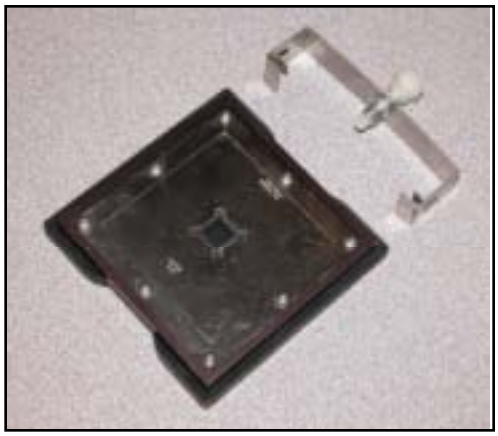
- Video is activated by operator or software. Focus/zoom/lighting adjustments are made to optimize clarity.
- The site image is integrated with the software and displayed on the PC monitor.

### 1.6.4 Universal Insertion Tool (AU6LGA47R)

- Mechanically self-centers any device for accurate pick up.
- Used in conjunction with component shuttle.

### 1.6.5 Paste-On-Device Micro Stencil Adapter (0024.24.111)

- Component-specific micro stencil applies solder paste directly to the component spheres.
- Pasted device in stencil is placed in micro stencil adapter, which is used in conjunction with the component shuttle to pick the pasted device.



Notes Of Interest:

- Air-Vac does not supply the component-specific micro stencils. Recommended supplier is Mini Micro Stencil (760-591-3804).
- Micro stencil installed into adapter for direct pick from shuttle.

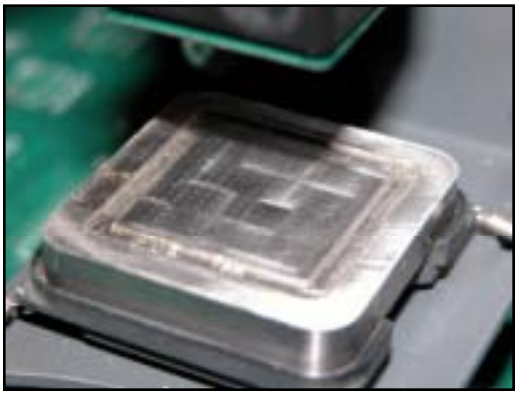
### 1.6.6 Flux Dip Pedestals (part number quoted per device)

- Stainless steel fluxing pedestals with precision-machined depth provides controlled application of tacky flux directly to the solder spheres on the device.
- Used in conjunction with the component shuttle.

Notes Of Interest:

- Various sizes and depths available.

  Recommended depth is 50% of ball height.



### 1.6.7 Fume Extraction Manifold & Hose Assembly (300.00.547)

Objective

- Removes flux vapors from the work environment for operator health and safety.

Includes:

- Fume extraction manifold and hose assembly.

Notes Of Interest

- Requires connection to a central exhaust or self-contained filtering system.

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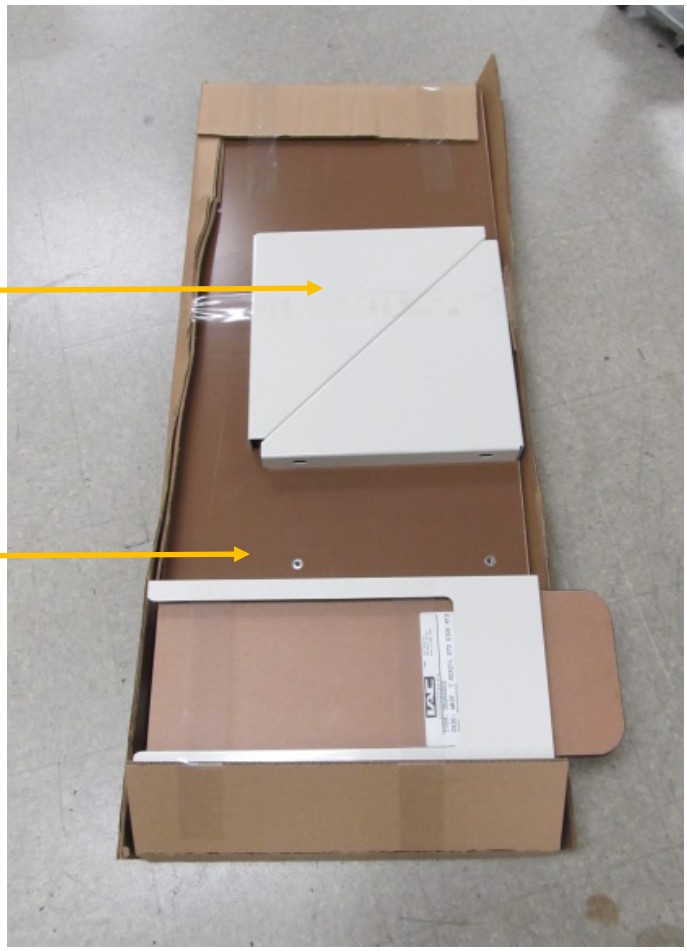
# 2 Unpacking, Installations & Facility Requirements

## 2.0 Unpacking from Crate

- Remove all boxes from crate.
- Remove side table and support wings from crate.

Table Support Wings (2)

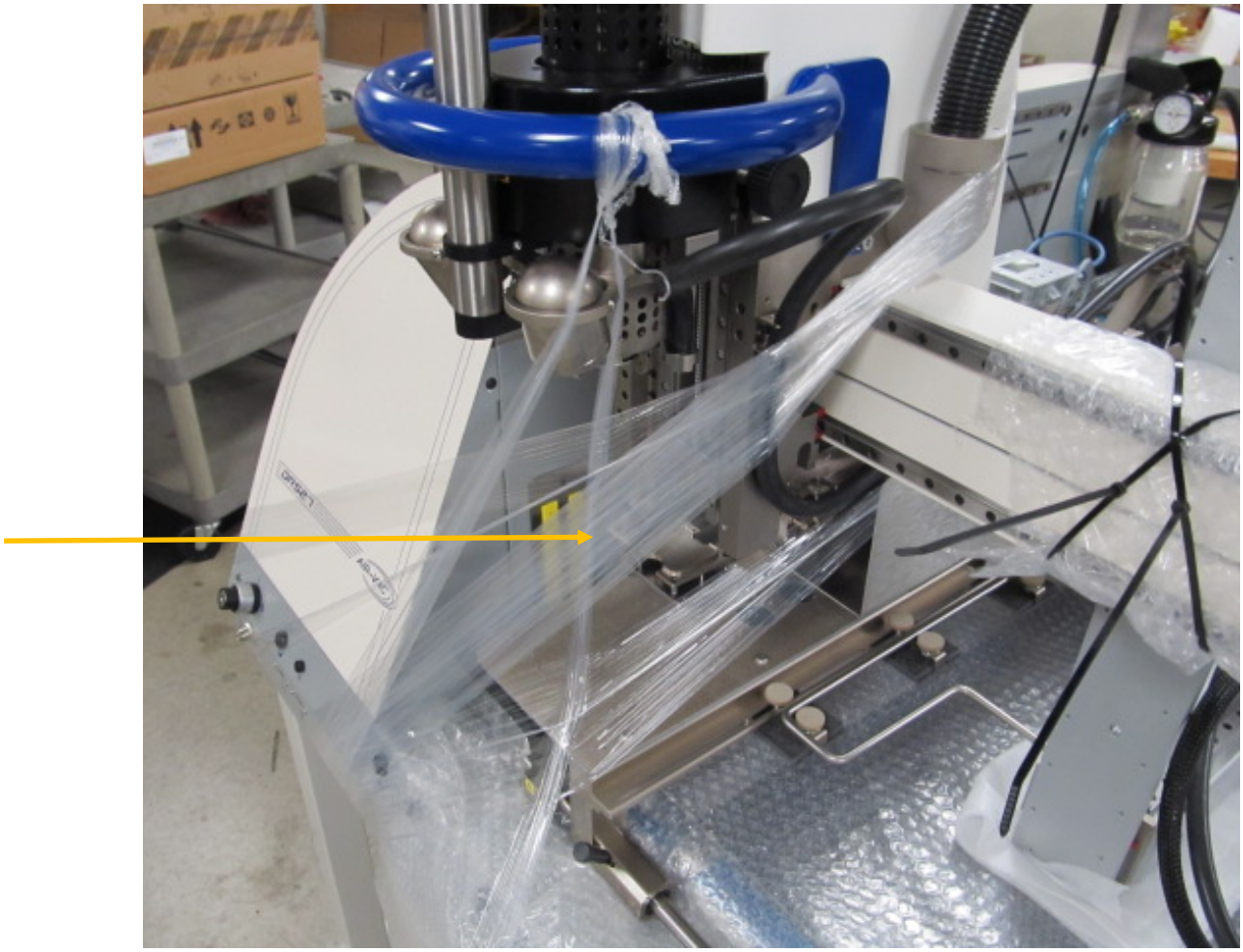
Side Table with keyboard tray



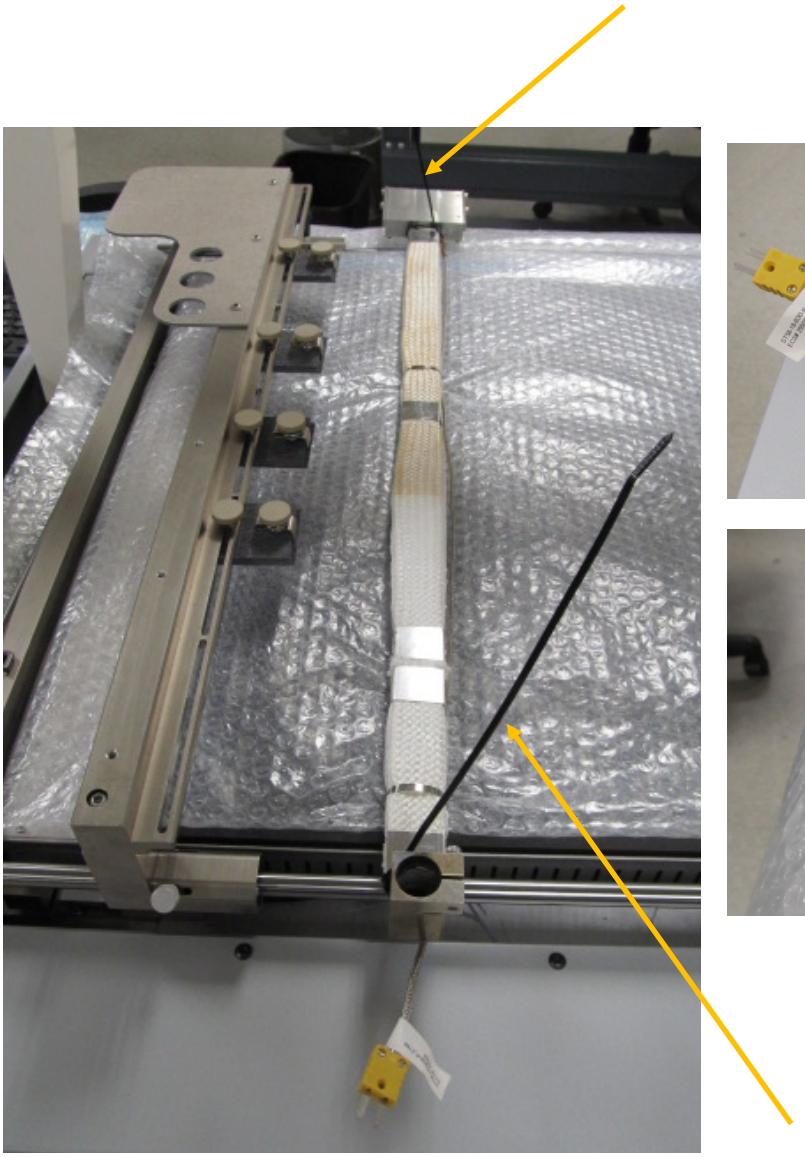
**NOTE**

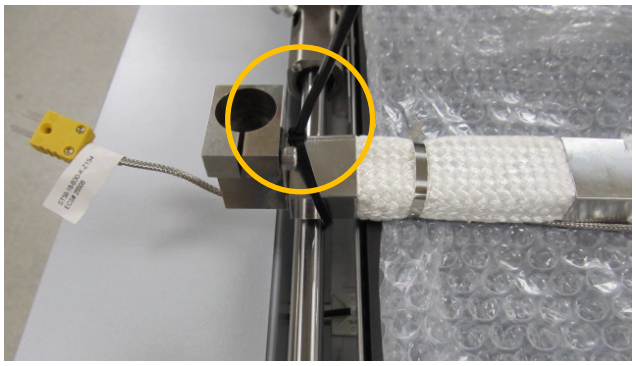
FOR 3 ZONE MACHINES THE WINGS ARE MOUNTED ON THE TABLE.

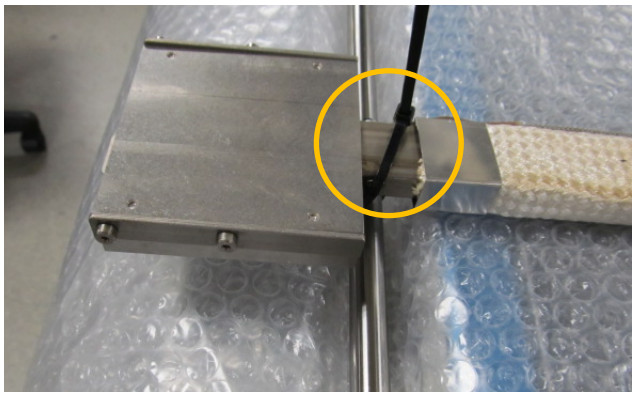
- Remove shrink wrap that's holding the X-Y-Z Axis in place.



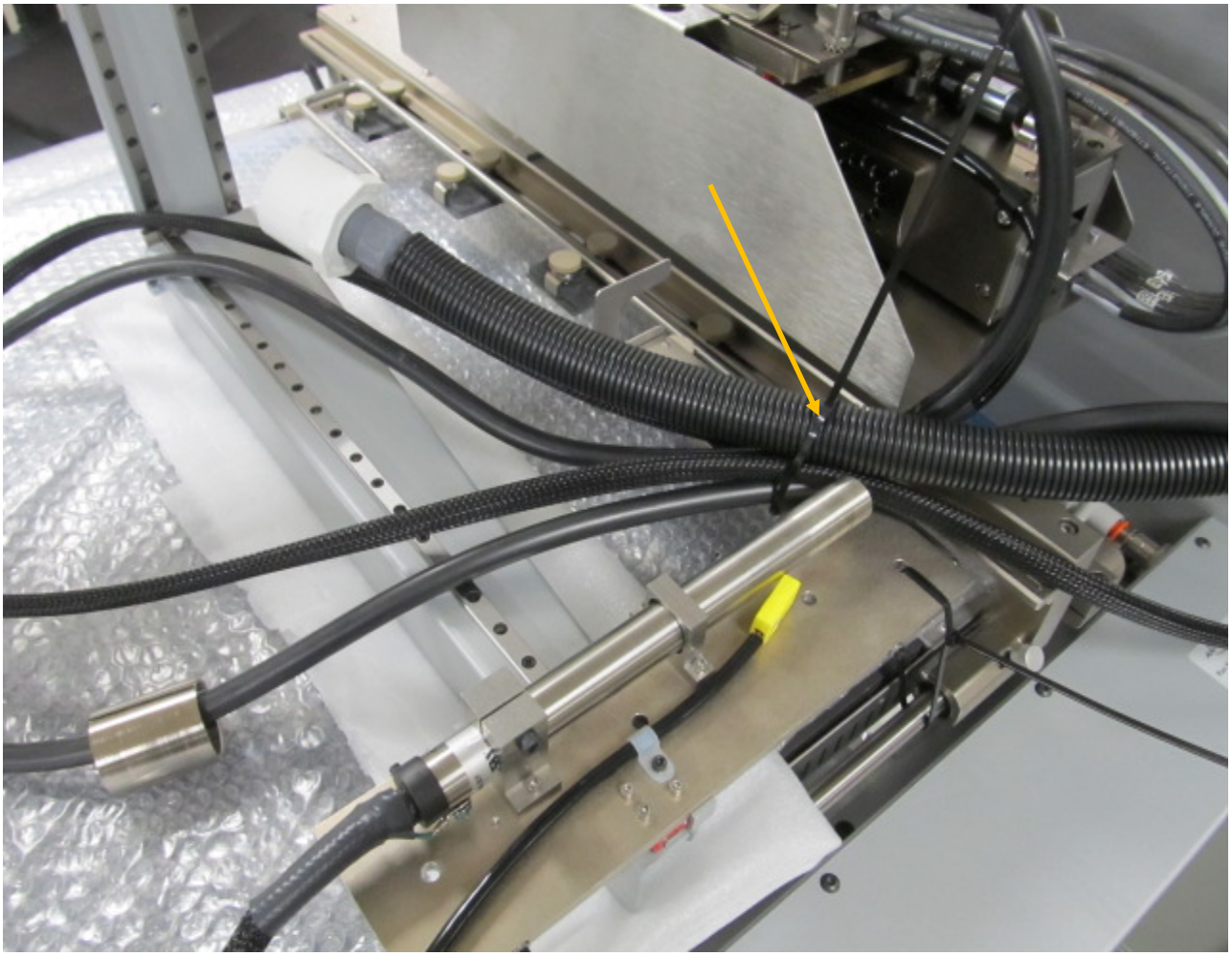
- For spot heater equipped machines only, cut off wire ties that are holding the spot heater to the carrier rail rods.





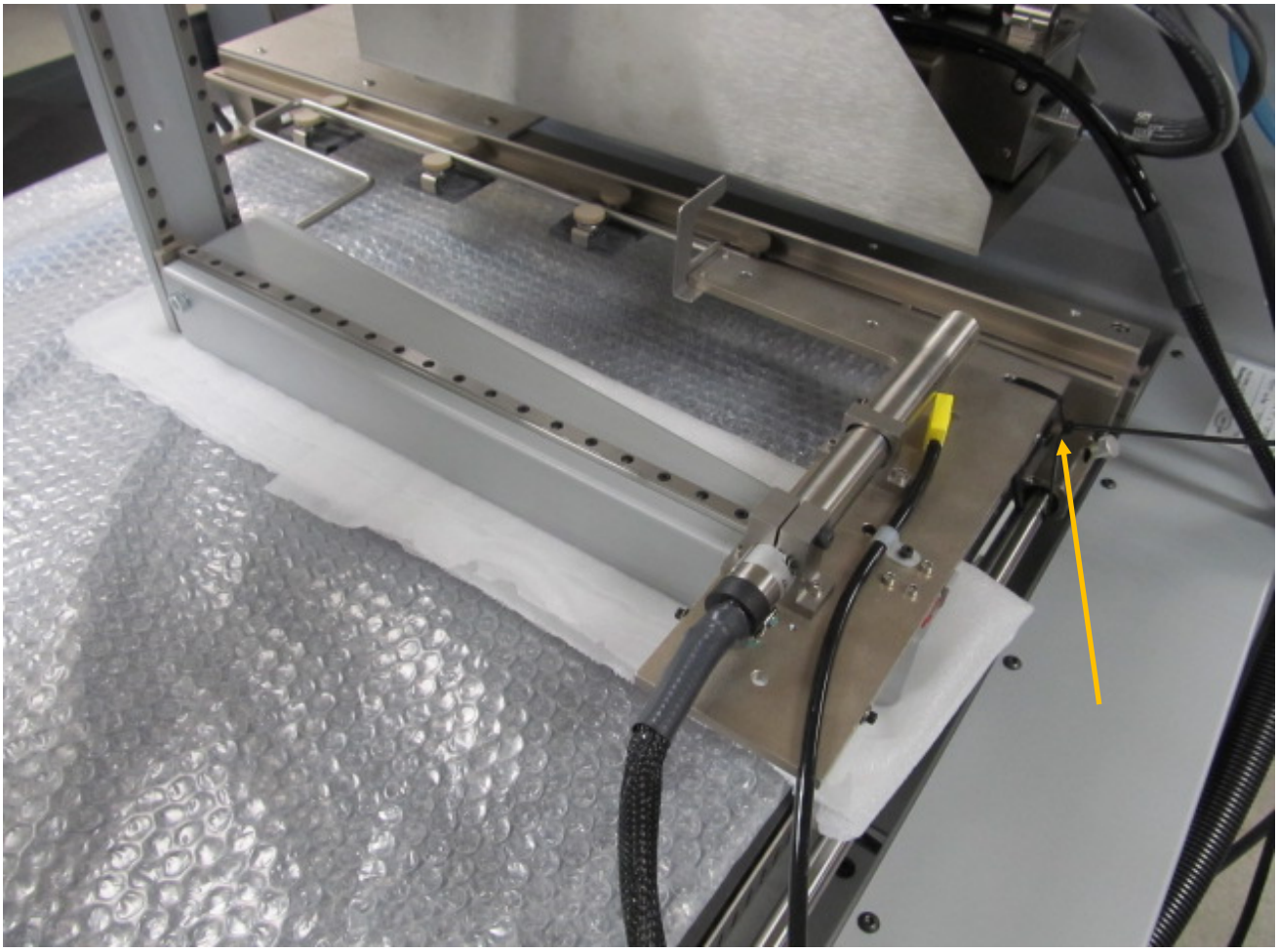


- Cut off wire ties holding the tubing and cables as shown.

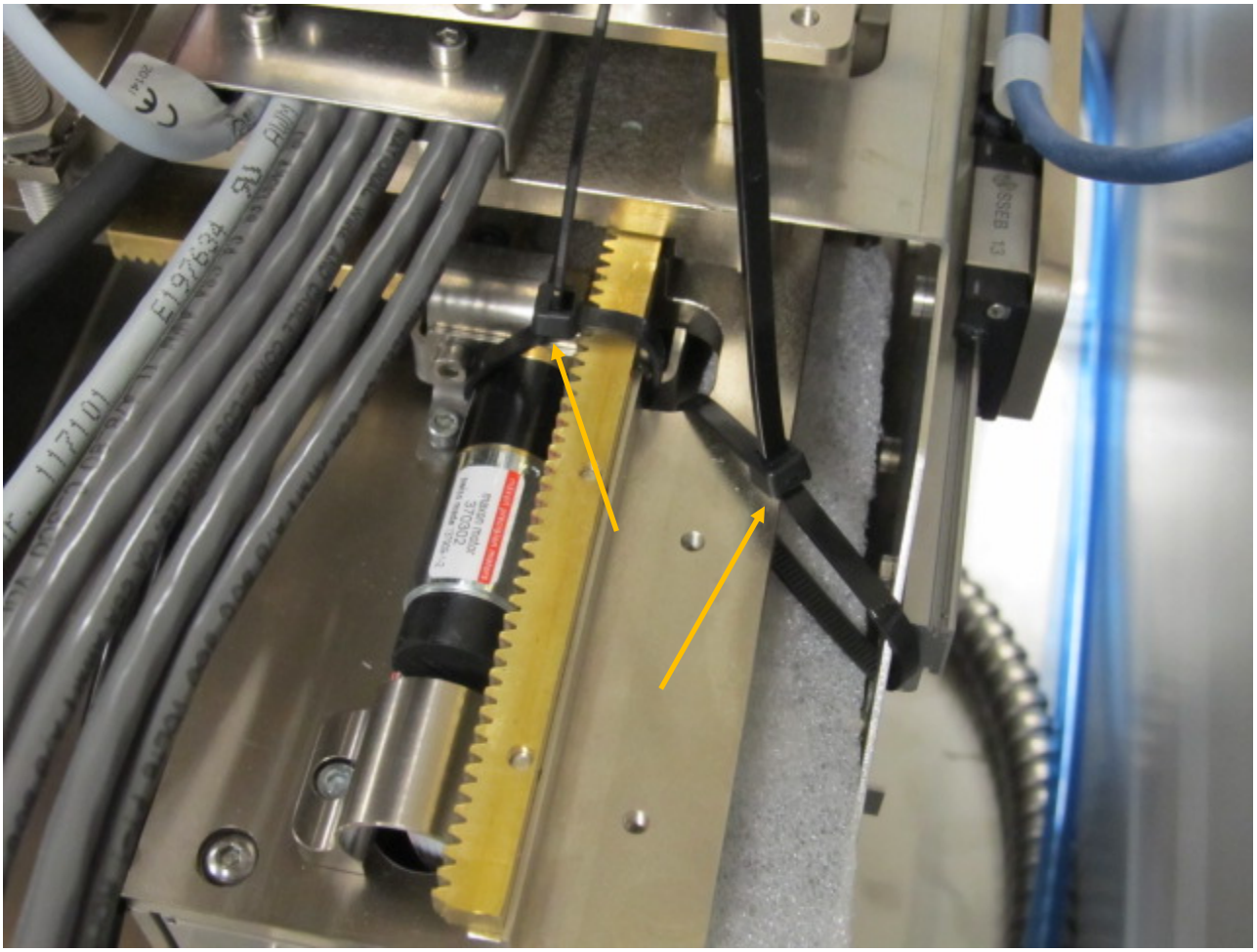


- Cut off wire ties holding the spot heater to the bridge as shown.

- Cut off wire ties holding the spot heater to carrier.

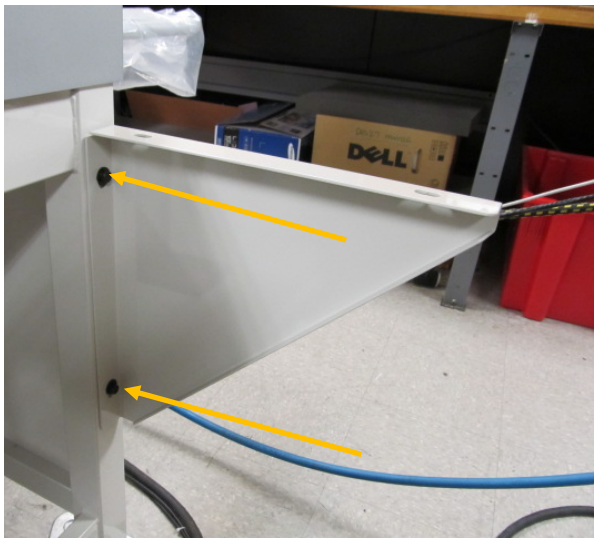


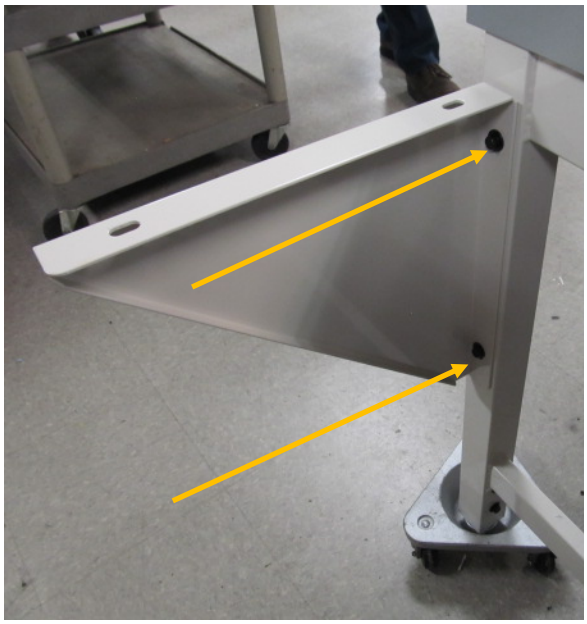
- Cut off wire ties holding the vision X and Y axis as shown.



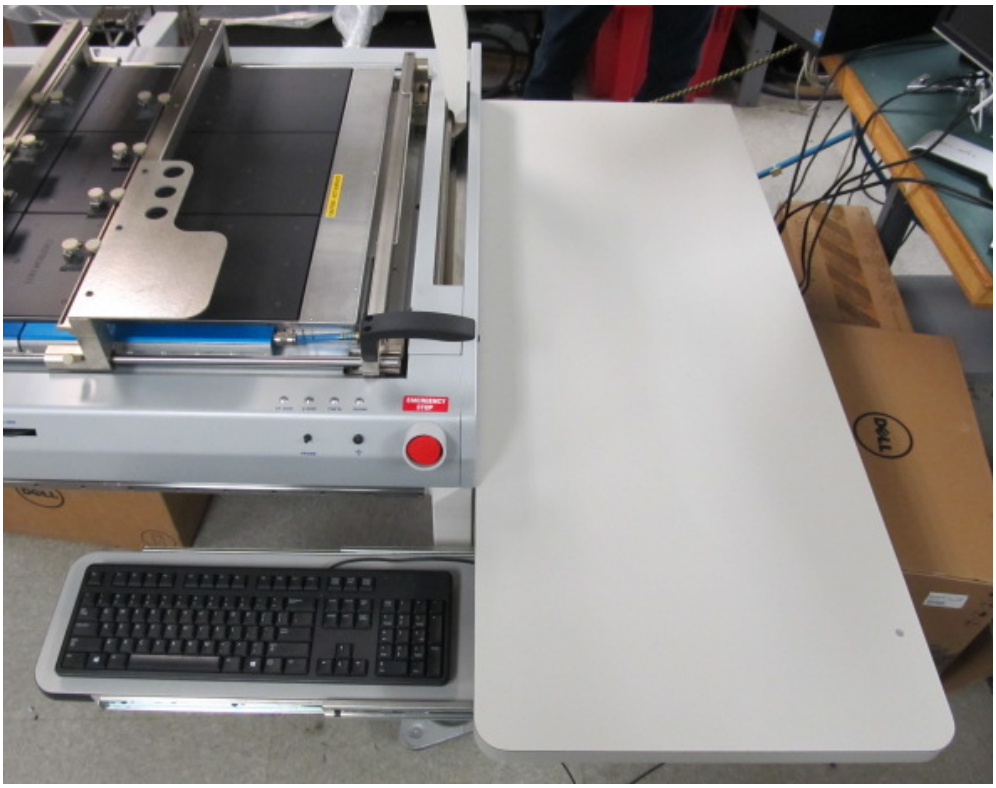
## 2.1 Installing the Side Table

- Install the front and rear table support wings to the right side of frame (2 bolts each wing).



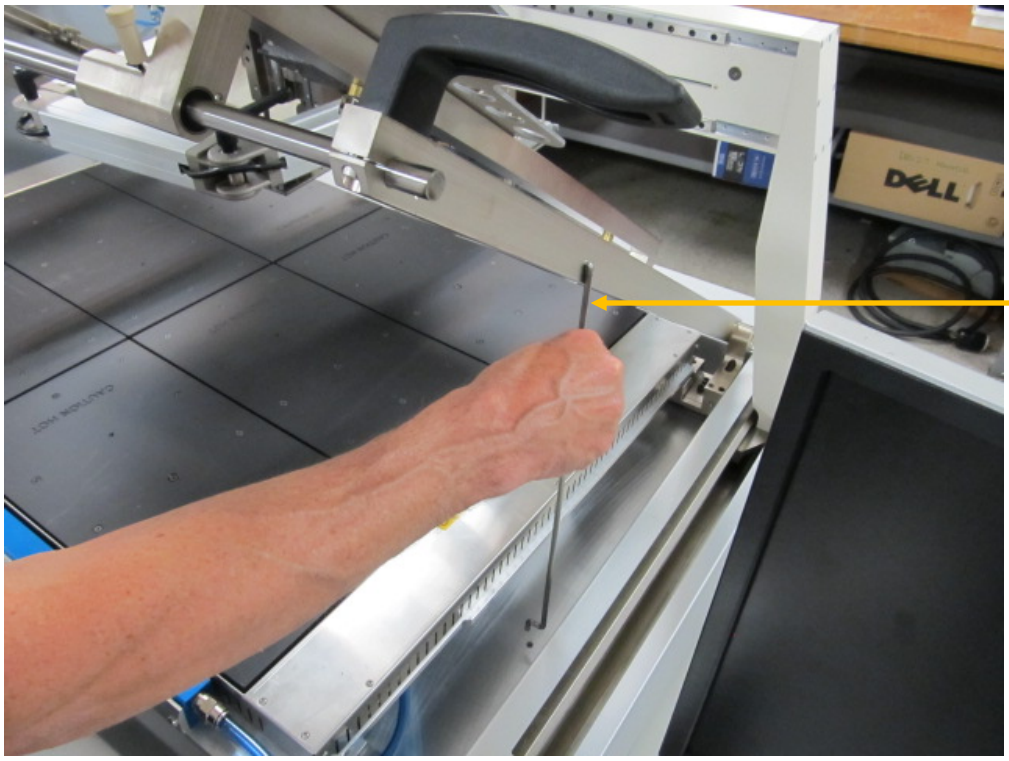



- Attach side table with keyboard tray to the support wings (4 bolts).

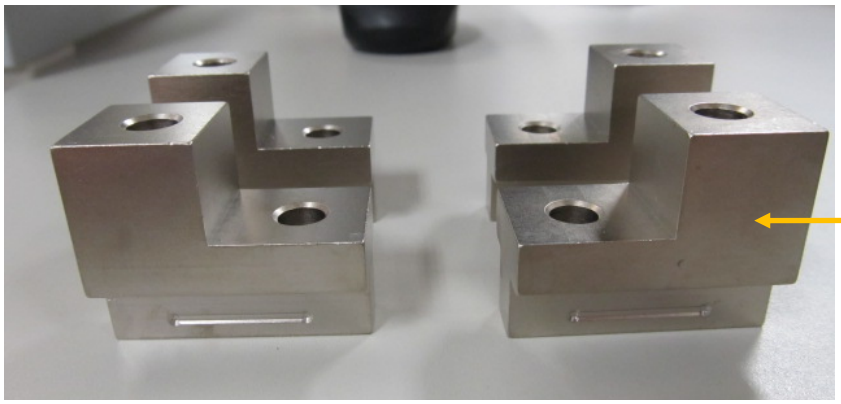


## 2.2 Installing the Bottom Heater

- Remove all bubble wrap covering the preheater.
- Release brake located on the front panel and push x-y axis to the rear of machine.
- Lift carrier and prop up using kick stand **(A)**.
- Locate preheater support blocks **(B)**.

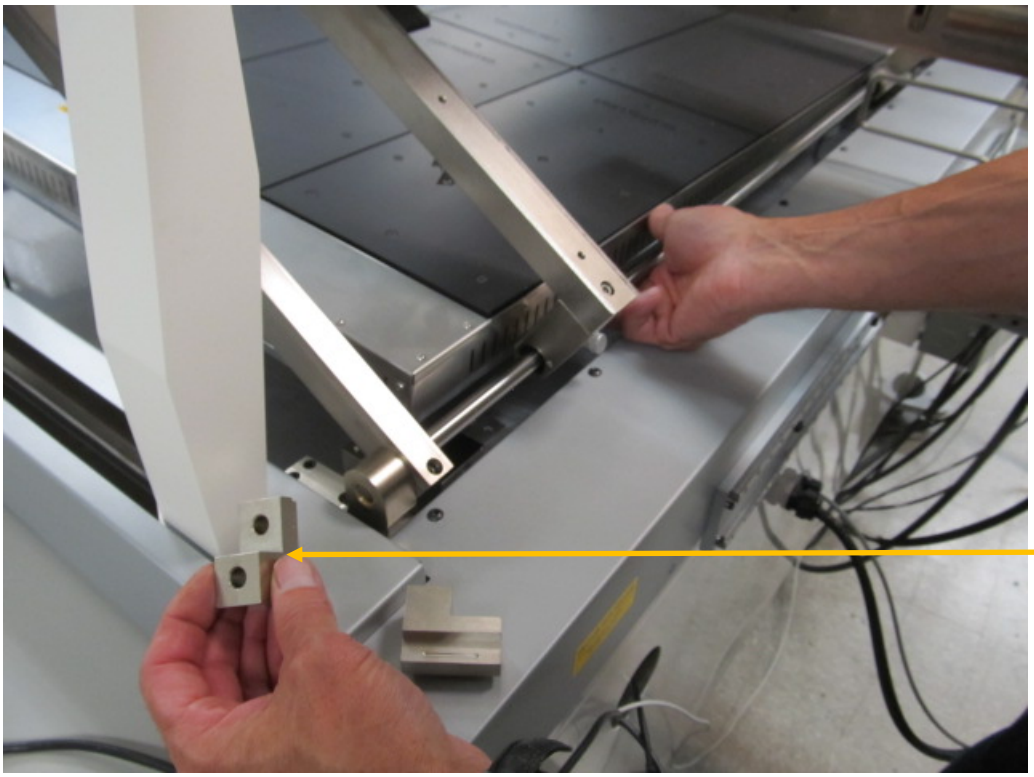


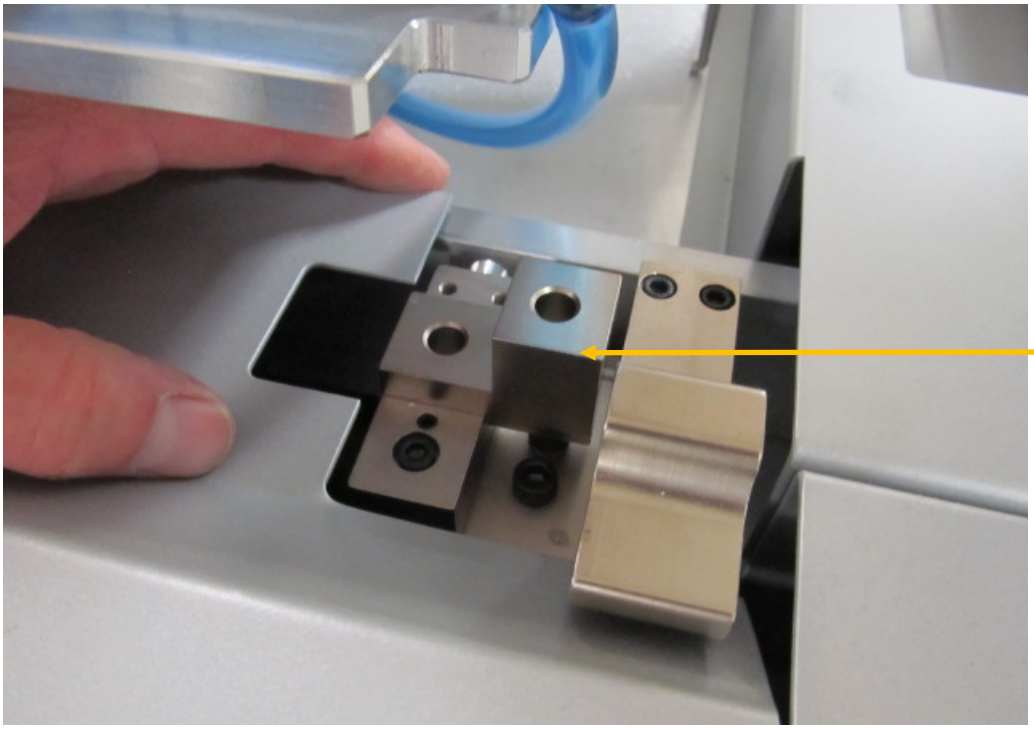

**(A)**



**(B)**

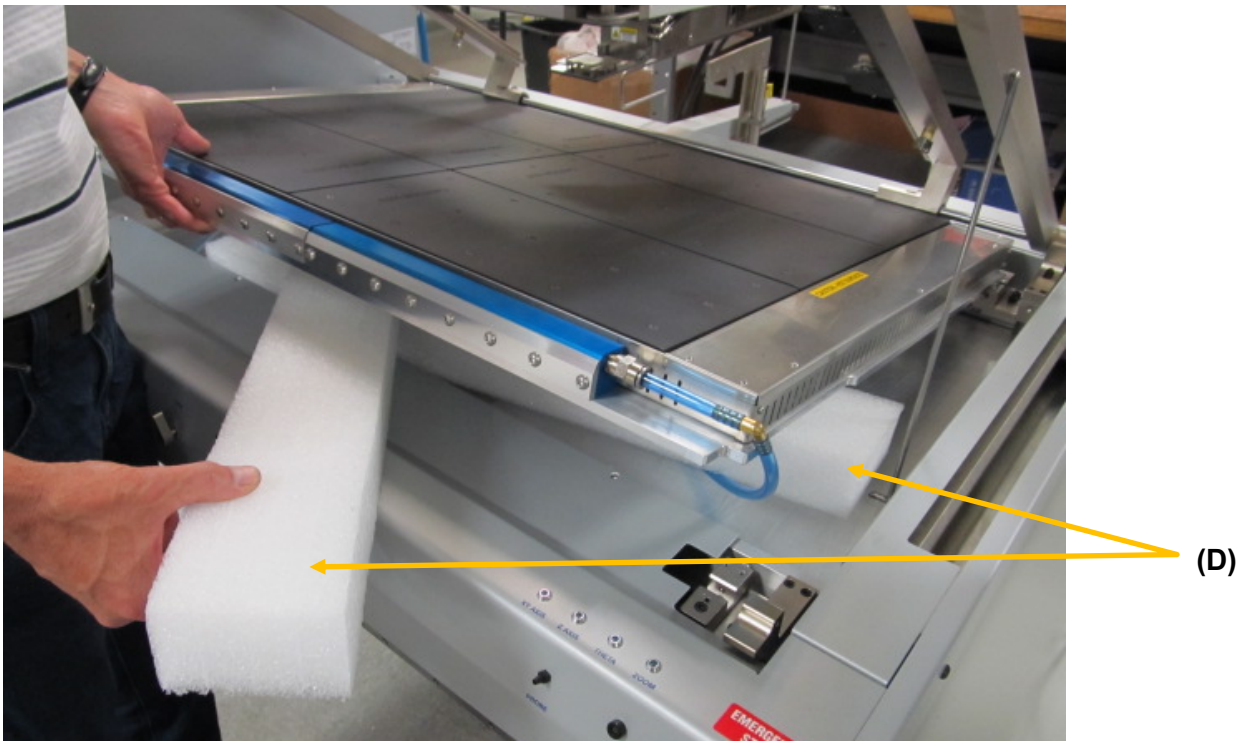
- Add preheater support block to each corner of the preheater (2 front, 2 rear) **(C)**.
- Position the four support blocks as shown in the photos so that the preheater is in its lowest possible position. This is necessary for proper clearance for the spot heater. The 41mm tall board supports are used with the preheater in the lowest position.

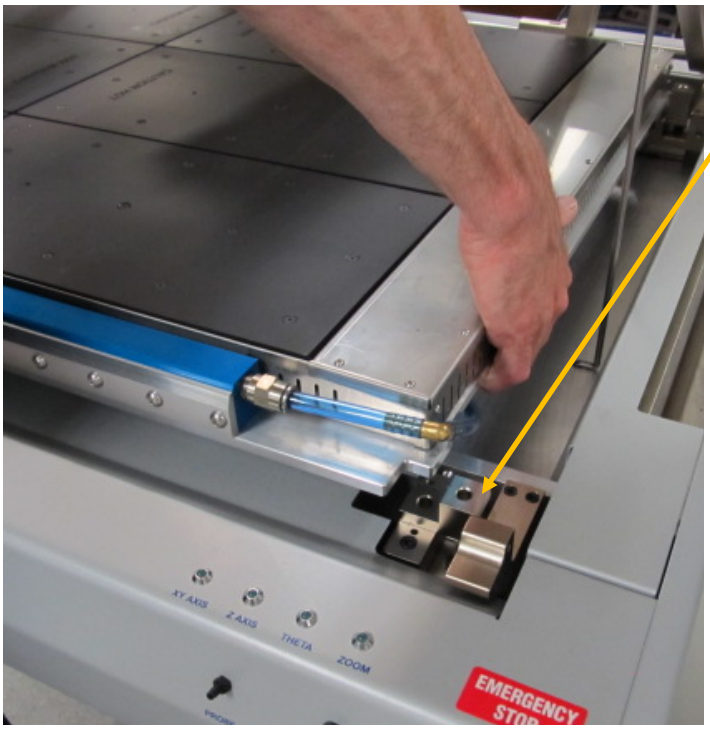


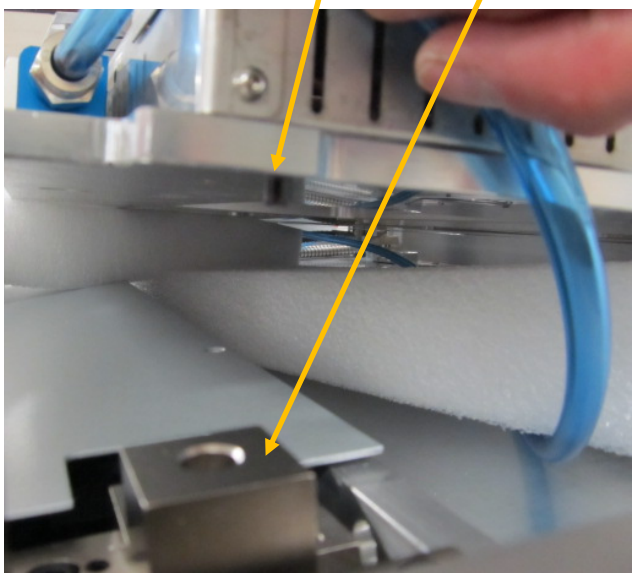



- Remove packing foam under preheater (it is recommended to have two people perform this). Lift front of heater and remove the two pieces of foam **(D)**.
- Locate preheater onto the support blocks **(E)**.

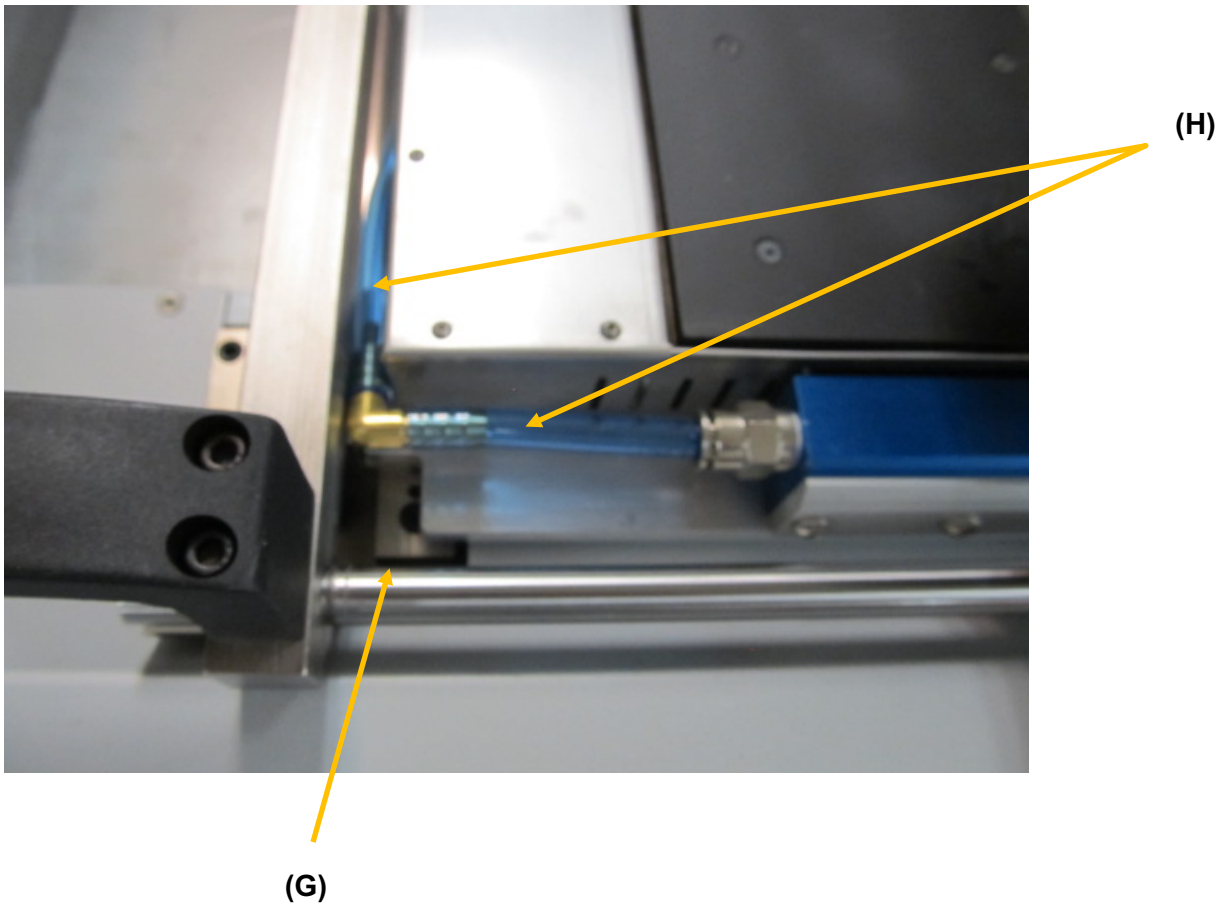
  **NOTE: The front right support (F) will locate with the dowel pin on the preheater.**



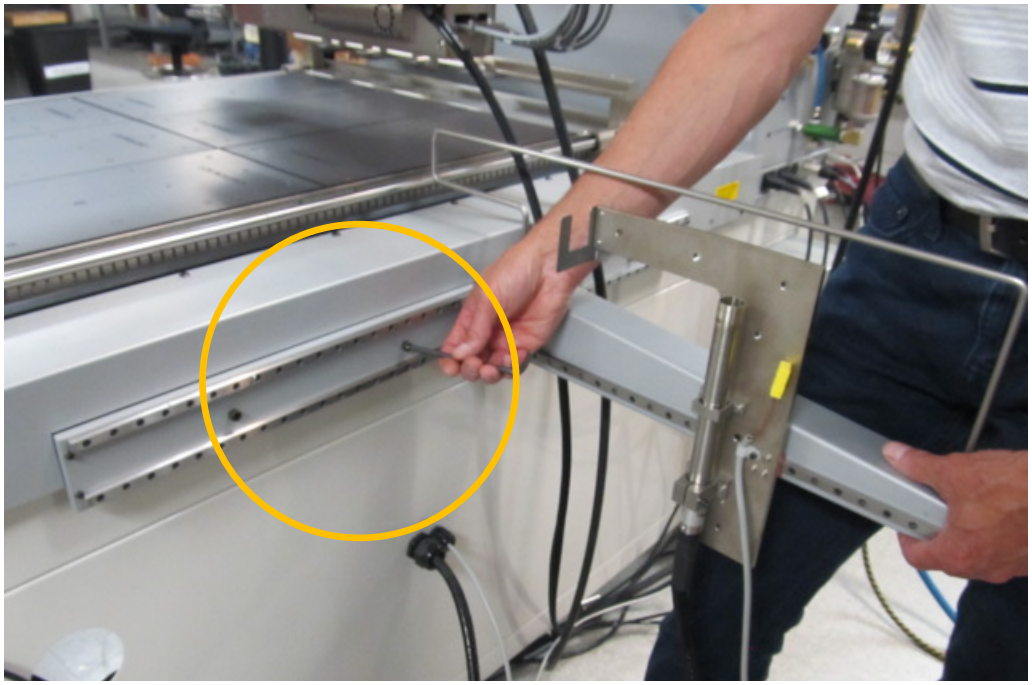



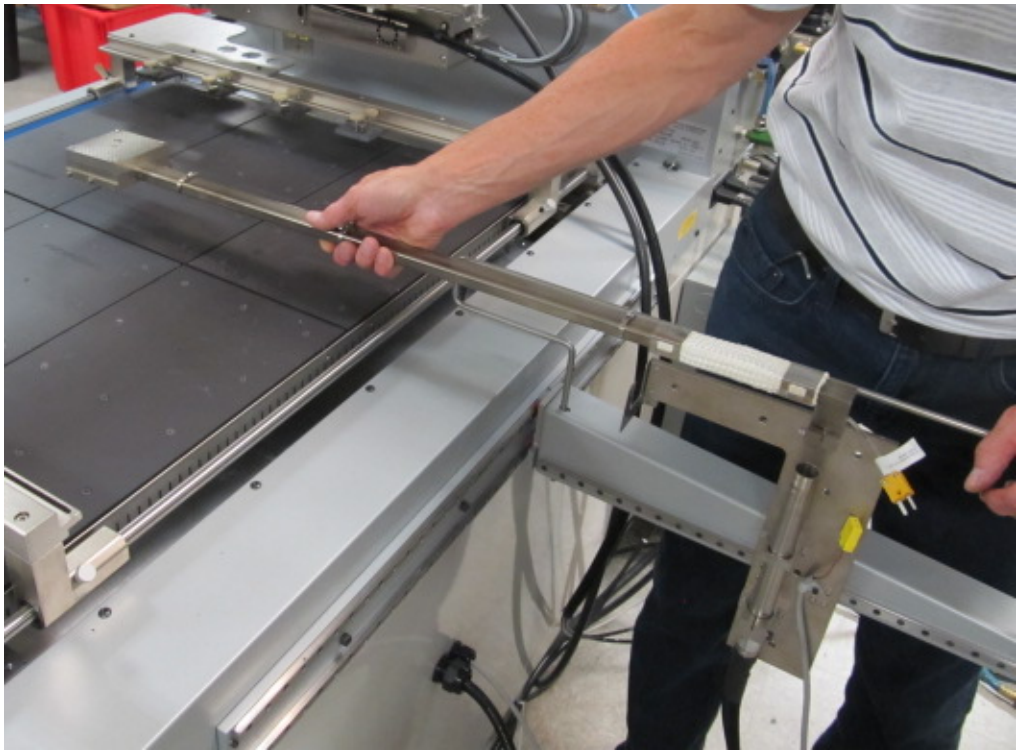
- Verify that the preheater is located on the other three support blocks in each of the 4 corners **(G)**.
- Situate the blue tube as shown **(H)** on the right and left side of preheater.



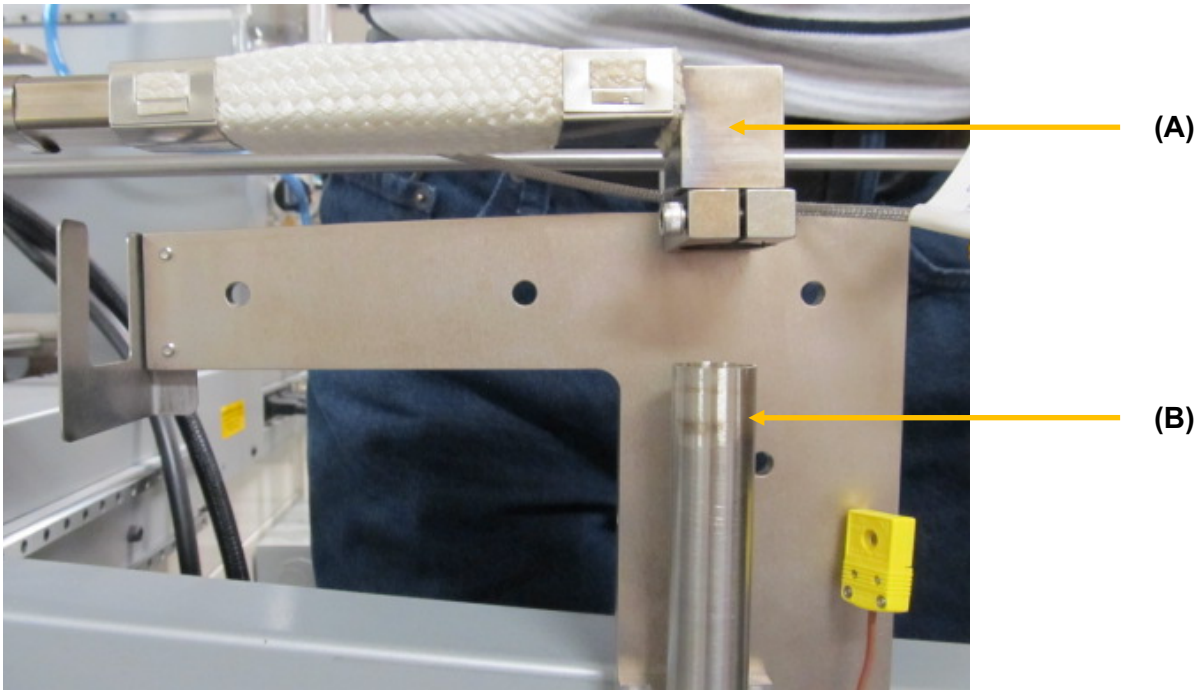
## 2.3 Installing the Optional Bottom Spot Heater

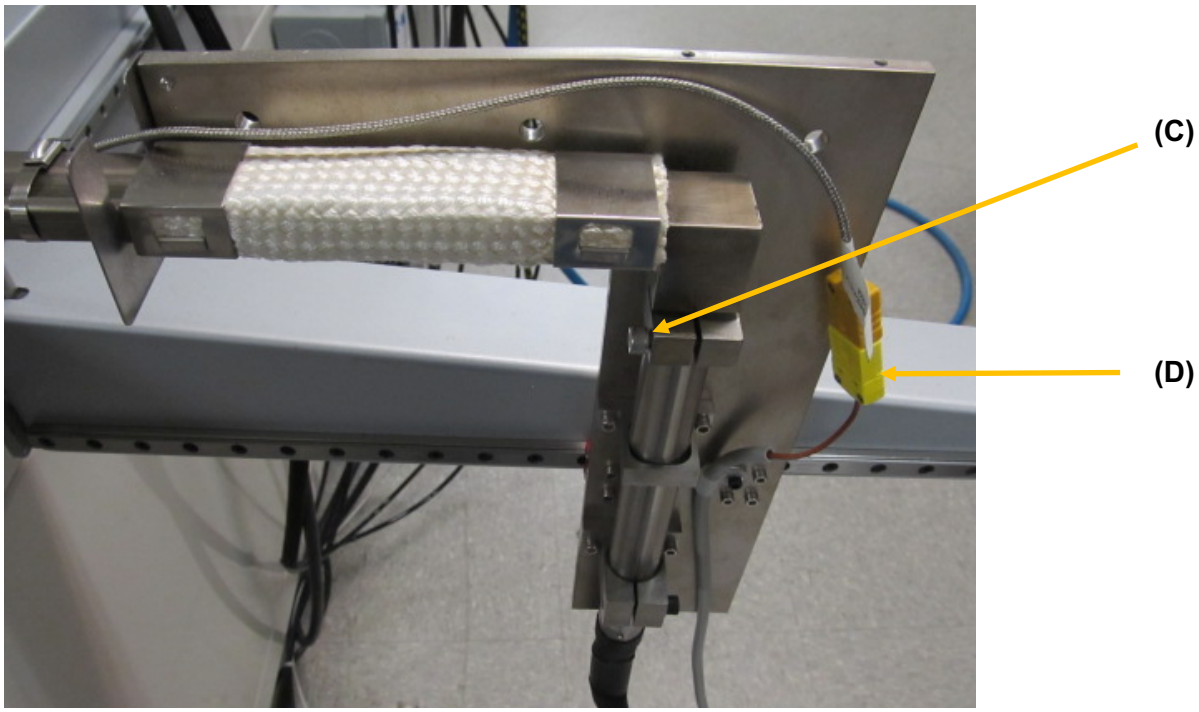
- Locate the spot heater and attach to the machine with four screws as shown.



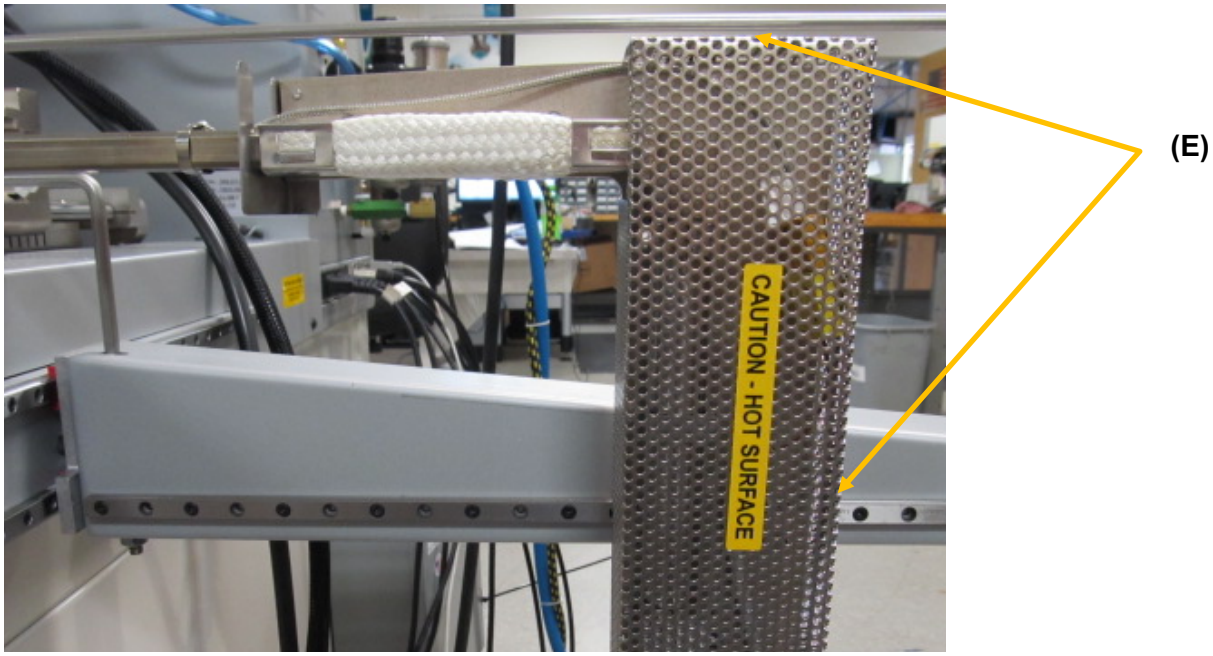


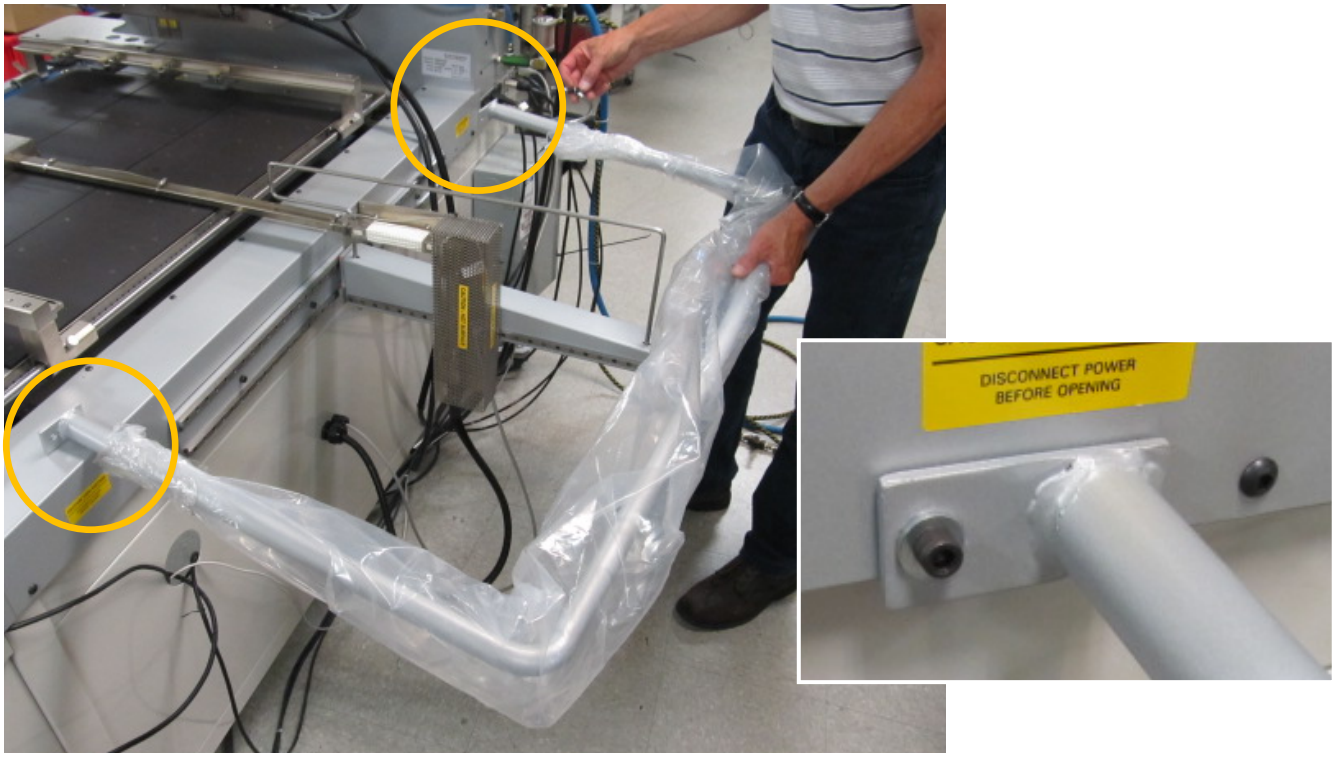
- Attach spot heater arm **(A)** to the heating element **(B). NOTE: Preheater must be in place before arm can be added**.
- Tighten screw **(C)** to lock the arm to the heater.
- Connect thermocouple connectors **(D)**.



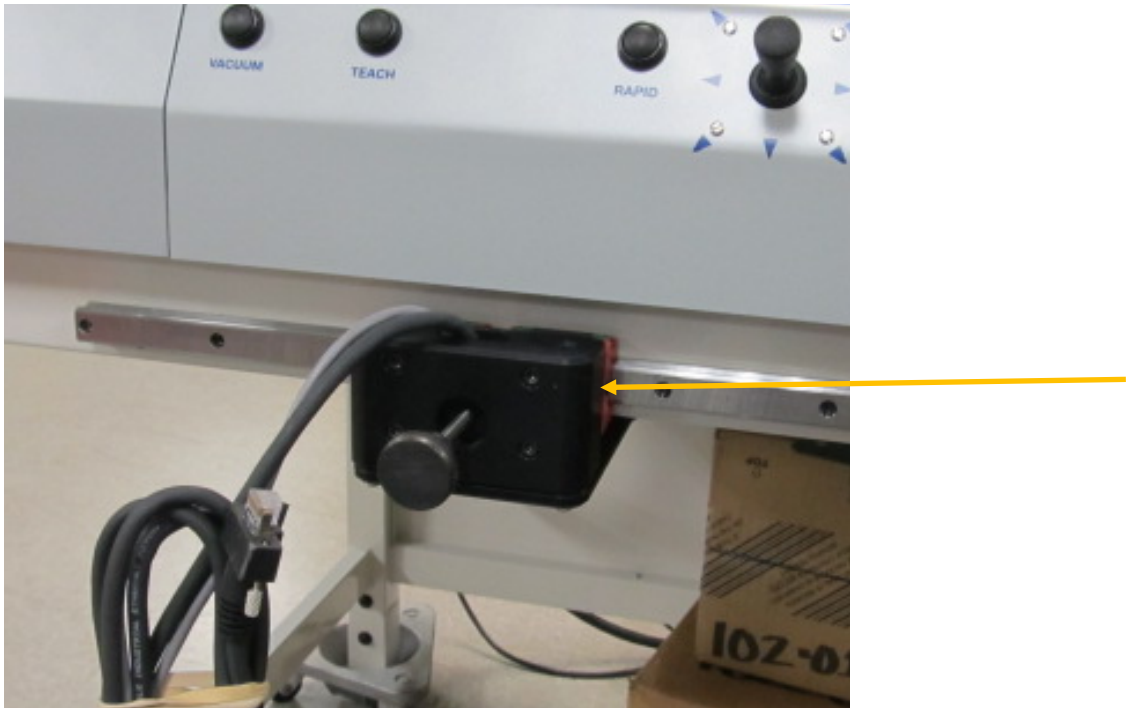
- Install heat shield over heating element with 4-40 screws (supplied) **(E)**.
- Attach protection bar to machine with two 1/4-20 screws (supplied) as shown **(bottom photo).**



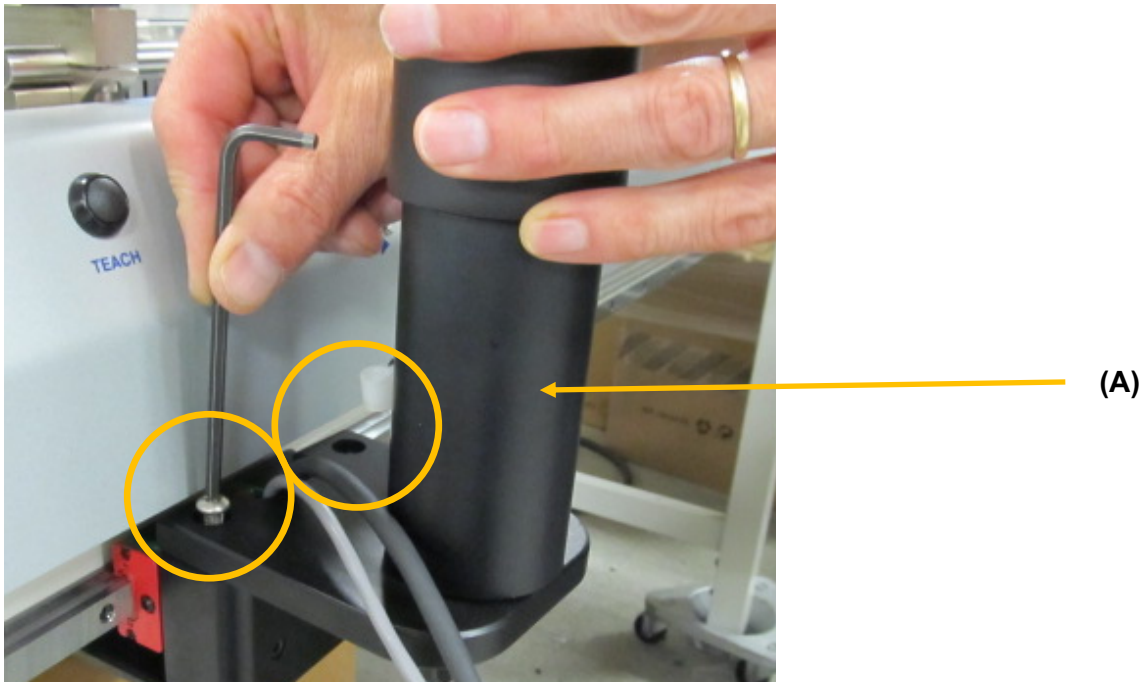



## 2.4 Installing the Optional Direct View Camera

Trolley mounting bracket and cables (front of machine) as shown.

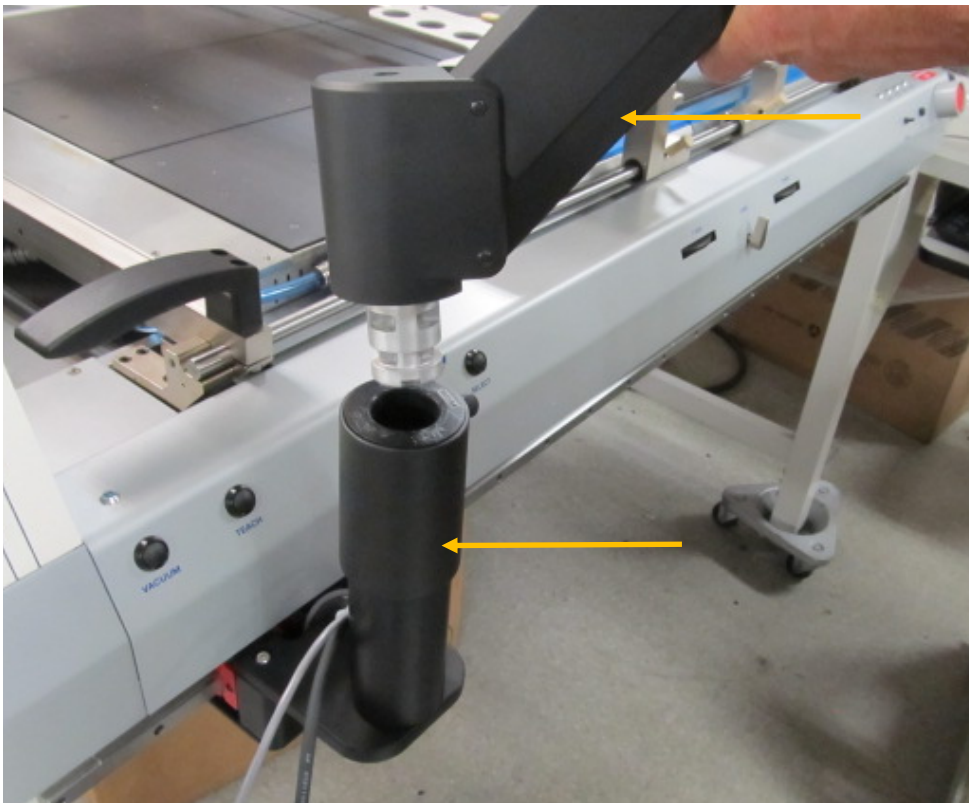



Locate camera arm pivot bracket **(A)** and mount with two screws supplied as shown.

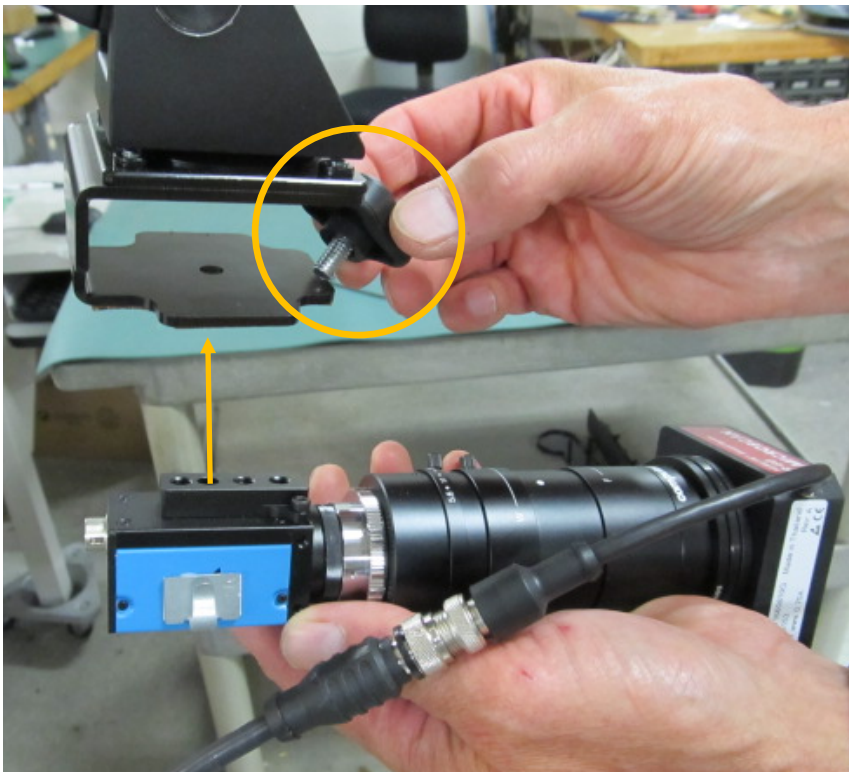


- Use wire clip to hold camera cables as shown.

- Insert camera arm into pivot bracket.

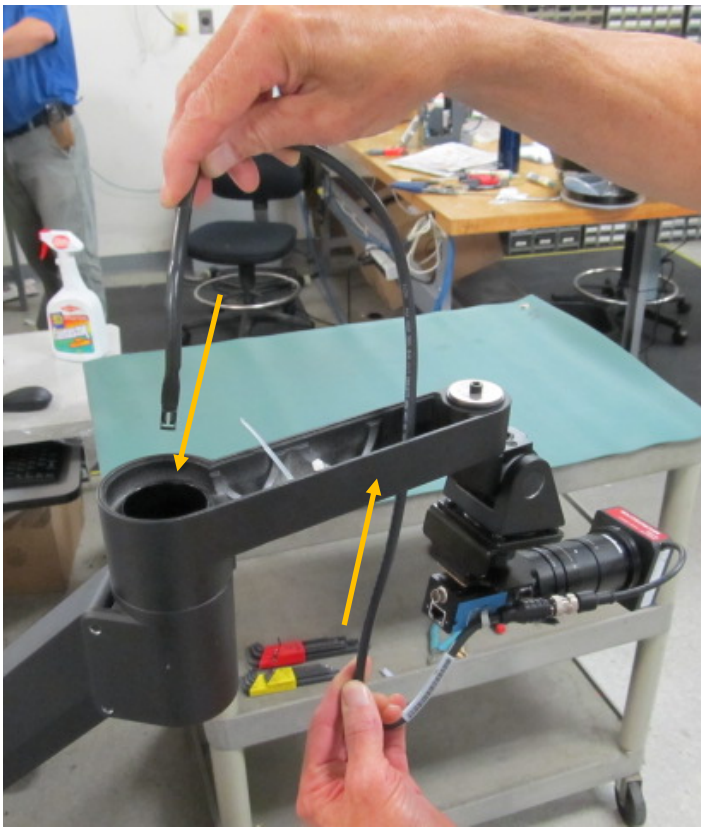


- Locate camera assembly and attach to camera arm with thumb knob as shown.

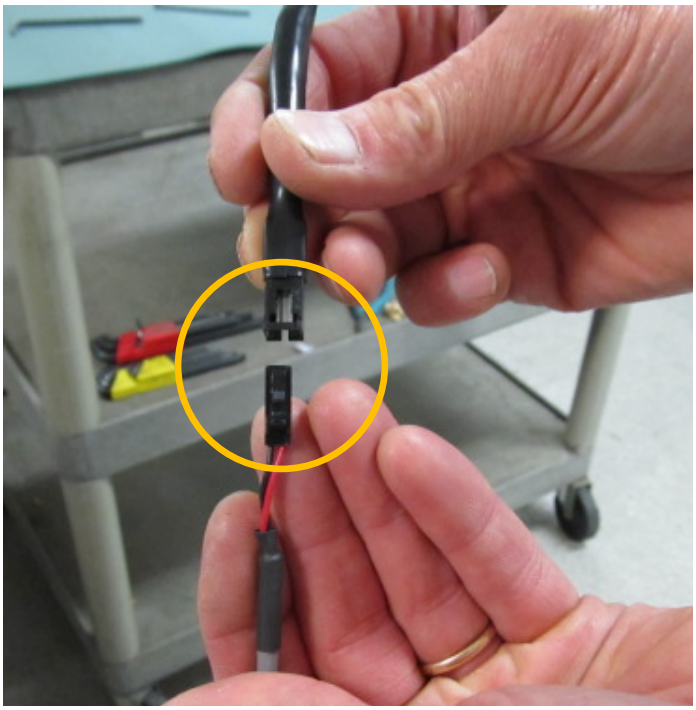


- Attach cable to clip.

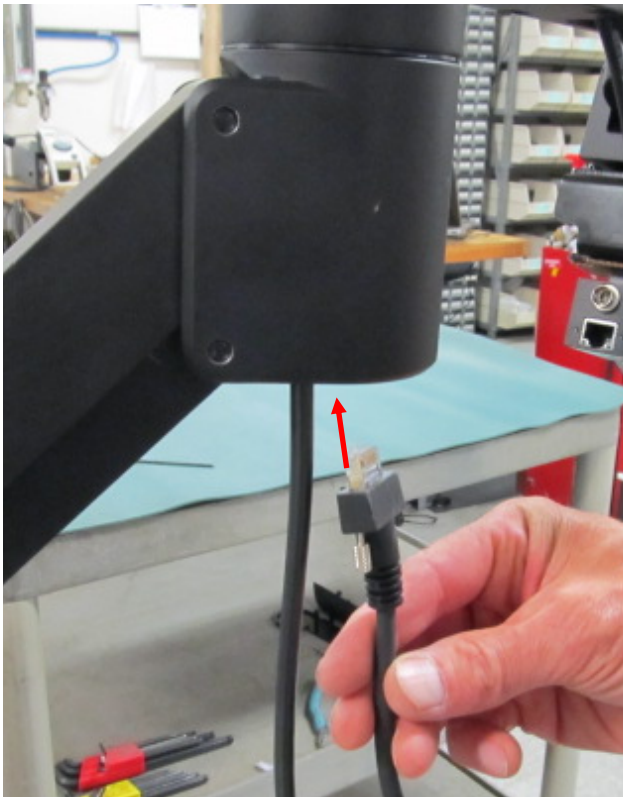
- Route camera light ring cable up and through camera arm as shown.



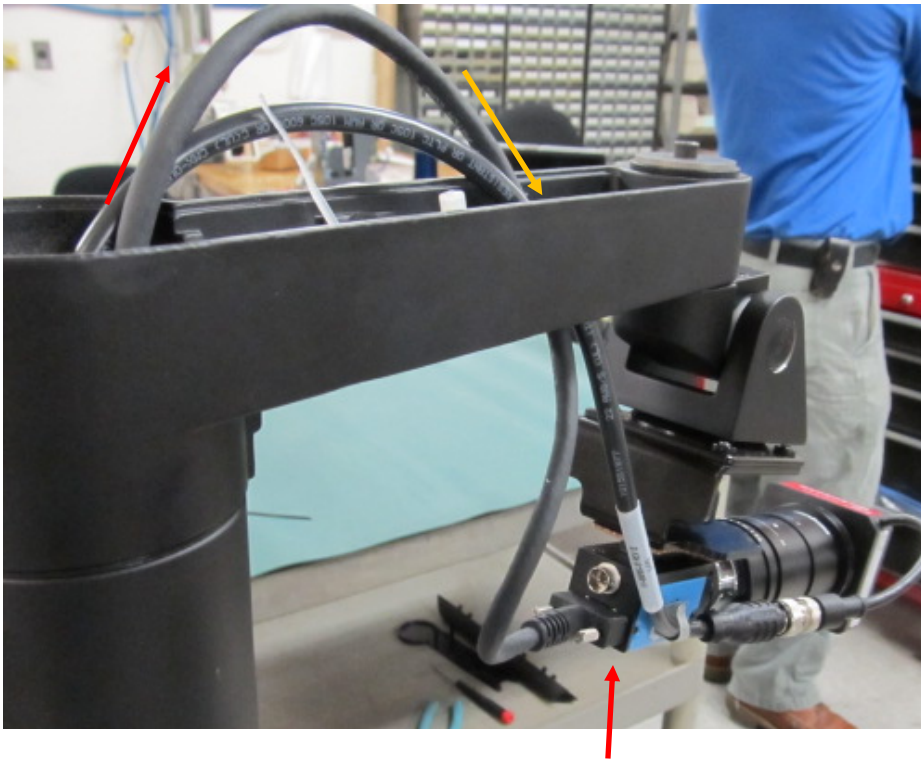
- Attach the ends of the camera light ring cables together.



- Route the Cat 5 camera cable up through the camera arm as shown.

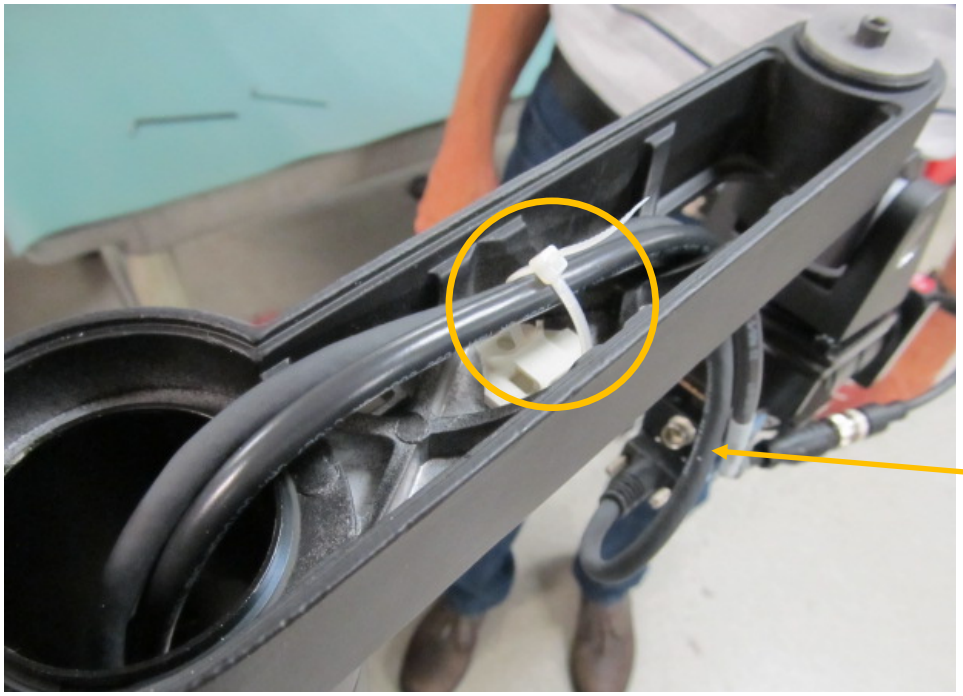


- Route Cat 5 cable down through camera arm and attach to camera.



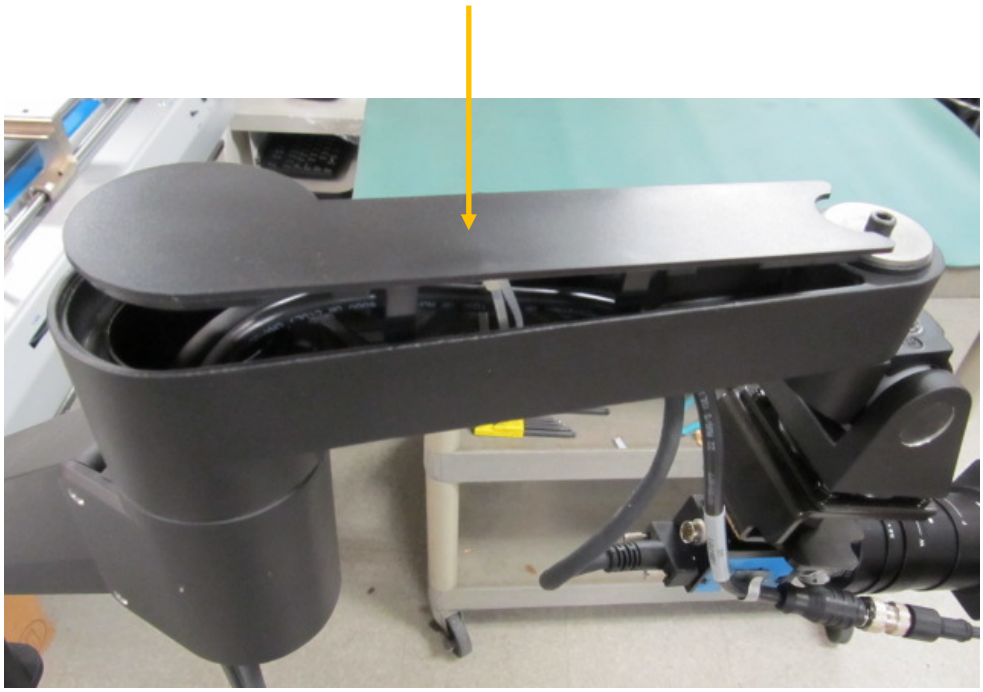
- Tie off cables as shown.

**NOTE: Leave enough of a service loop so camera can pivot without pulling on the wires.**



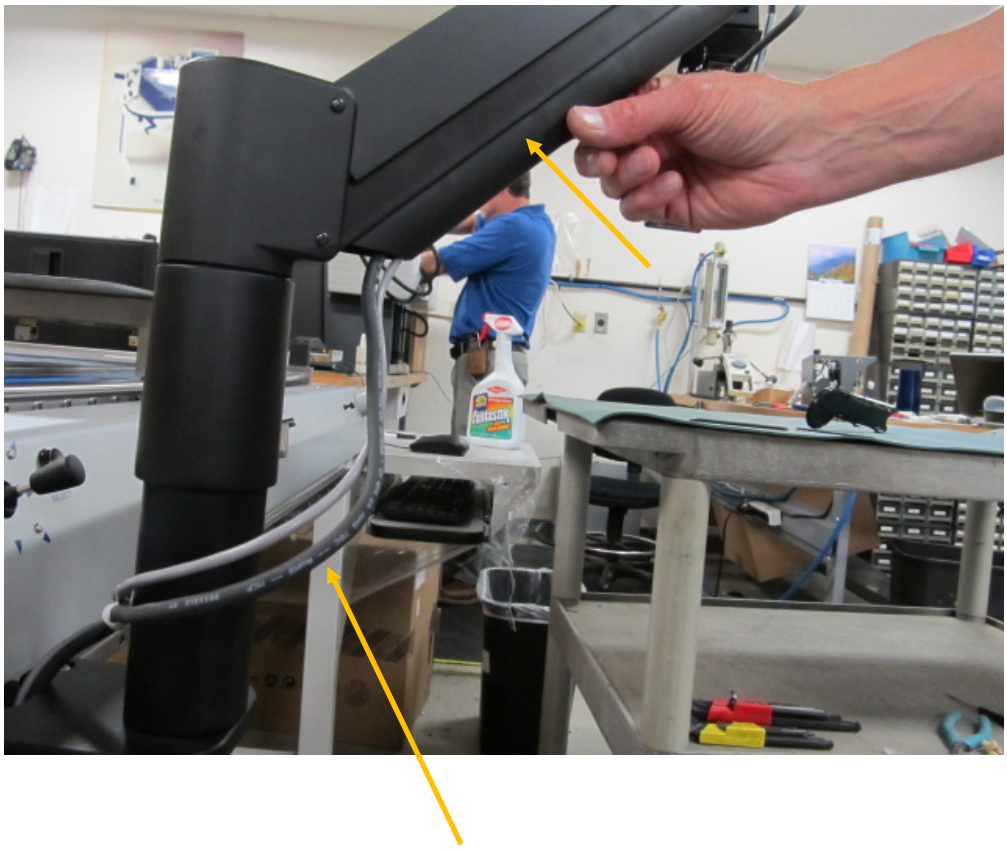
**(service loop)**

- Attach arm cover.



- Attach lower arm cover.

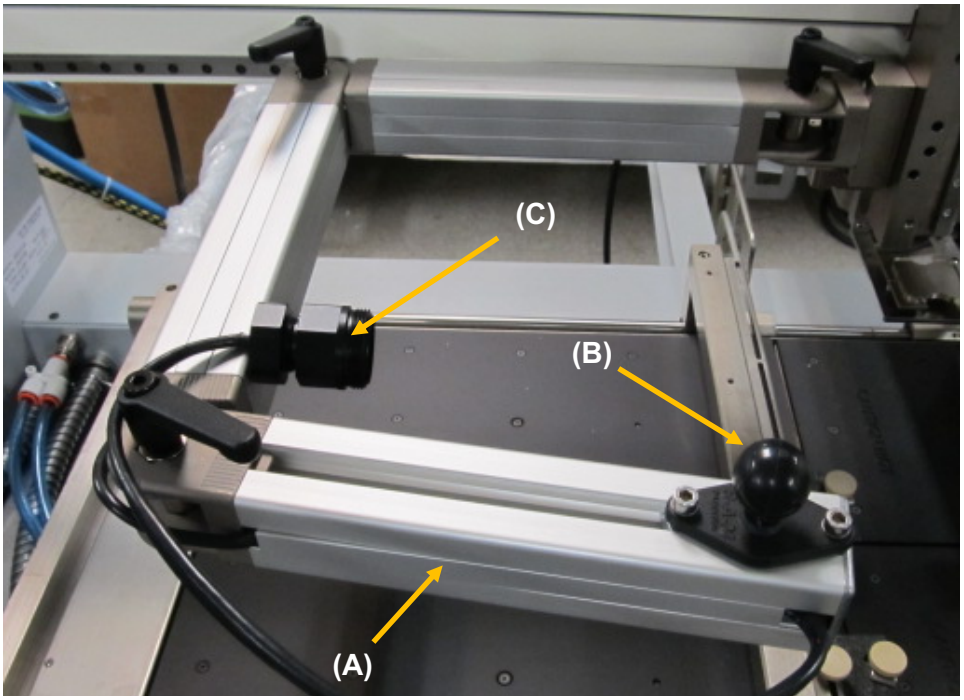
**NOTE: Leave enough of a service loop so arm can pivot without pulling on wires.**



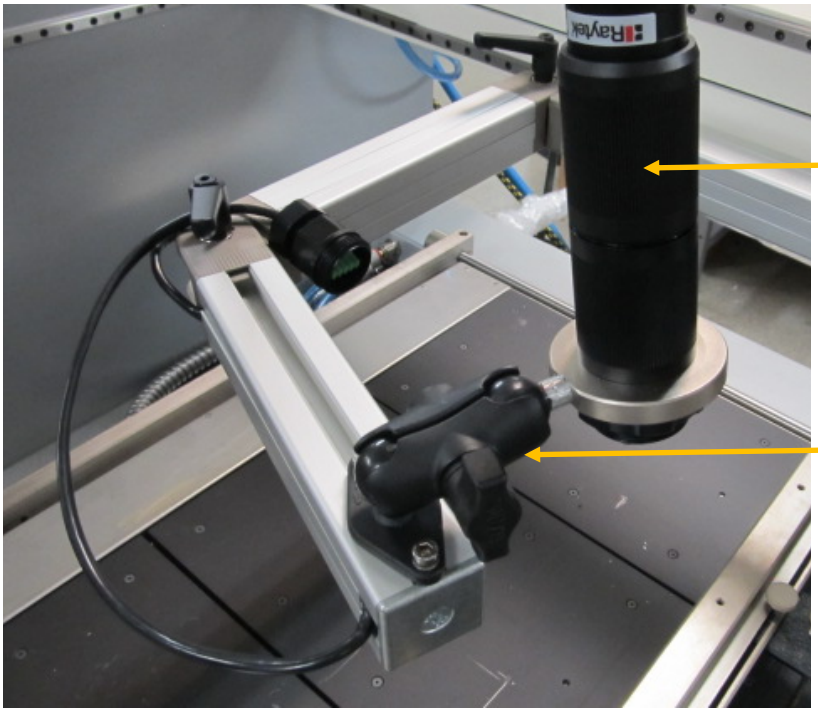
**(service loop)**

## 2.5 Installing the Optional IR Sensor with Fine Spot Laser Pointer

- IR probe arm **(A)** is shipped installed on machine with ball mount **(B)** and IR sensor connector **(C).**

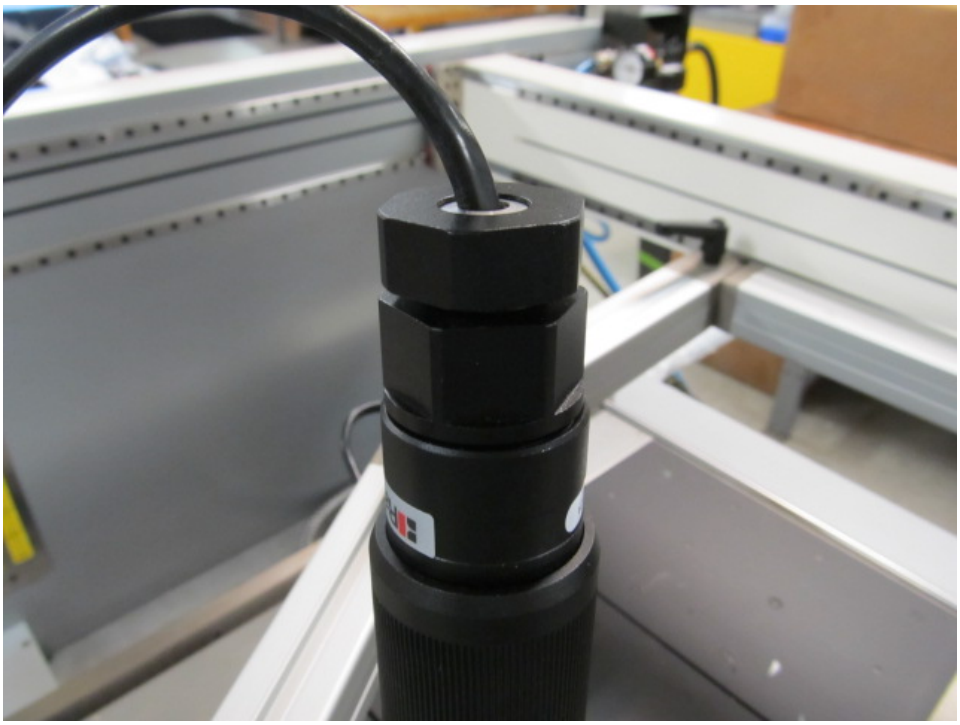



- Locate IR probe **(D)** and mount to ball mount **(E)** as shown.



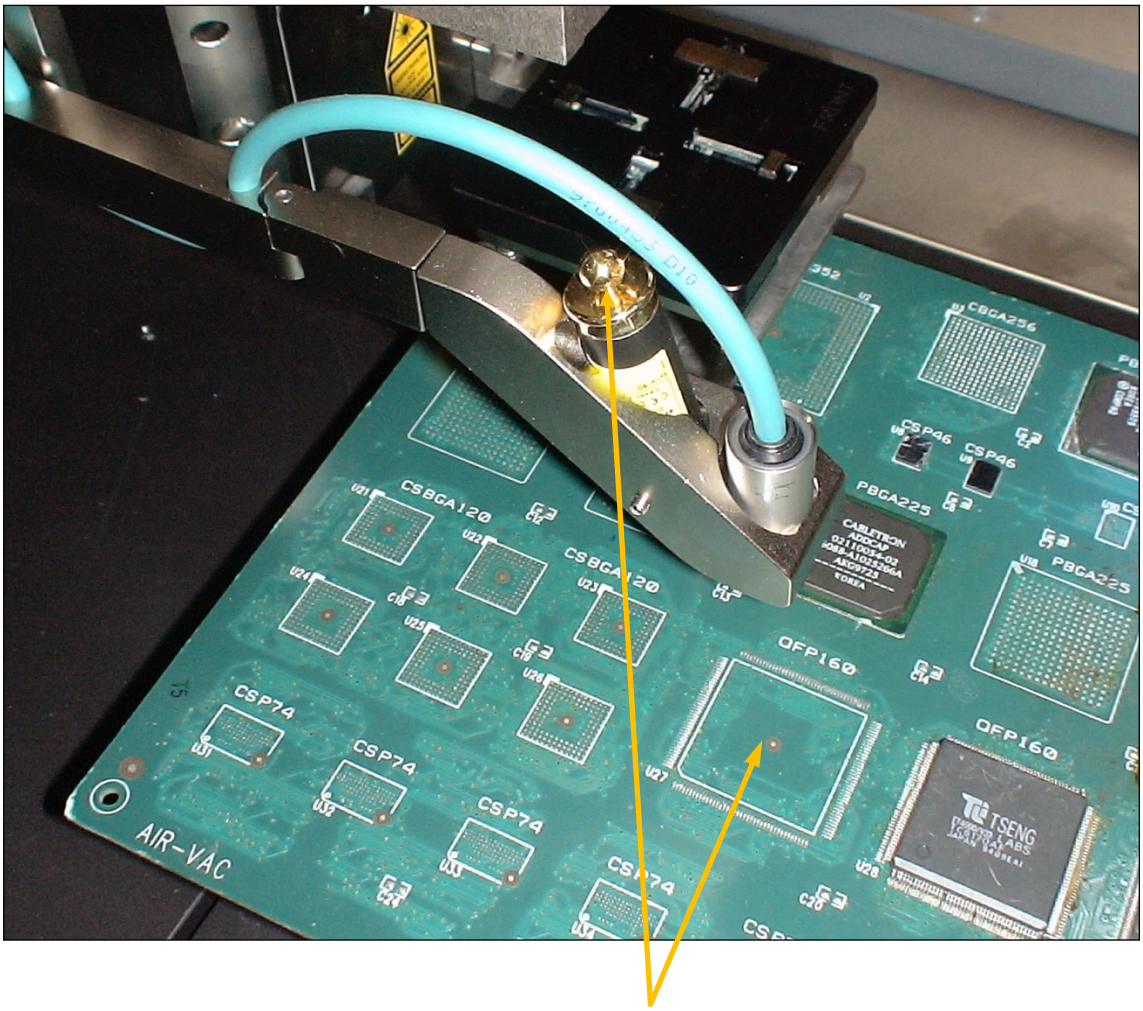
- Install connector to the IR sensor and screw down nut.
- Install strain relief grommet and lock nut to the end of the IR sensor.


- Assembled view.



## 2.6 Installing the Optional Pivoting IR Sensor

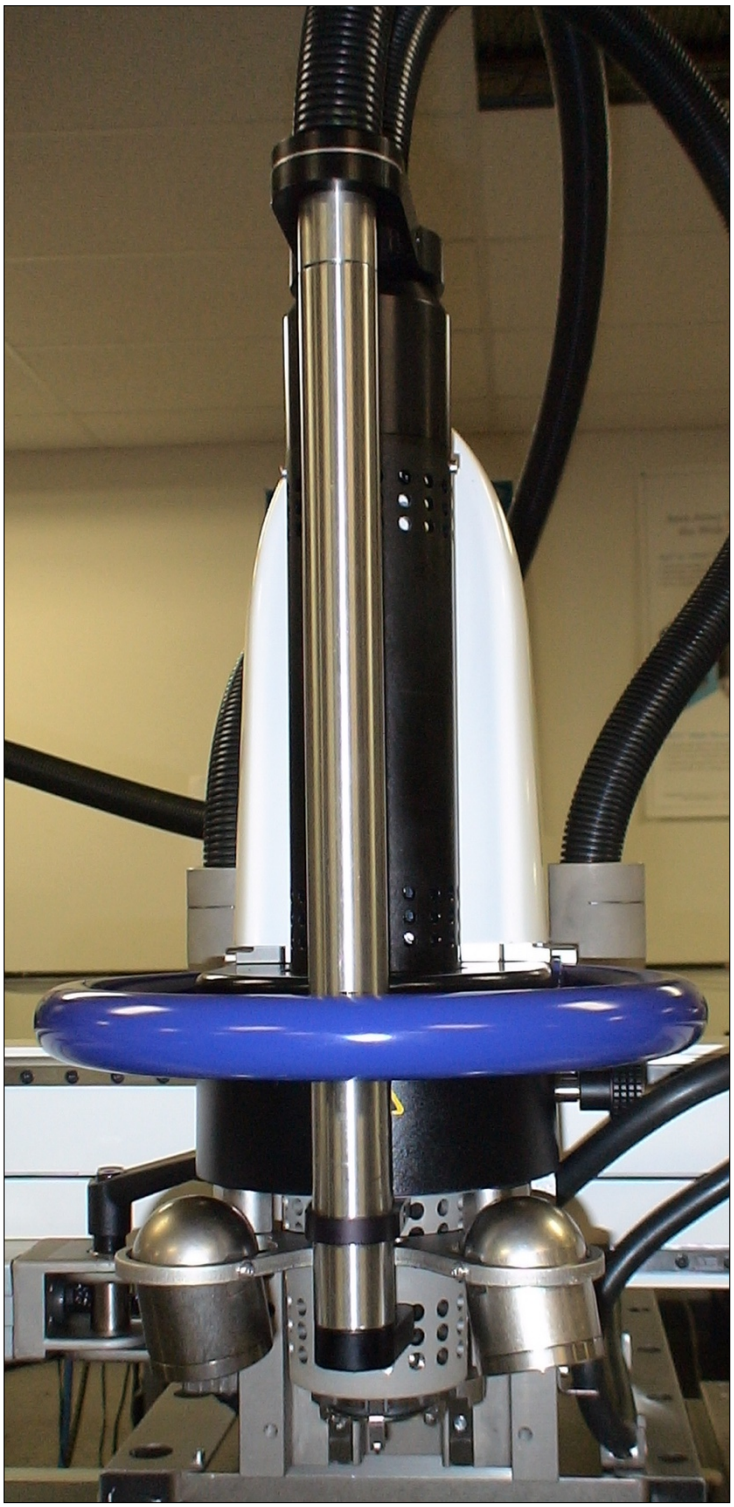
The IR Sensor option is installed by Air-Vac prior to shipment. No installation is required.




***Laser Pointer to indicate area being monitored by IR Sensor.***

## 2.7 Installing the Optional Fume Extraction Manifold

The Fume Extraction Manifold is installed by Air-Vac prior to shipment.



## 2.8 Facility Requirements – DRS27

### Electrical (also see Operating Notes):

- Machine Power:

| *Configuration* | *Volts* | *Amp* | *Phase* | *Hz* | *Plug /Disconnect Rating (min amp)* |
|---|---|---|---|---|---|
| DRS27 2 zone | 3 x 208 | 25 | 3 | 50-60 | Nema L15-30 (30a) |
| DRS27 3 zone | 3 x 208 | 25 | 3 | 50-60 | Nema L15-30 (30a) |
| DRS27 3 zone – Euro | 3 x 400/230 | 25 | 3 | 50-60 | No Plug (30a) |
| DRS27 3 zone, Spot heater | 3 x 208 | 35 | 3 | 50-60 | Hubbell CS8365C (50a) |
| DRS27 3 zone, Spot heater - Euro | 3 x 400/230 | 35 | 3 | 50-60 | No Plug (50a) |
| DRS27 6 zone | 3 x 208 | 45 | 3 | 50-60 | Disconnect box (50a) |
| DRS27 6 zone, Spot Heater | 3 x 208 | 50 | 3 | 50-60 | Disconnect box (60a) |

Customer must follow the above recommendations for warranty and safety reasons.

- PC Power: (208/230 VAC) – Provided by convenience plug on machine
- Monitor Power: (208/230 VAC) – Provided by convenience plug on machine

### Pneumatic:

- Upper Heater: 90-130 psi, 3 scfm, air or nitrogen. Clean, dry air (non-condensing) source. 1/8"-27 NPT male fitting x 6' hose supplied.
- Accessories: 90-130 psi, 21 scfm (intermittent). Clean, dry air (non-condensing source. 1/4"-18 NPT male fitting x 6' hose supplied.

### Operating Notes - IMPORTANT!:

#### Electrical:

- The DRS27 is supplied with either the above plugs or a disconnect box on the frame. The plug or disconnect arrangement is the means to have the machine be locked in the "Off" position. See Maintenance section for details of Lockout Tagout. The Euro versions are to wired according to local electrical codes and are to be provided with a means of disconnect and lockout.
- This system is designed to operate on 208 VAC.
- **Under full load conditions**, power must not drop below 205 VAC. Full load is defined as DRS27 fully operating, plus all other equipment down the line fully operating. <u>If 205 VAC is not met, a buck up transformer or another line must be connected.</u> Under general conditions, expect incoming line voltage to drop approximately 3-10 volts.
- Under no load conditions, power must not exceed 220 VAC (US).
- If the PC and monitor are connected to a separate power source, or connected through a voltage regulator, the machine minimum voltage is 200 VAC.
- In areas susceptible to frequent power disturbances, line filtering/protection may be required.

**Air/Nitrogen:**

- With top heater and accessories operating at 100% flow, system consumes up to 24 scfm @80 psi. With all systems activated, 70 psi. must be maintained. Requires both gas lines be direct plumbed.
- A means of isolating the machine from compressed gas supply needs to be supplied. Examples of this are a lockable quick disconnect or a lockable valve. See maintenance chapter in LOTO section for more details. Be sure the device can handle the required flows.

Environmental:

- Temperature Range: +5˚C to +40˚C
- Relative Humidity: Not to exceed 50%
- Altitude: Up to 1500m above sea level

Physical:

- Machine Operating Dimensions (WxDxH): (DRS27) 67"x57"x72"; (DRS27.6Z) 82"x57"x72"
- Machine Weight: (DRS27) 750 lbs. (est.); (DRS27.6Z) 1000 lbs. (est.)
- Monitor Dimension (W x D x H): 17" x 17" x 10"
- Monitor Weight: 20 lbs.

Transportation:

- When transporting the machine, use factory crate and packing or equivalent / better.
- Contact Air-Vac for proper shipping hardware and instructions if original materials are not available.
- Storage temperatures to be -25°C to +55°C with short excursions (not exceeding 24 hrs) up to 70°C.

## 2.9 Pneumatic Connections: Top and Bottom Heater

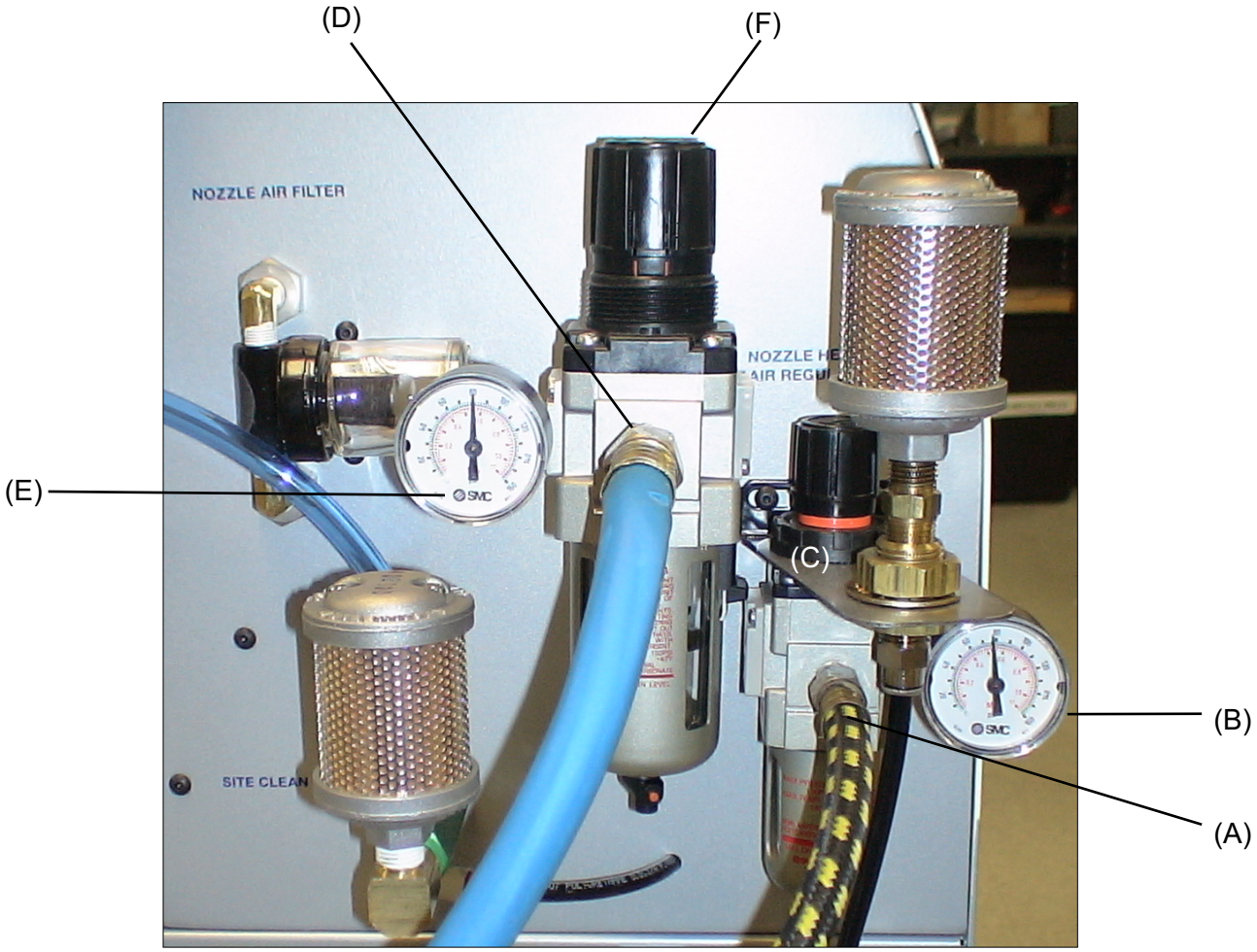
CAUTION: REFER TO FACILITY REQUIREMENTS OF DRS27.
All Pneumatic and electrical connections described in the following sections must be done prior to powering on the DRS27.

Upper Heater Pneumatics:

- Connection (A): 1/8-27 NPT (male fitting) x 6 ft. hose (1/4" diameter) supplied
- Pressure Setting (B): 80 psi, adjust as required (C)
- Air/Nitrogen Consumption: 3 cfm

Other Pneumatics (nozzle vacuum, site cleaning vacuum, board cooling option):

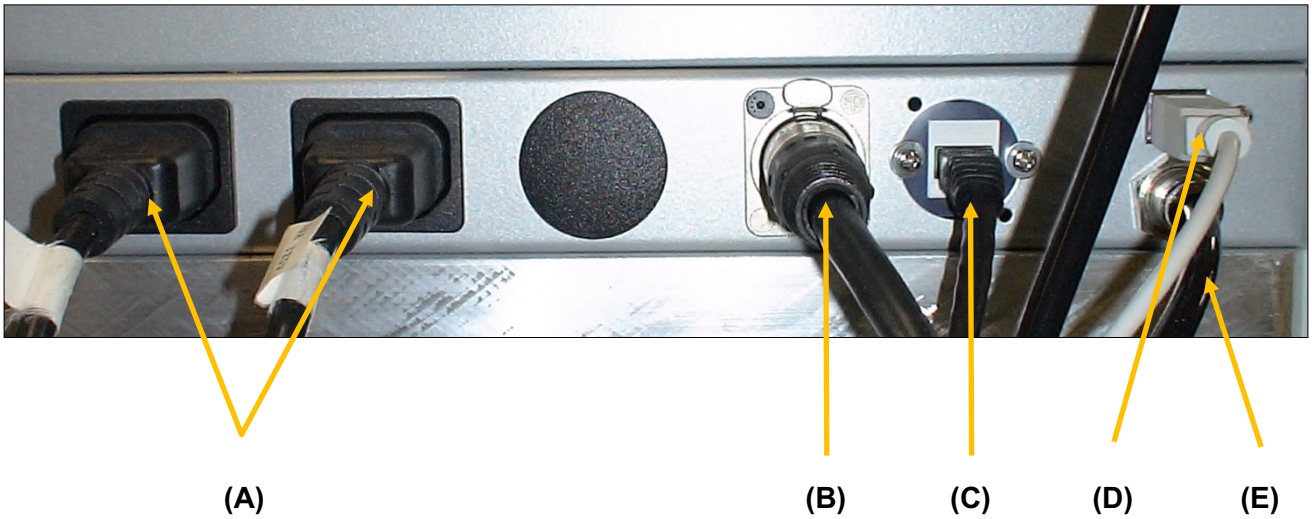
- Connection (D): 1/4-18 NPT (male fitting) x 6 ft. hose (3/8" diameter) supplied
- Pressure Setting (E): 80 psi, adjust as required (F)
- Air Consumption: 21 cfm



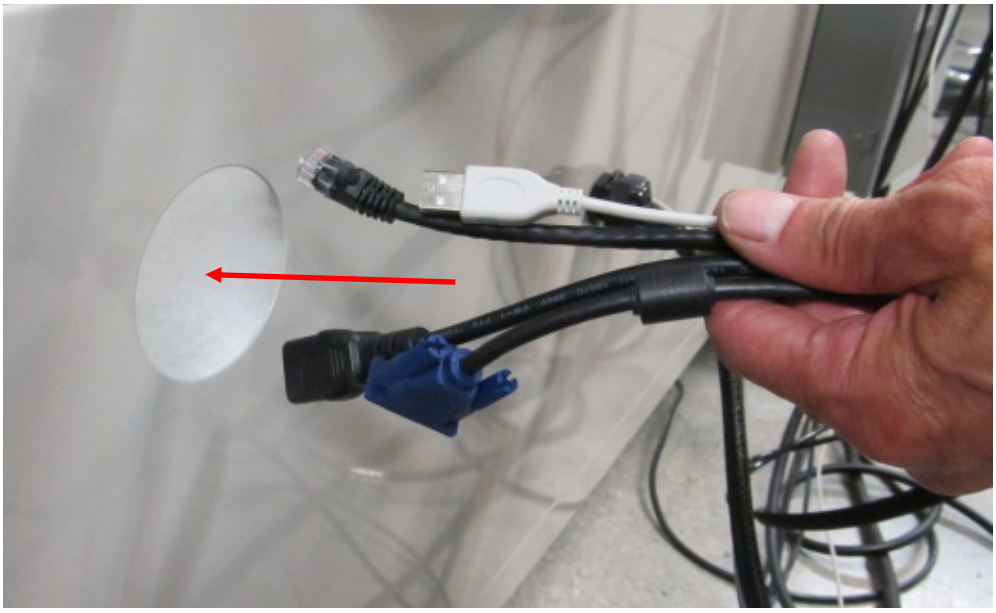
## 2.10 Other Connections

### Accessory Panel

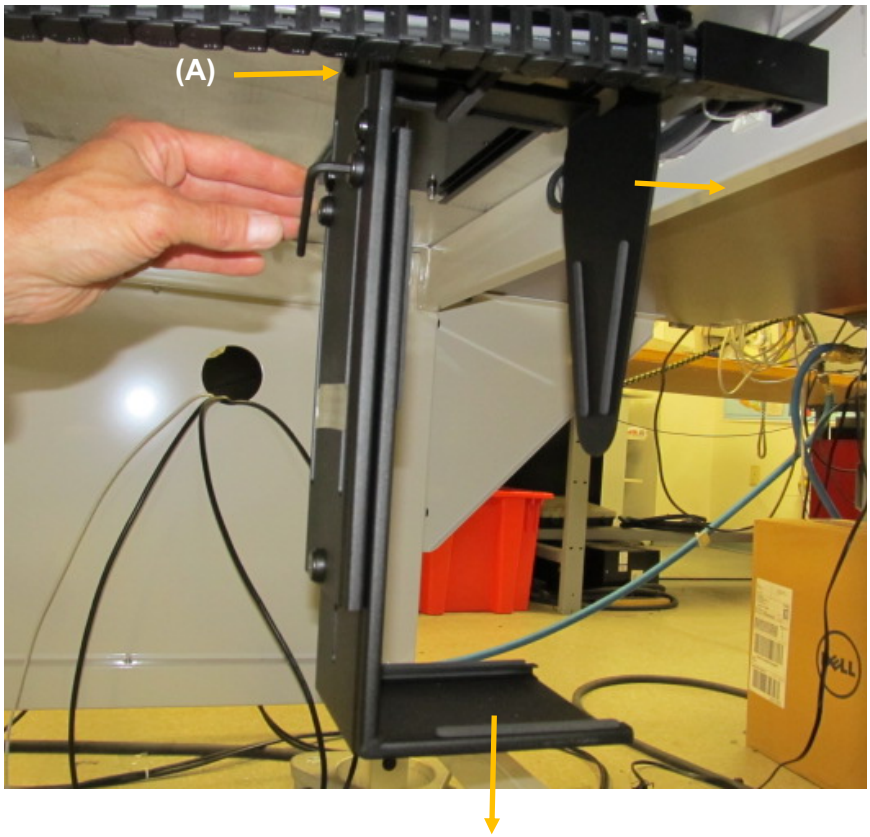
- Power (Computer and Monitor) **(A)**
- Footswitch **(B)**
- Ethernet **(C)**
- USB **(D)**
- Cooling Chamber Air **(E)**




- Route cables from accessory panel (and monitor) through the hole in rear of table frame to hook up to computer.



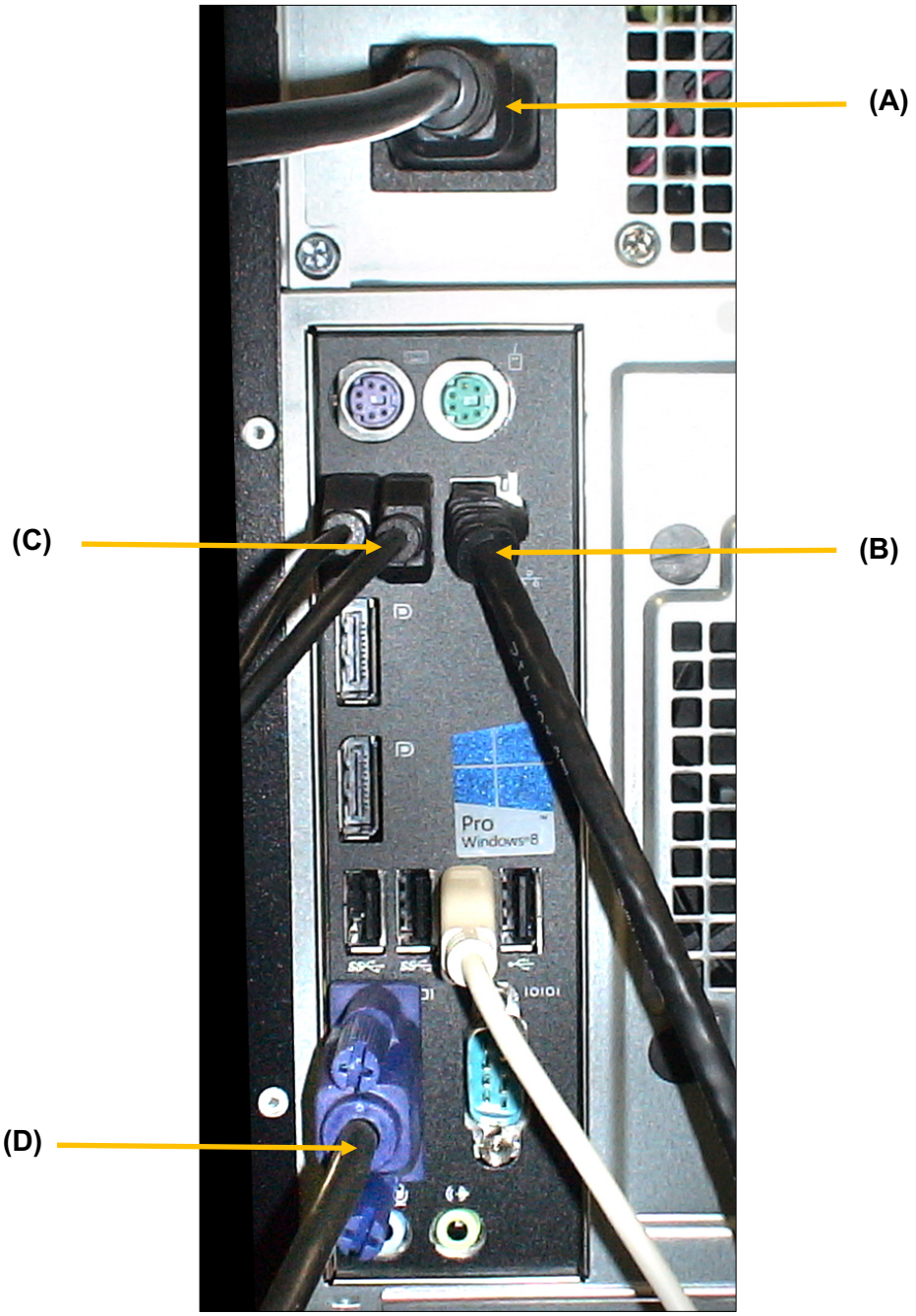
- Adjust the computer holder (3 places up or down) to accept the computer using Allen wrench (supplied) and adjust thumb knob **(A)** from right to left.




- Install computer into holder as shown and adjust as required then tighten adjustment screws.

### CPU Connections

- Computer Power **(A)** - CPU and Monitor are both powered with 220V from machine.
- Machine Ethernet **(B)**
- Mouse and Keyboard **(C)**
- Monitor **(D)**



## 2.11 Material Check List

The following accessory items are shipped with all new DRS27 systems.

| | |
|---|---|
| **Operators Manual** | 0027.00.902 |
| **Calibration Components** | |
| • Temperature Calibration Nozzle | NCAL-5 |
| • Flow Meter | 0024.00.104 |
| • Flow Meter Hose | 9001.15.036 |
| • Flow Meter Fitting | 9001.00.013 |
| **Tool Kit (includes)** | 0024.00.040 |
| • Filter Element | 0001.11.101 |
| • Wrench Set All | 12055 |
| • Probe Tip, 3 De | 29A3 |
| • Button Probe | 3SBP100 |
| • Fitting, 1/4 BA | 9001.00.013 |
| • Tubing, Cond-SI | 9001.15.018 |
| • Tubing, 3/8"ID | 9001.15.036 |
| • Clip, Grounding | 9002.01.065 |
| • Fuse, 10 amp | 9002.04.018 |
| • Fuse, 4 amp | 9002.04.033 |
| • Fuse, 1/2 amp | 9002.04.038 |
| • Fuse, 12 amp | 9002.04.055 |
| • Component Assy | 9002.14.005 |
| • Board, 28mm QFP | 9002.14.017 |
| • Nozzle | NT27EZ27 |
| • Box, Plastic | 9004.00.005 |
| • Case, Plastic | 9005.03.029 |
| • Anti-Seize | AS15 |
| • Filter Element | F1AE |
| • Gas Nozzle Stand | GNS1 |
| • Gas Nozzle Tool (small) | GNT1 |
| • Gas Nozzle Tool (large) | GNT4 |
| • O-Ring assortment | ORASST |
| • Steel Brush | STB7 |
| • Needle | TS5LL-1 |
| • Stringe (5cc) | TS5LL/PP |
| • Cup assortment, Silicone | VCASST |

# 3: Machine Function Verifications

**3 Machine Function Verifications ..... 3**
3.0 VERIFICATION OVERVIEW ..... 3
3.1 VOLTAGE VERIFICATION ..... 4
3.2 PRESSURE VERIFICATION ..... 6
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# 3 Machine Function Verifications

## 3.0 Verification Overview

Once the DRS27 has been setup according to the instructions as outlined in Chapter 2, critical machine functions including pressure, gas flow rate, temperature and vision must now be verified to ensure proper machine performance. It is important that the verification procedures be done sequentially as outlined in this section.

Machine verification should be done:

- After initial setup
- Anytime the system is physically moved or disconnected
- At regularly scheduled intervals such as every 3-4 months.

Verification processes are stored in a hidden menu, to enter the hidden menu please do the following:

- Right click on the Air-Vac logo **(A)** and the toolbar color will change to red.
- To return to the main menu, right click anywhere else on the screen and the toolbar will return to normal.

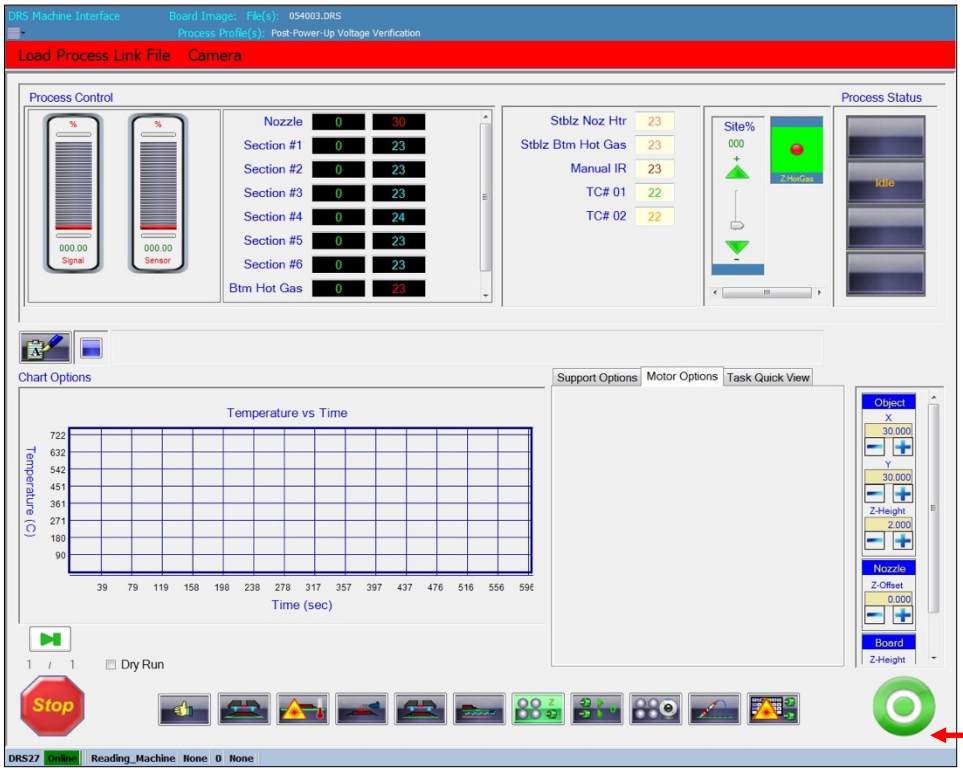
## 3.1 Voltage Verification

**NOTE: Qualified Personnel ONLY.**

1. Open the electrical box.
2. Turn machine power on (release e-stop and turn key).
3. Turn on PC .
4. Click on the black Air-Vac administrator icon. The administrator password is "AirVac".
5. Double click on the DRS27 icon to load the software.

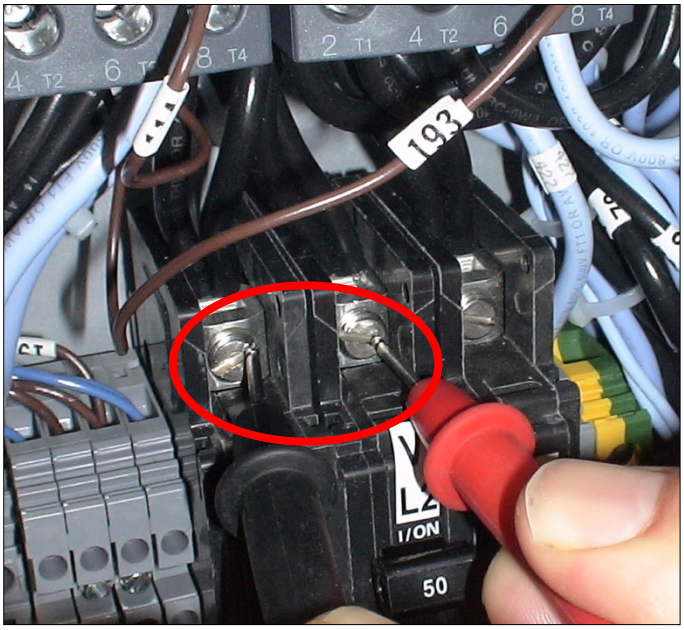

6. Type in "DRS27" as operator and select the thumbs up icon to advance to the next screen.
7. Select thumbs again when prompted for the password (system is shipped with no password).
8. Machine will perform a Home Operation. Click on OK.
9. Using the right side mouse button, click on the Air-Vac logo on the screen (main menu background color will change to red). You are now in the "Hidden" setup window.
10. Select Options from the menu bar.
11. Select Open, then Profile Open. The file group should default to System-System-System.
12. Select the Post-Power-Up Voltage Verification profile. Click on the Thumbs Up icon. Click on the thumbs up icon again to advance to the run screen.

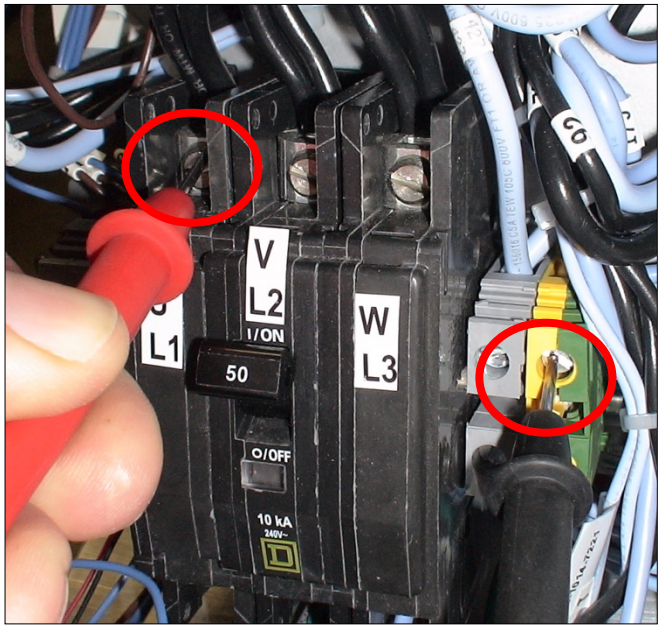
13. Click on the cycle start icon to begin the process.




**Cycle Start**

14. Verify that the machine voltage **(below left)** is between 205 and 220 volts while the process is running. Voltage must not be below 205 volts. See facility sheet regarding buck up transformer if the voltage drops below 205 volts.
15. Each leg **(below right)** must be approximately 120 volts.



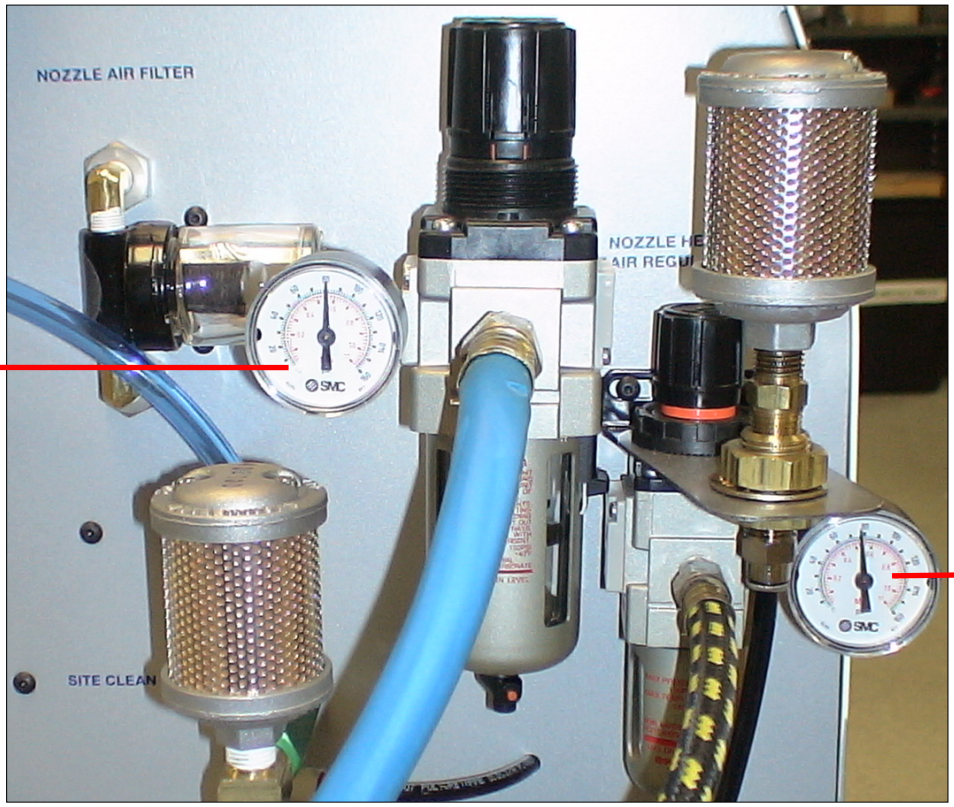



## 3.2 Pressure Verification

1. Check the air pressure to the upper heater and accessory ports.

**Important:**

THE PRESSURE GAUGE FOR THE UPPER HEATER (A) AND ACCESSORY PORTS (B) SHOULD READ 80 PSI. ADJUST REGULATORS AS NEEDED.




(B)

(A)

**Important:**

AIR CONSUMPTION FOR THE ACCESSORY PORT IS 21 SCFM. THE AIR CONSUMPTION FOR THE UPPER HEATER IS 3 SCFM. IF AIR LINE IS COMBINED, 24 SCFM MUST BE MAINTAINED AT 80 PSI.

INSUFFICIENT AIR SUPPLY (LOW VOLUME DUE TO QUICK DISCONNECTS, SMALL DIAMETER LINES OR ANY LINE RESTRICTION WILL CAUSE A PRESSURE DROP.

INSUFFICIENT AIR WILL RESULT IN PREMATURE HEATER DAMAGE AND/OR PROCESS REPEATABILITY ISSUES. IN ADDITION, TRANSFERRING PROFILES FROM MACHINE TO MACHINE WILL NOT BE POSSIBLE.

2. Close the machine cover and re-install the hold down screws.

## 3.3 Flow Rate Verification and Adjustment

Once the pressure verification is complete, the gas flow rate should be verified. Accurate gas flow through the nozzle is critical for achieving repeatable results. The DRS27 incorporates a Mass Flow Controller with closed loop control to monitor and regulate gas flow rates.

The two areas of flow verification include the Nozzle Flow Controller, which controls actual flow rates and the Nozzle Flow Sensor, which controls the Computer Digital Flow Display. Nozzle flow verification is required for initial installation, or any time the machine is disconnected and/or moved.

### 3.3.1 Nozzle Flow Controller Verification and Adjustment

**Materials required:**

- Scribed reference flow meter supplied with the machine.

**Initial conditions:**

- Pressure to upper heater must be set precisely to 80 psi (+/- .5psi).

**Set-up:**

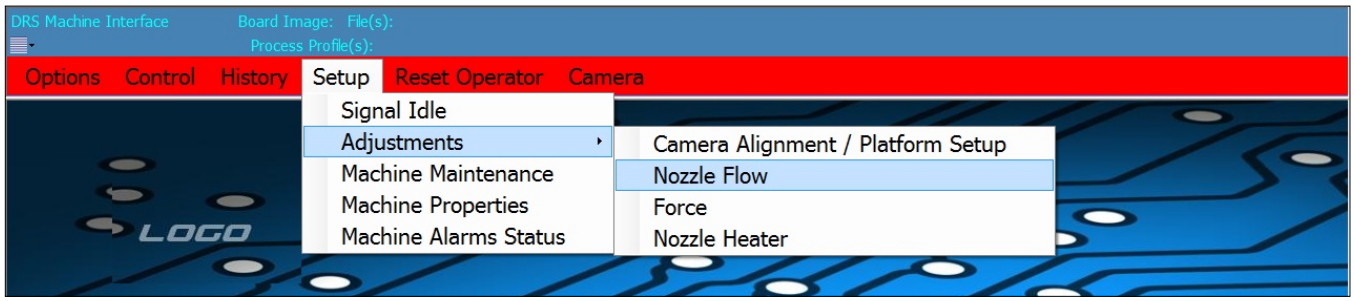
- Connect the Black Hose from the Flow Meter into the Flow Cal Fitting.

**WARNING:**

BE CERTAIN ALL THE BLACK HOSE IS INSERTED INTO FITTINGS COMPLETELY. A BAD CONNECTION CAN RESULT IN ERRONEOUS CALIBRATION READINGS.

**To access the Flow Adjustment Screen:**

- Log on as "DRS27" or any "high level" security operator and select the Thumbs Up icon.
- Using right side mouse button, click the Air-Vac logo. You are now in the 'Hidden' Setup window.
- Select Setup/Adjustments/Nozzle Flow from the menu bar.




The Nozzle Flow Adjustment screen will appear as shown below.

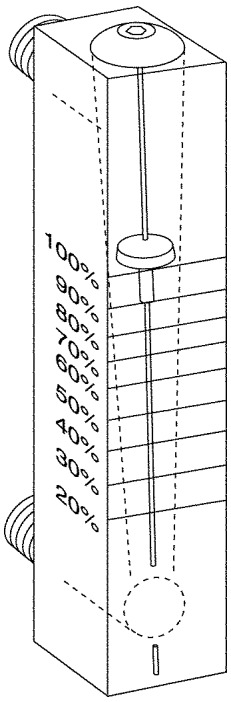
**Making Flow Controller Verifications and Adjustments:**

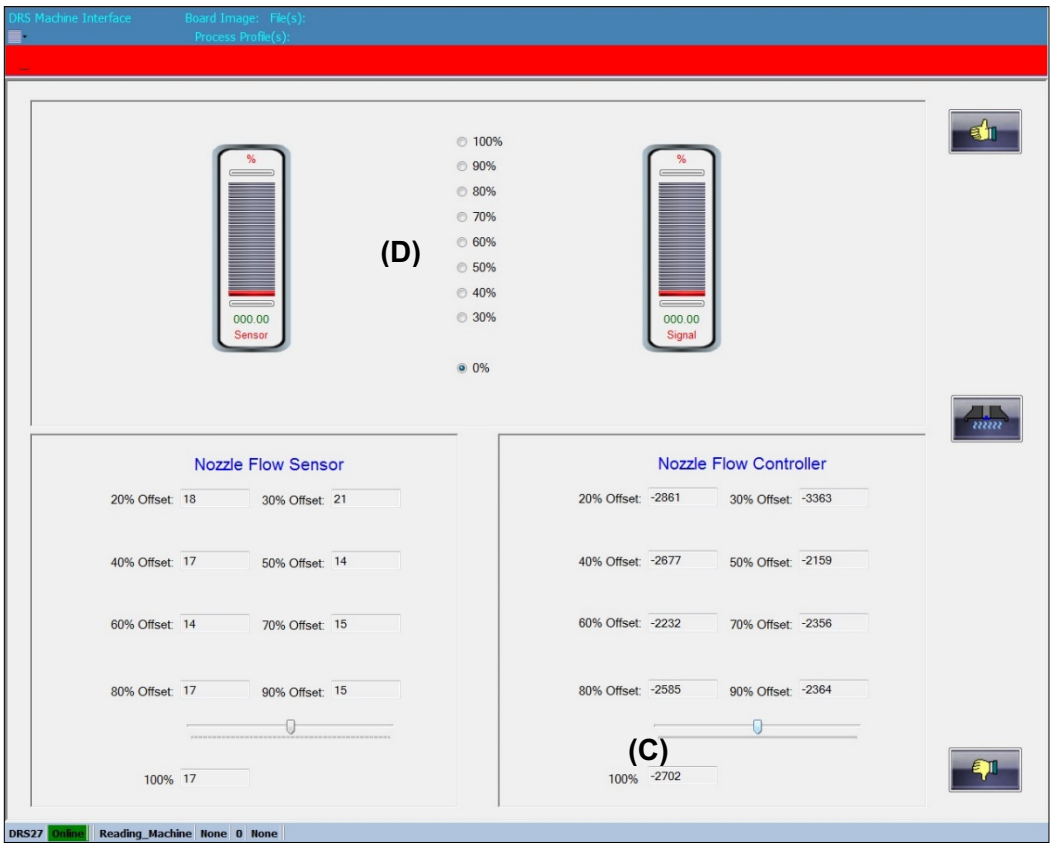
- Click on the 100% radio button **(A)** on the Flow Adjustment Screen. The airflow will activate after 1-4 seconds.
- Wait 45 seconds before making any adjustments.
- Check the 100% scribe line on the flow meter. If the flow meter reads too high or too low, adjustments can be made immediately by dragging or clicking on the track bar within the Nozzle Flow Controller group box **(B).** The airflow should not be interrupted. The adjustments will be automatically applied and stable within 3-5 seconds. The track bar is always connected to the active flow rate helping to minimize incorrect adjustments.

**Note:**

NO ADJUSTMENT IS NECESSARY IF THE FLOW IS OFF BY LESS THAN THE THICKNESS OF THE FLOAT +/-. READ THE BOTTOM OF FLOAT HEAD (LARGEST DIAMETER).

**Flow Meter:** **Air Flow Table:**



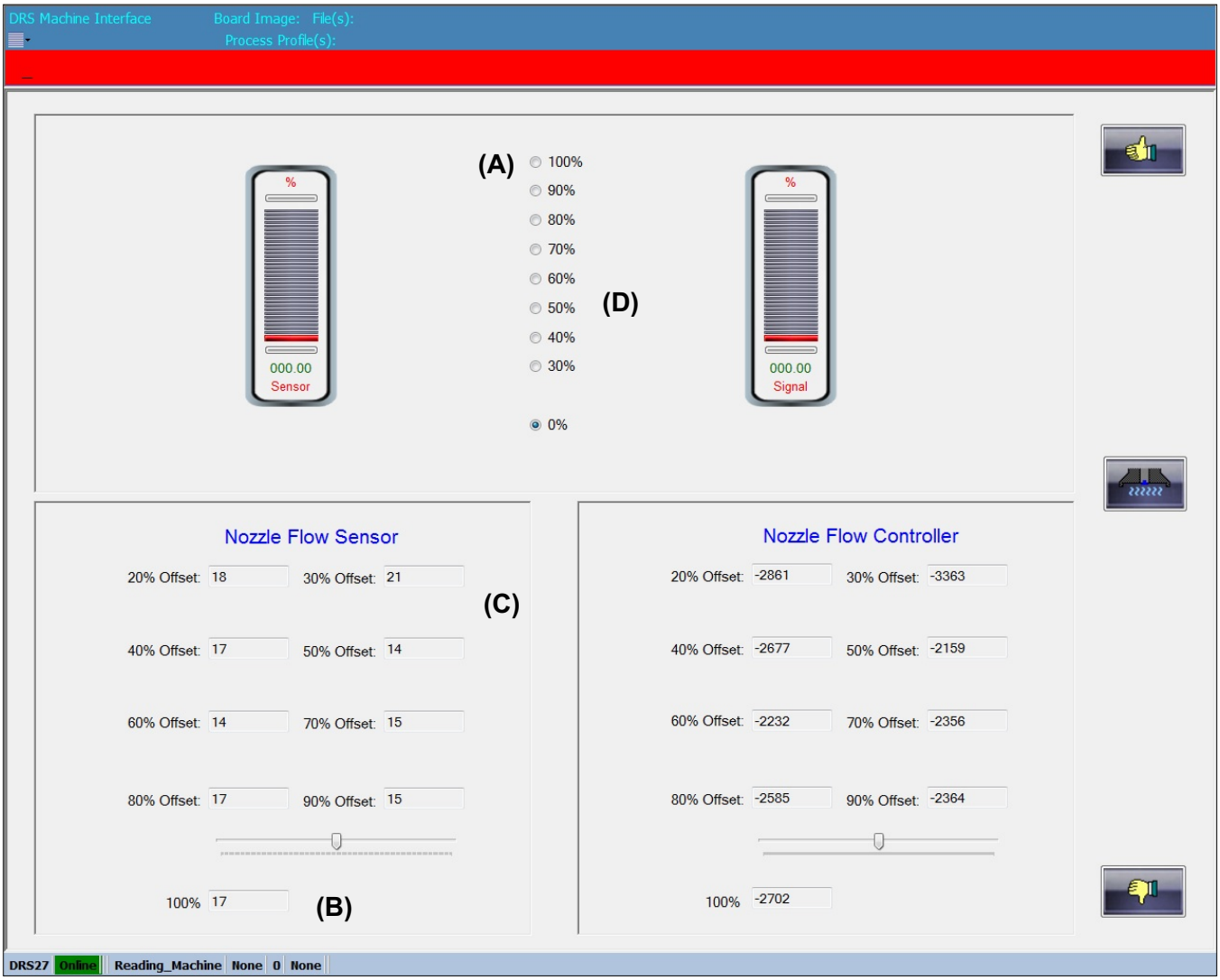




- If the flow meter reads too high, <u>decrease</u> make 2 clicks on the left side of the track bar **(C).**
- If the flow meter reads too low, <u>increase</u> make 2 clicks on the right side of the track bar **(C).**

Once the 100% Flow Controller value has been set, check flow controller verifications for 30-90% settings **(D).** With the nozzle flow system activated for the various settings, check the flow using the meter. Adjust the nozzle flow controller **(C)** as required until the float corresponds to the scribed setting.

**Making Flow Sensor Verifications and Adjustments:**

- Click on the 100% radio button **(A)** on the Flow Adjustment Screen. The air flow will activate after 1-4 seconds.
- Wait 45 seconds before making any adjustments.
- Check the blue meter that is being displayed on the left side software screen. This meter represents the actual flow rate sensor output from the flow controller.
- If the blue meter is too high, decrease the value by making 2 clicks **(B)** on the left side of the track bar.
- If the blue meter is too low, increase the value make 2 clicks **(B)** on the right side of the track bar.
- Retest for 30-90% Flow Sensor values **(C)** for each nozzle flow setting **(D).**



### Making Flow Sensor Verifications and Adjustments:

**Note:**

AFTER COMPLETING THIS VERIFICATION PROCEDURE, THE OPERATOR SHOULD QUICKLY RUN THROUGH ALL OF THE FLOW SENSOR RANGES (30-90%). THE PURPOSE OF THIS STEP IS TO ASSESS THE OVERALL PERFORMANCE OF THE FLOW SYSTEM.

- Select the **Thumbs Up icon to save changes** and exit the Flow Adjustment screen.
- Disconnect the black hose and the flow meter.

| **Software Screen** | **Flow Meter**<br>*Target Value* |
|---|---|
| 30% | (30% scribe): .82 scfm |
| 40% | (40% scribe): 1.10 scfm |
| 50% | (50% scribe): 1.37 scfm |
| 60% | (60% scribe): 1.65 scfm |
| 70% | (70% scribe): 1.92 scfm |
| 80% | (80% scribe): 2.20 scfm |
| 90% | (90% scribe): 2.47 scfm |
| 100% | (100% scribe): 2.75 scfm |

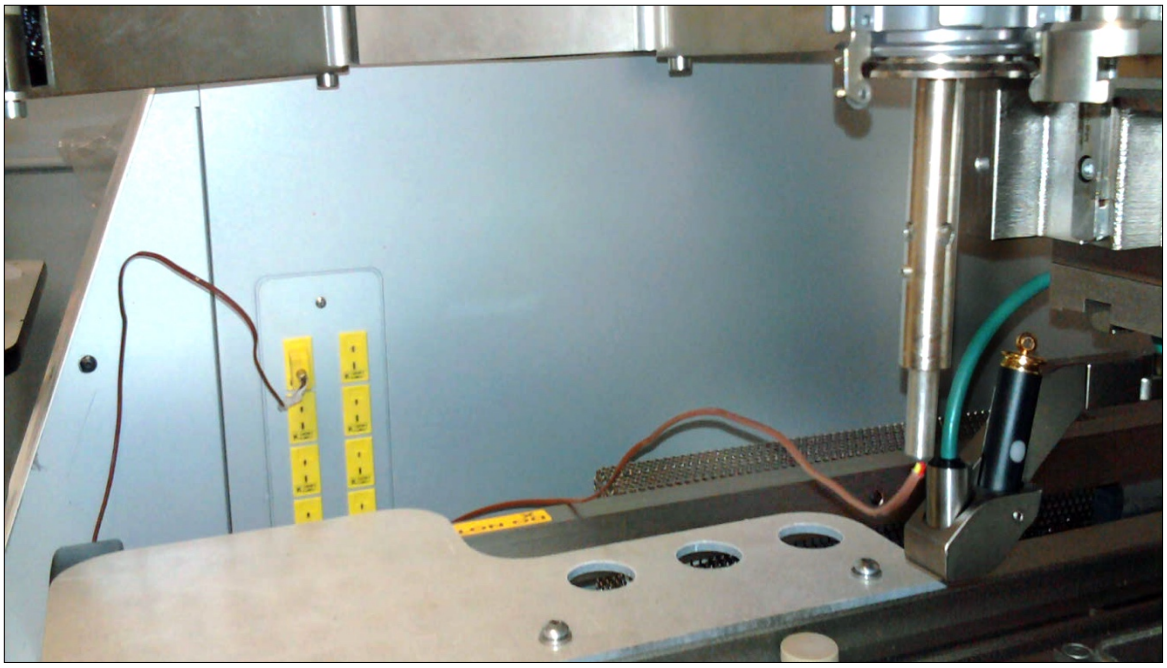
## 3.4 Nozzle Heater Temperature Verification

After the machine pressure and flow have been verified, the next step is to verify heater temperature accuracy.

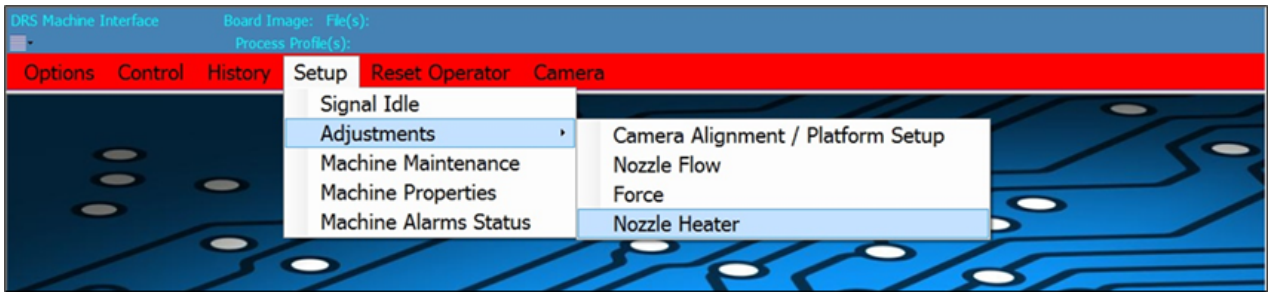
**Overview-** This verification assures 'programmed' temperatures stay within an acceptable range of +/- 10 degree's C accuracy at each level requested by the thermal-profile. You will run the process using the screen selection-COMPUTE NOZZLE OFFSETS, which records the heater thermocouple temperatures compared to the NCAL-5 nozzle thermocouple temperatures. During this thermal run, the software generates offset values for each temperature level and these values are *applied automatically* during the next thermal run called APPLY NOZZLE OFFSETS. This procedure is explained in detail, in the following pages.

Begin by-

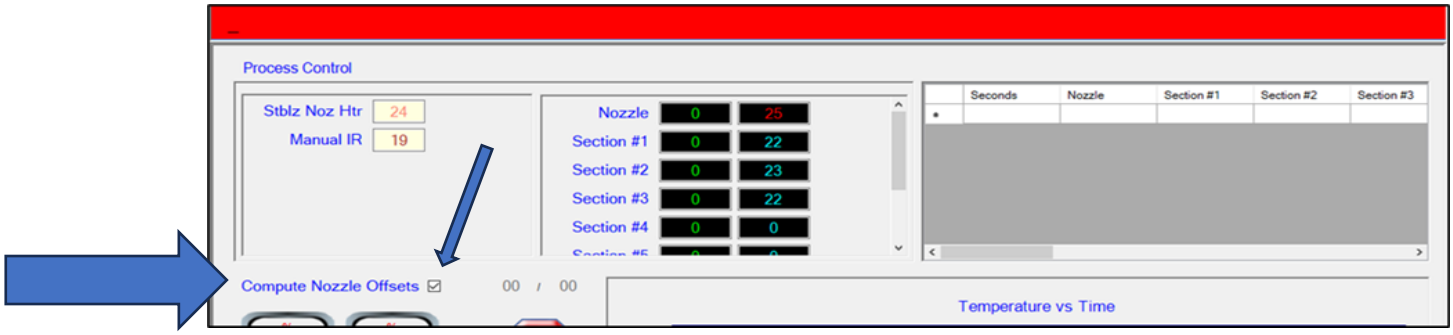
1. Install NCAL-5 temperature verification nozzle into the machine.
2. Plug the nozzle thermocouple into channel #1.



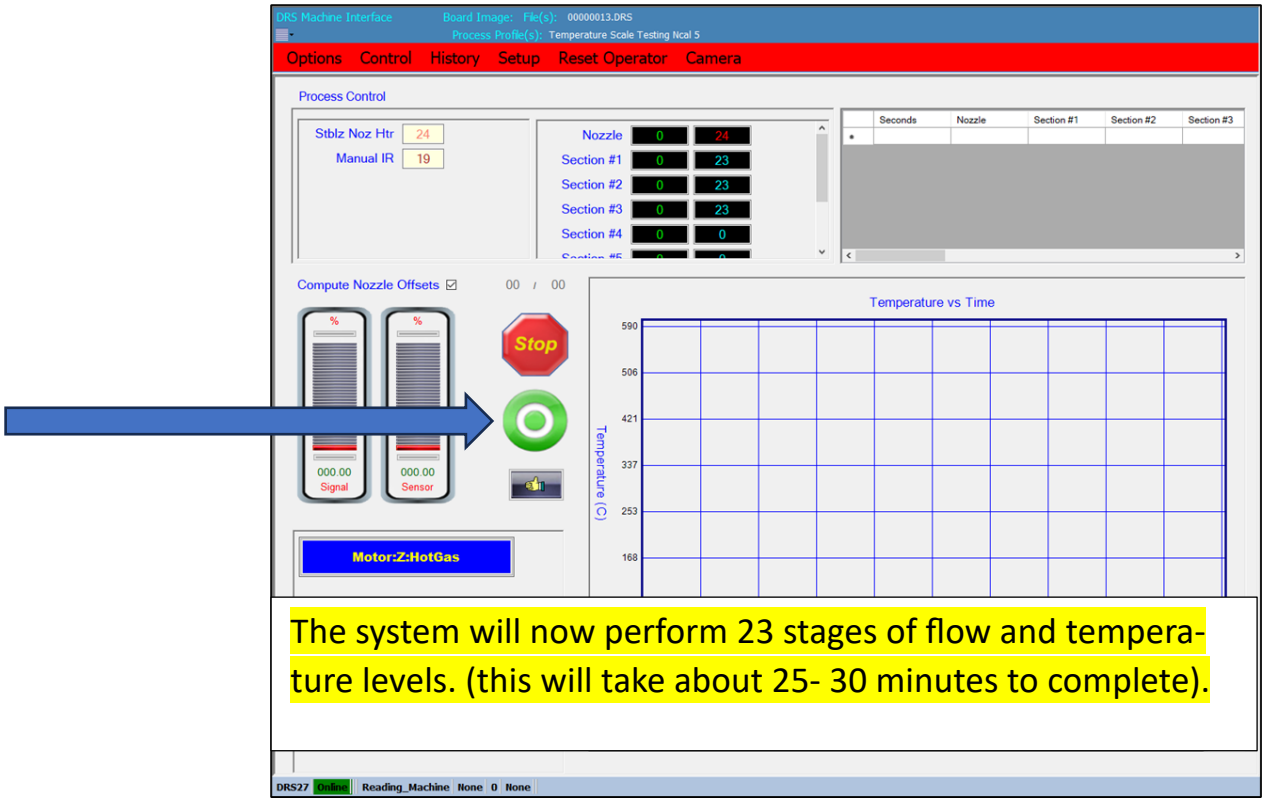
3. From the main screen, right-click on the Air-Vac LOGO to access the 'Hidden Menu' area with the top-bar highlighted in RED. You will now go to- SETUP/ADJUSTMENTS/NOZZLE HEATER.



4. On the Nozzle Heater Screen, be sure that COMPUTE NOZZLE OFFSETS (including a check in the box) is selected (in the upper left section of the screen), as shown here.

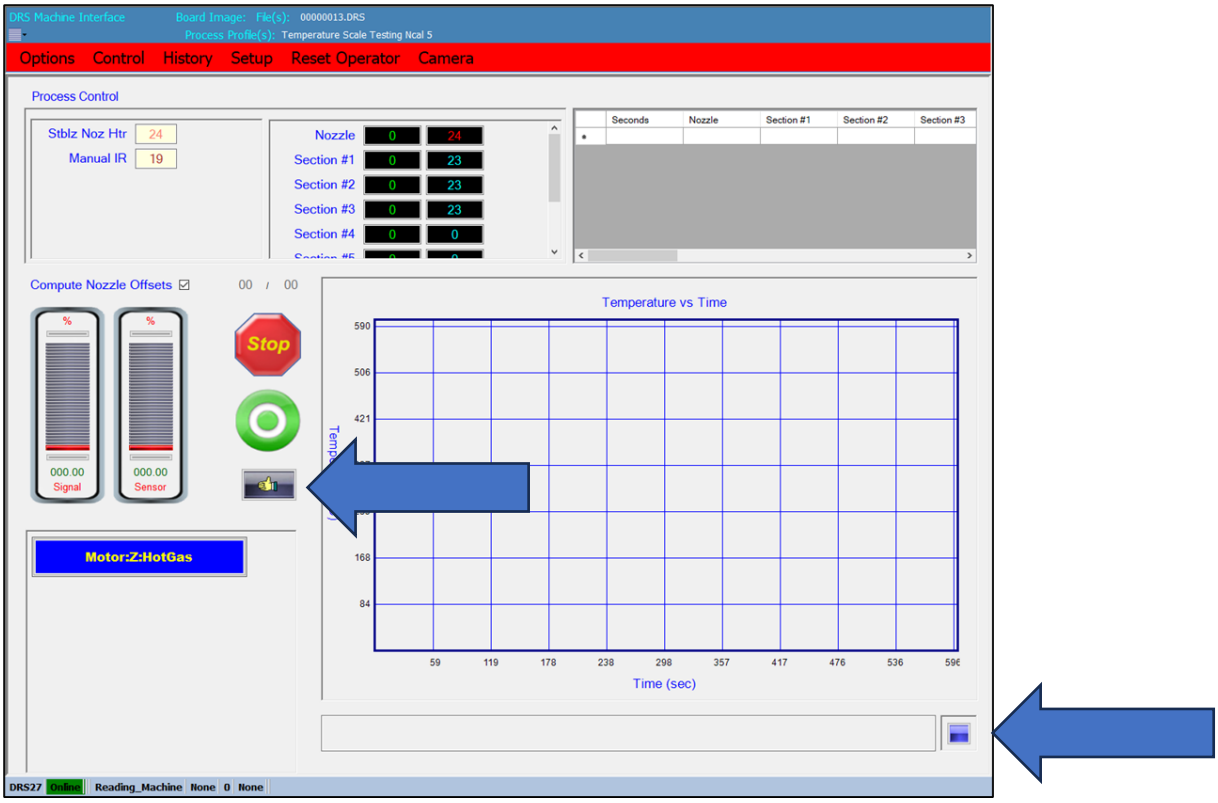



**5.** Begin the Nozzle Heater Temperature Verification by clicking on the START ICON**.**

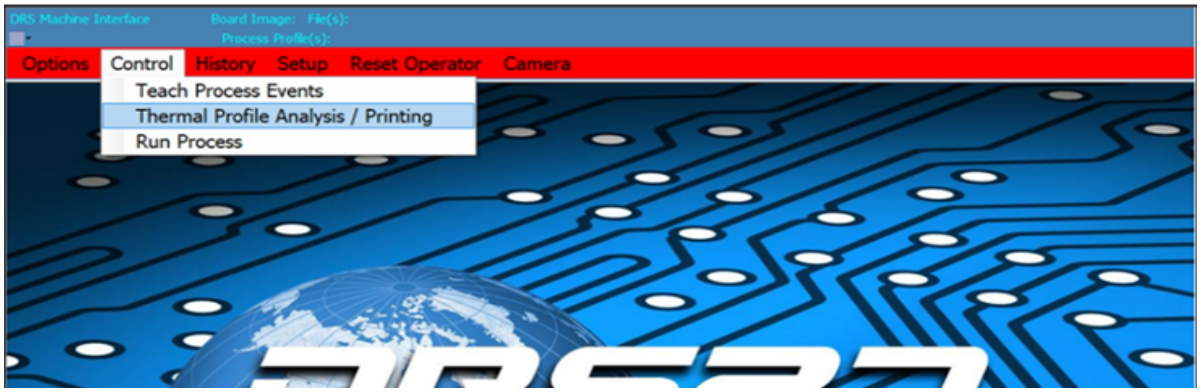



The system will now perform 23 stages of flow and temperature levels. (this will take about 25- 30 minutes to complete).

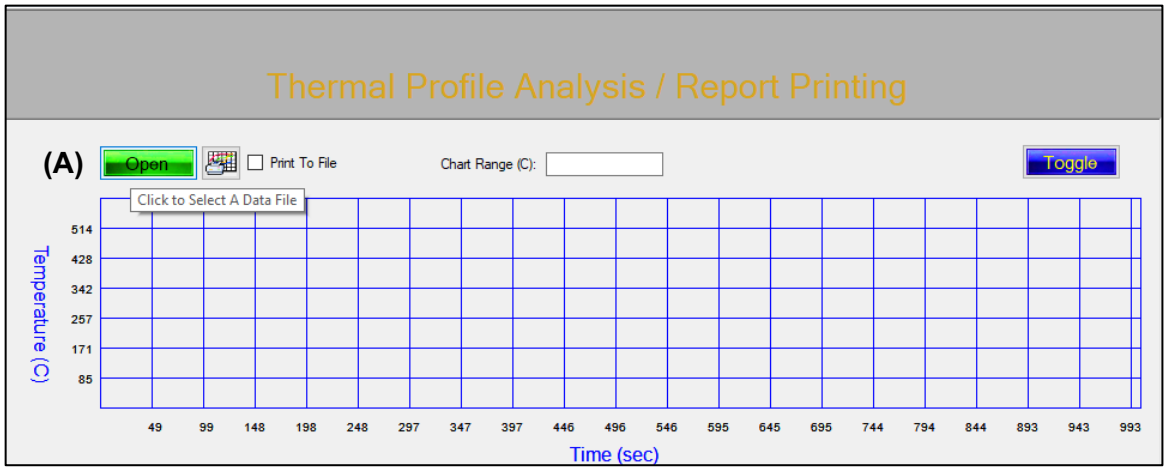
6. When the process is complete, you must save your thermal results. To do this, click on the blue box first, then hit the THUMBS UP ICON to save the data.



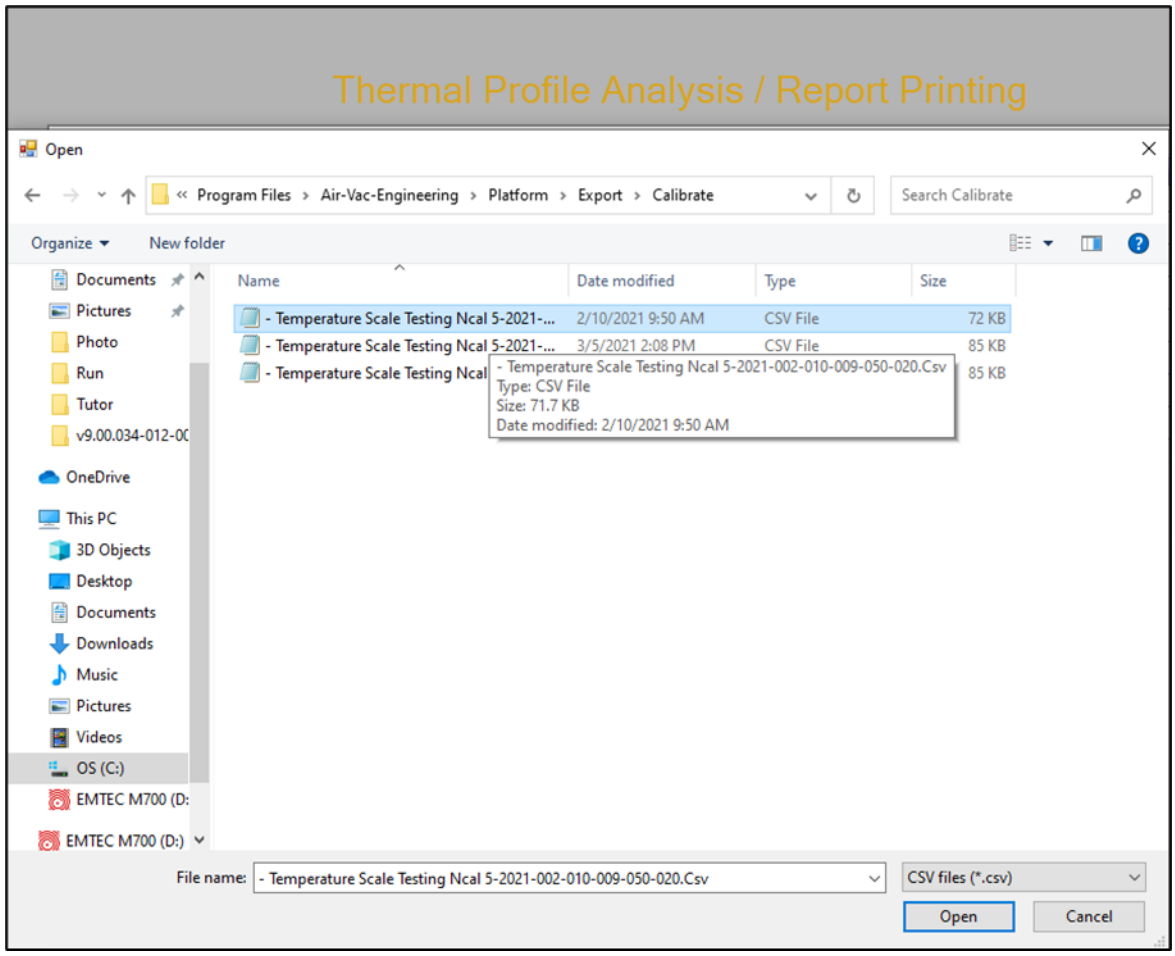

7. Verify your system is within acceptable range of plus/minus 10˚C at any of the 100/200/300/400˚C set point(s), by selecting **Control/Thermal Profile Analysis** from the main menu.



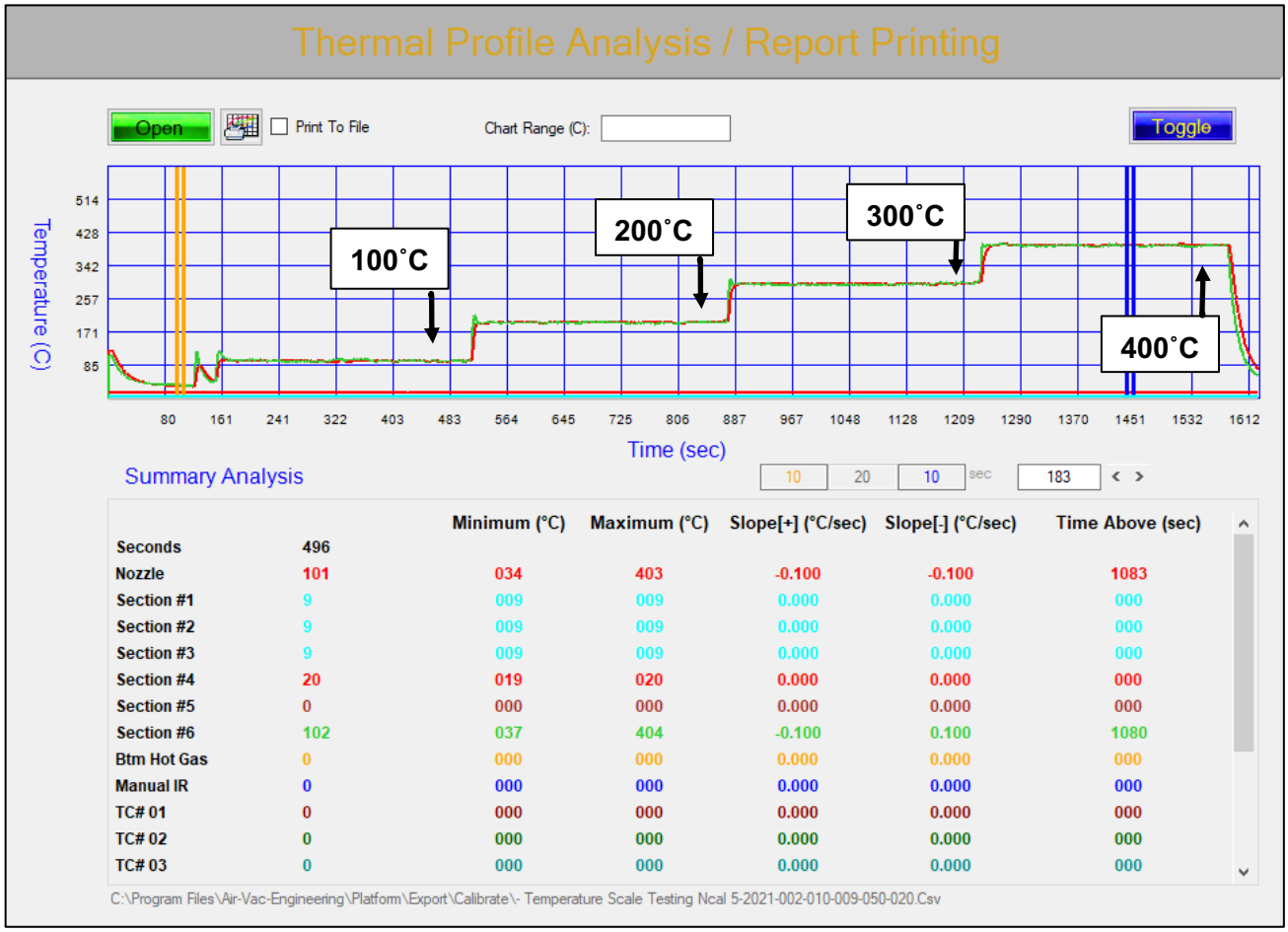
8. Click on the green **Open button (A).**




9. Select the latest **Temperature Scale Testing Ncal-5** that you just ran.



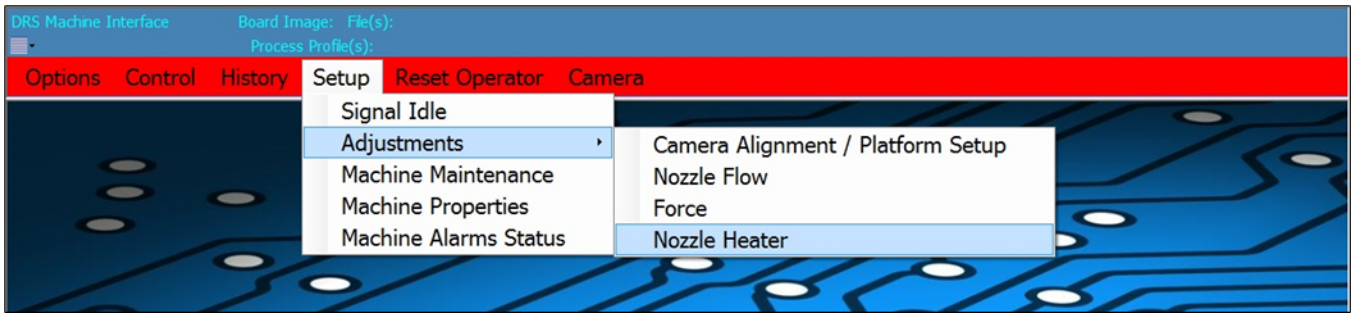
10. Move the cursor so that it points to the last few seconds of each level on the chart at 100˚C, 200˚C, 300˚C, and 400˚C.



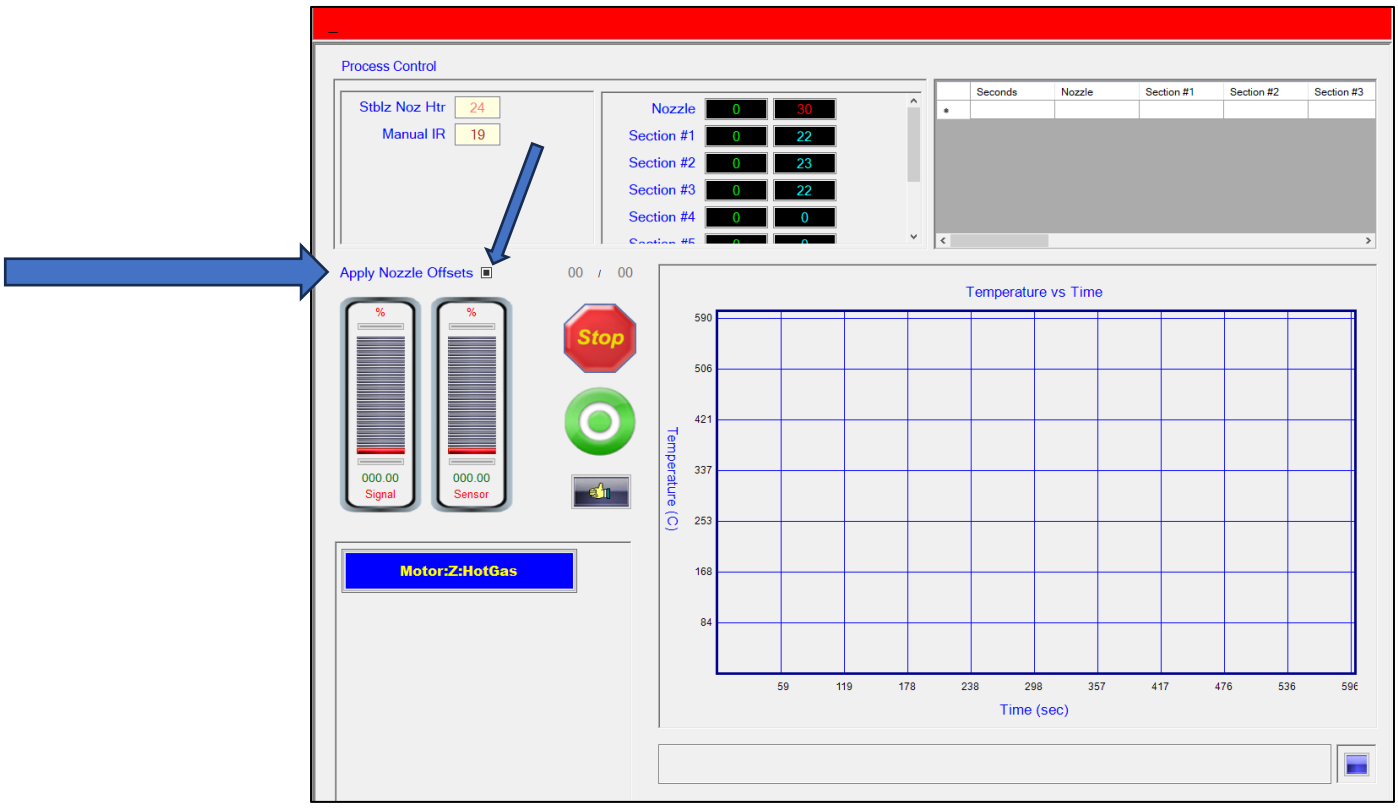

| | | Minimum (°C) | Maximum (°C) | Slope[+] (°C/sec) | Slope[-] (°C/sec) | Time Above (sec) |
|---|---|---|---|---|---|---|
| Seconds | 496 | | | | | |
| Nozzle | 101 | 034 | 403 | -0.100 | -0.100 | 1083 |
| Section #1 | 9 | 009 | 009 | 0.000 | 0.000 | 000 |
| Section #2 | 9 | 009 | 009 | 0.000 | 0.000 | 000 |
| Section #3 | 9 | 009 | 009 | 0.000 | 0.000 | 000 |
| Section #4 | 20 | 019 | 020 | 0.000 | 0.000 | 000 |
| Section #5 | 0 | 000 | 000 | 0.000 | 0.000 | 000 |
| Section #6 | 102 | 037 | 404 | -0.100 | 0.100 | 1080 |
| Btm Hot Gas | 0 | 000 | 000 | 0.000 | 0.000 | 000 |
| Manual IR | 0 | 000 | 000 | 0.000 | 0.000 | 000 |
| TC# 01 | 0 | 000 | 000 | 0.000 | 0.000 | 000 |
| TC# 02 | 0 | 000 | 000 | 0.000 | 0.000 | 000 |
| TC# 03 | 0 | 000 | 000 | 0.000 | 0.000 | 000 |

11. The green Ncal5 temperature line at the four points should be plus/minus 10˚C of the 100/200/300/400˚C set points. If your temperature readings are within range at each temperature level, you are finished and you can thumbs-up to save results and leave the screen.

12. If the green Ncal5 temperature line is beyond plus/minus 10˚C at any of the 100/200/300/400˚C set points, you must re-run the thermal process. Right click on the Air-Vac logo to select the red hidden menu. Re-select **Setup/Adjustments/Nozzle Heater** from the main menu.



13. Be sure to change the RUN selection to APPLY NOZZLE OFFSETS (showing a solid box) in the upper left section of the screen, as shown here, before you begin.

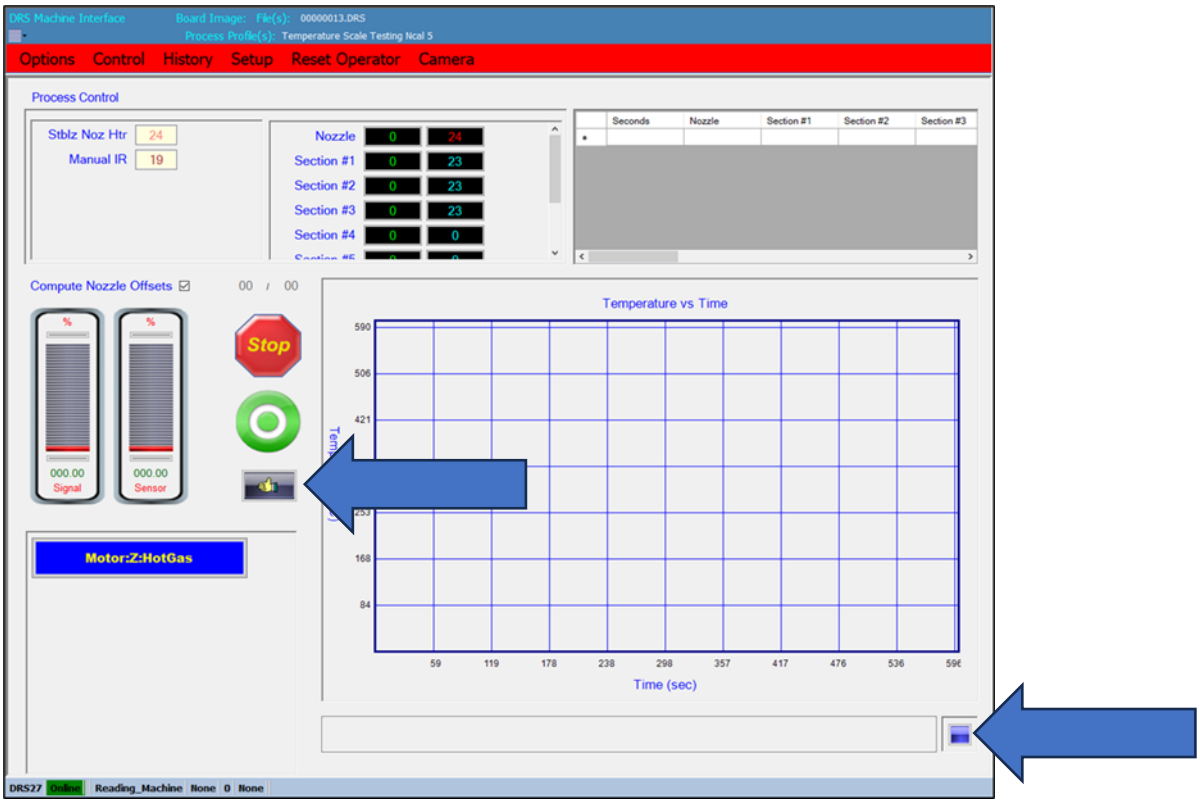



**14.** Begin the Nozzle Heater Temperature Verification again by clicking on the START ICON**.**

15. During this APPLY NOZZLE OFFSETS run, the software will *automatically adjust* the temperatures to be within the correct range.

The system will now perform 23 stages of flow and temperature levels. (this will take about 25- 30 minutes to complete).

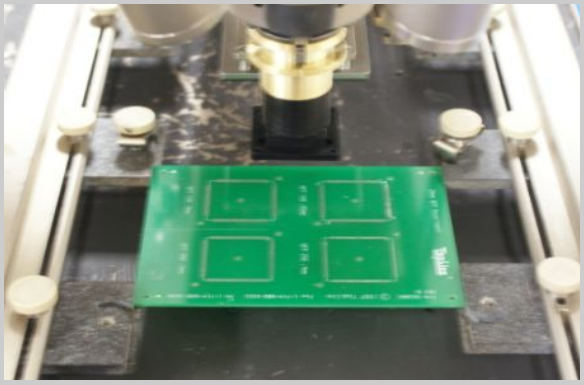
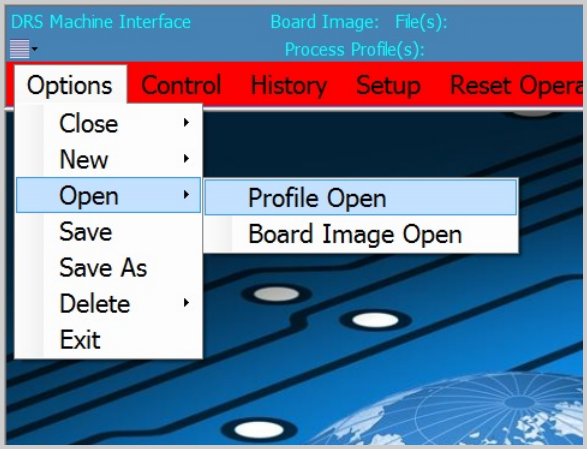
16. When the process is complete, save your thermal results by clicking on the blue box first, then hit the THUMBS UP ICON to save the data.

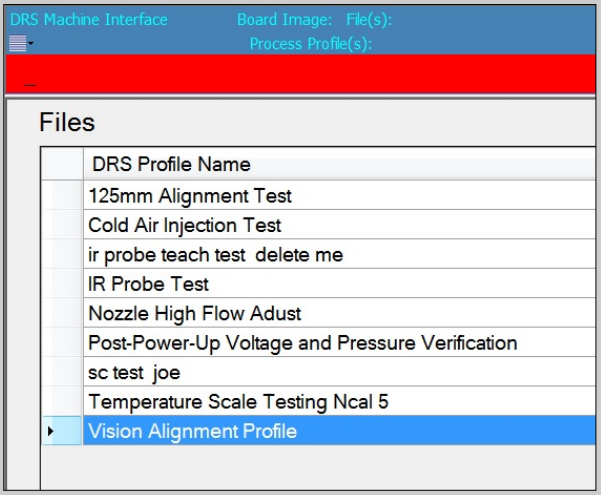



17. To view and confirm the upper heater temperatures are now within acceptable range, repeat steps 7 through 11. This will show the results of your last APPLY NOZZLE OFFSETS run.

**18.** This completes the **Nozzle Heater Temperature Verification.**

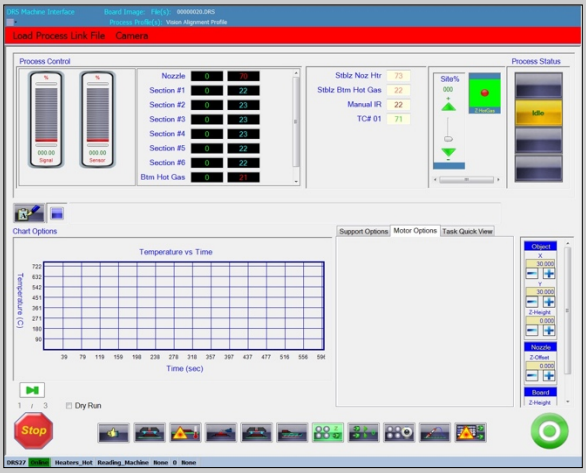
## 3.5 Vision Alignment Verification and Adjustment

| | |
|---|---|
|  | Vision Alignment Nozzle 1016.03.101<br><br>Vision Alignment Plate 1016.03.100 |
|  | Load an unpopulated PCB into carrier.<br><br>Load Vision Alignment Nozzle into nozzle clamp. |
|  | Select Options/Open/Profile Open from the Red Restricted menu. |

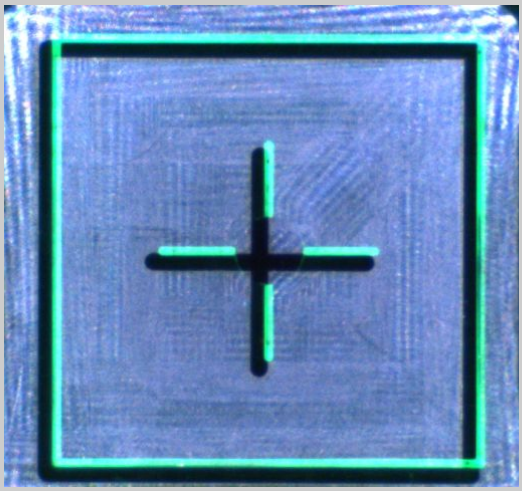



Select (Double click) the Vision Alignment profile.

Thumbs Up to continue to run screen.

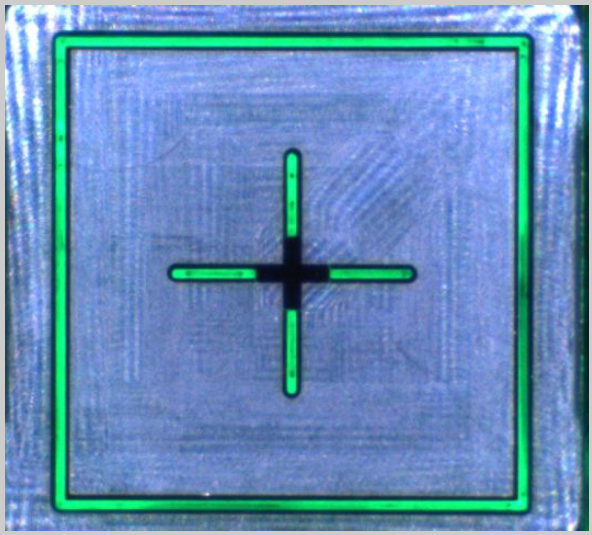
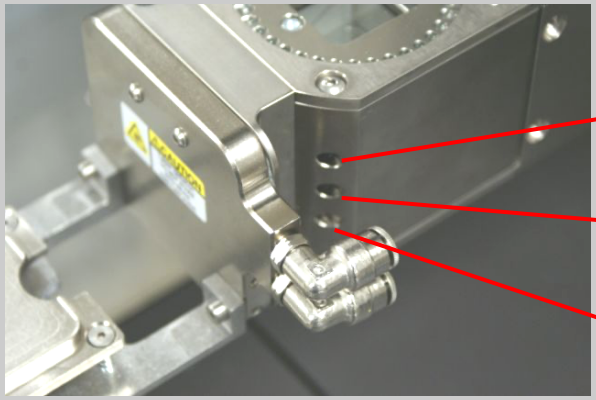



Click on the Green Cycle Start icon and follow prompts.



Shown is an image overlay of the Vision Alignment Nozzle and the Vision Alignment Plate. Note that the black lines do not match up with the green lines.

This indicates that an adjustment to the Vision System is required.

| | |
|---|---|
|  | Use a 2mm Allen wrench to adjust the X and Y adjustment screws located on the right side of the vision assembly (see below). Adjust the image so that the green lines are centered as shown.<br><br>If it is not possible to center the green lines as shown, loosen the center lock screw slightly. Make X/Y adjustments as required and carefully tighten lock screw. |
|  | Y-Axis adjustment screw<br><br>Lock screw<br><br>X-Axis adjustment screw<br><br>Run the Vision Alignment Profile a second time to verify that the alignment is now correct. |

# 4: Software Overview

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# 4 Software Overview

**NOTE**

ACCESS TO MANY OF THE SOFTWARE SCREENS DETAILED IN THIS SECTION ARE RESTRICTED TO HIGH LEVEL USERS. OPERATOR LEVEL USERS CAN NOT ACCESS MOST OF THESE SCREENS.

## 4.0 Windows Tools Overview

### DRS27 Software – Main Screen


### Buttons:


Icon buttons are generally used to activate a procedure or function. Moving the cursor over the top of the icon and clicking on the left mouse button will initiate the button's functionality. Button icons have a popup message that will tell the operator what the purpose of the button is; this automatically occurs when the cursor is placed over the top of the icon.

**Note:**

IF A BUTTON IS COMPLETELY GRAY, THE FUNCTIONS ASSOCIATED WITH IT ARE DISABLED.

**Edit Boxes:**


Edit Boxes allow information to be entered by placing the cursor over the top of the box and clicking on the left mouse button. Characters are entered directly into the edit box from the computer keyboard.

**Trackbar Buttons:**


Trackbar Buttons are used to directly modify information within an edit box. Click and drag (using left button) slider to adjust the value in the edit box. Single increment adjustments can be made by single clicking on the range line or arrow. (tick marks - connected to the slider).

**Boxes:**

Check boxes are generally used to program a DRS25 function or activity.

Inactive Clear state: A blank check box indicates the Off or the inactive state.

Active Black state: A black check mark indicates the On condition or the active state.


For Example:

The footswitch mode is activated. The time mode and time delay value are not used.

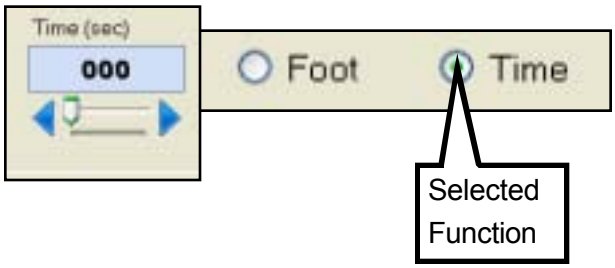
Filled state: A filled box indicates a third option.

For Example: Clear – Continue to Main Screen. Checked – Continue to Run Screen.

Filled – Continue to Teach Screen.


**Radio Buttons:**

Similarly, radio buttons allow a functions or activities to be programmed. Typically, radio buttons are grouped together by related functionality. Within a group, only one option can be selected at a time.



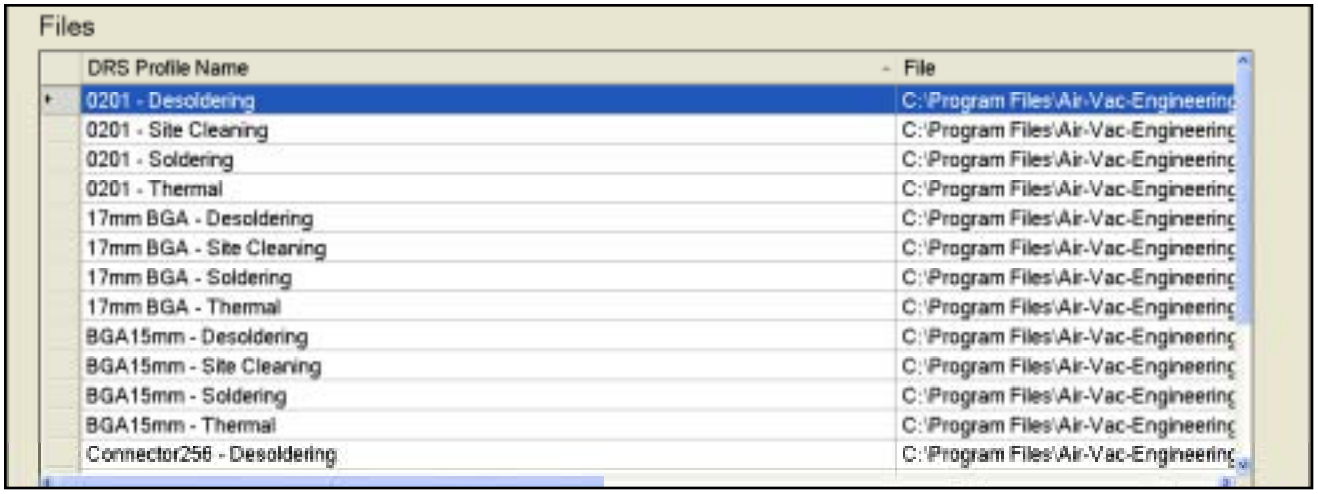

For Example:

The Time Function is selected. Time will run in the event for the value/time set in the box.

.

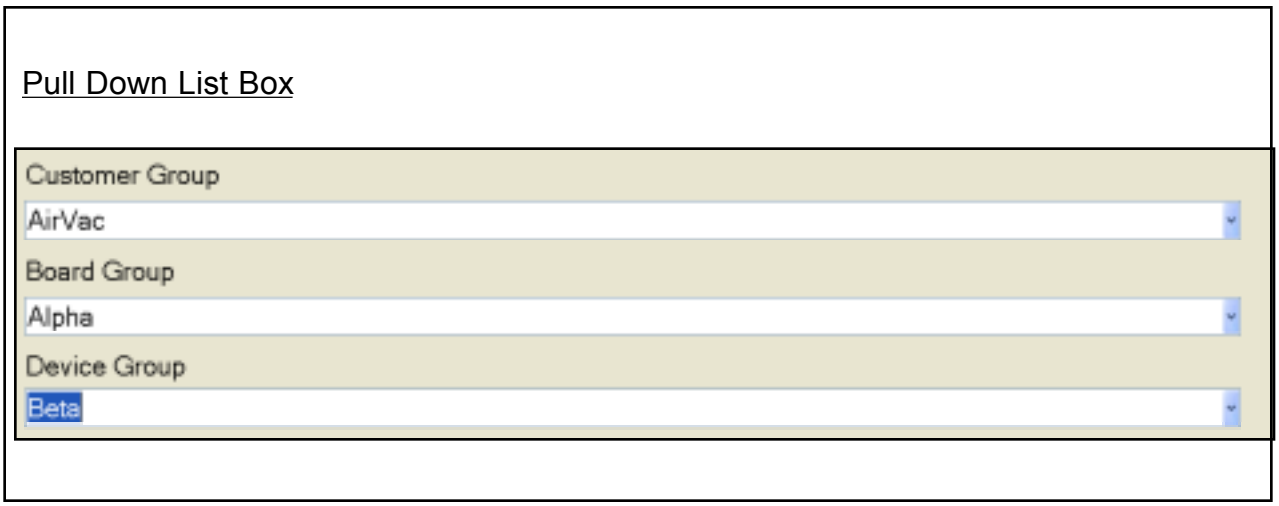
**List Boxes:**

A list box is a multiple line display of information. The operator can scroll through the list using the scroll bar to the right of the list box. The operator can select any line within the list by moving the mouse to that line and clicking (left button) on that line.




To select an entry, the operator can highlight the line (click) and then select the OK button (Up Thumb). The operator can also select an entry by double-clicking on the line.

A pull down list box is very similar to a full list box, except that this control is displayed on a single line and provides a pull down arrow. By clicking on that arrow the list box expands to display several lines of information on the screen. After making a selection, the list box collapses back down to one line.




**For Example:**

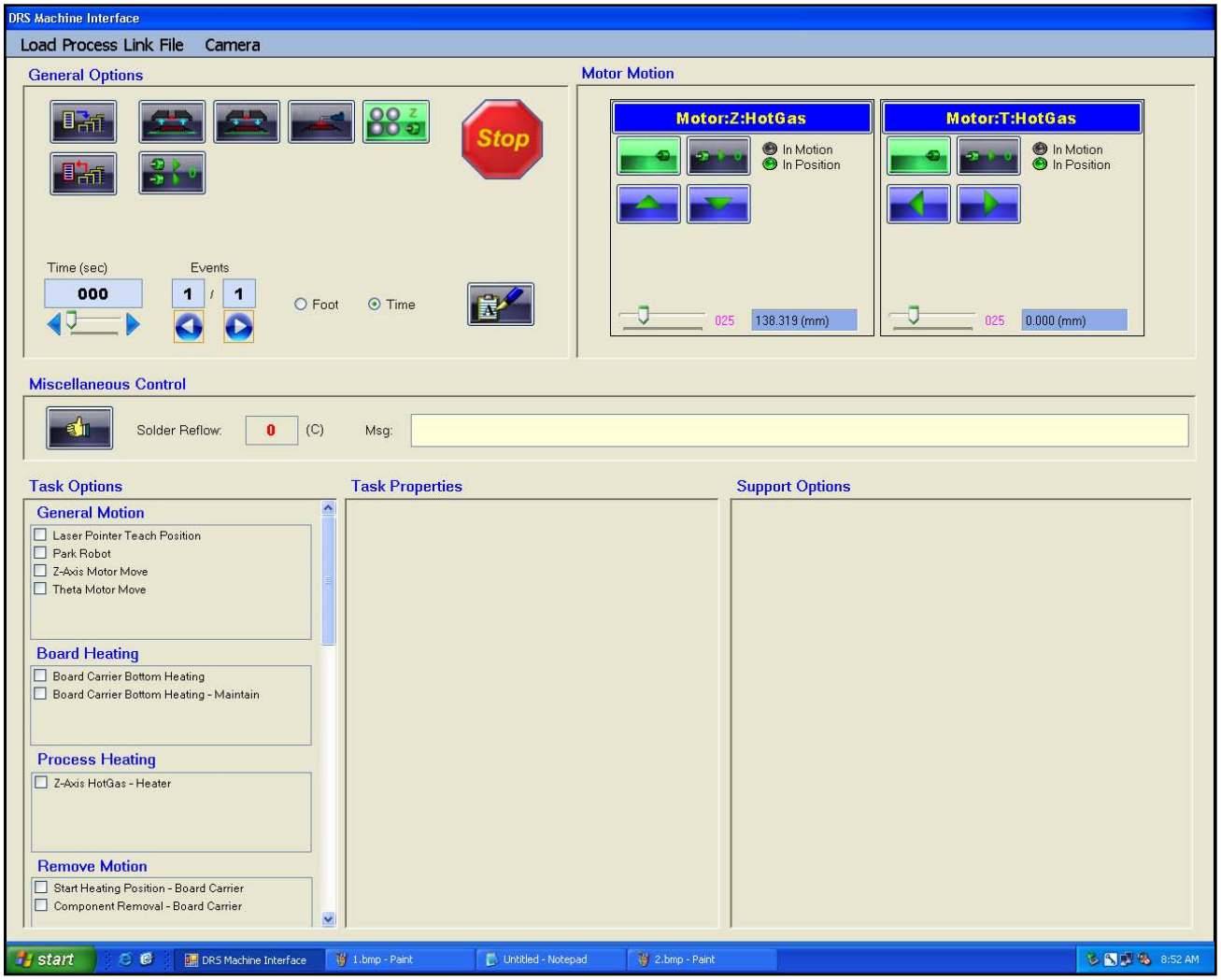
By clicking (left button) on the down arrow, the board group list box will expand to show more of the possible choices. The operator can select any line within the list box by simply clicking (left mouse) on that line. The edit box will return to its original state with the new selection being displayed.

## 4.1 Options Menu Functions

**View of the Options Menu**

### New (restricted access):

The **New** option, located on the **Options** menu, will automatically clear the current profile from memory and display the teach screen. The system is ready to teach a new profile.




**NOTE**

IT IS HIGHLY UNLIKELY THAT YOU WILL EVER NEED TO CREATE A NEW PROFILE FROM SCRATCH. THE **SAVE AS** AND **PROFILE BUILD** FUNCTIONS ARE TYPICALLY USED AND ARE EXPLAINED LATER.

**Open:**

The **Open** option is used to load an existing profile from a library. Selecting the **Open** option will display the **Open Profile** screen.

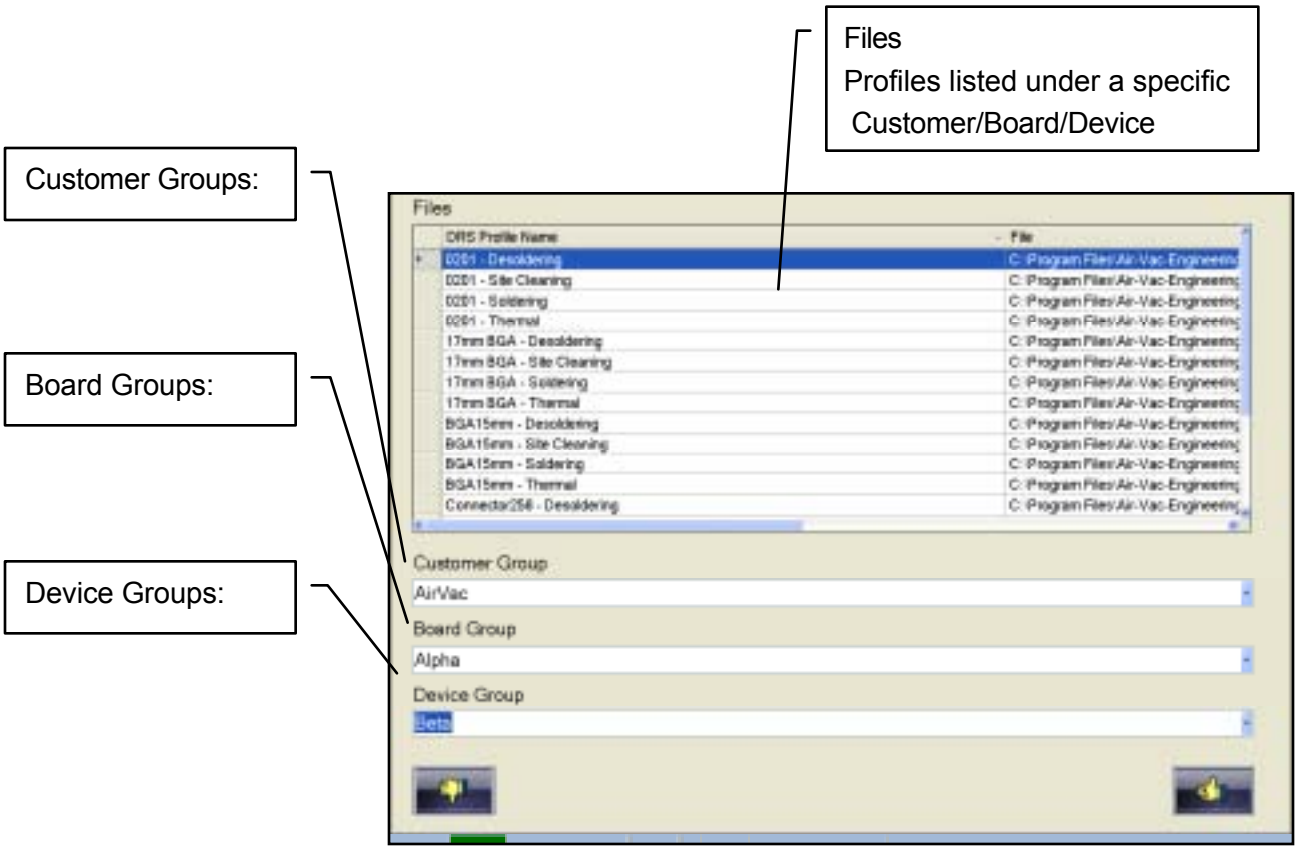
Three group categories are available to organize profiles into common or related processes:

- Customer
- Board
- Device

New groups can be easily added to expand the profile library organization.

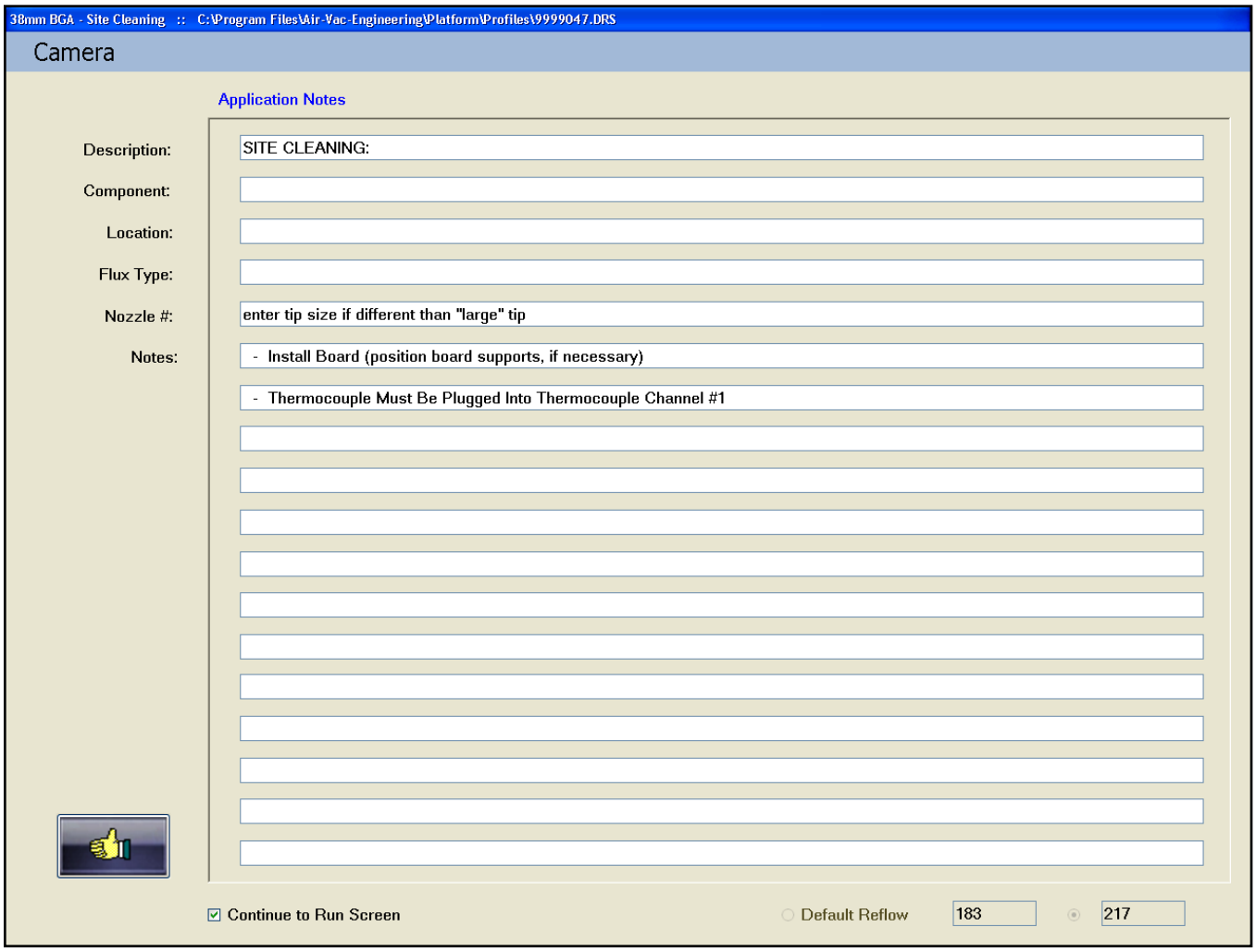
The profile list can be adjusted by changing the group selection combination.

Clicking on the down arrow (of a group list box) will display a window with all the available options for that group. Use the scroll bar to view any additional entries beyond those that are currently displayed.




To make a profile selection, click on the desired entry (File list box), then, click on the Ok button to open this file or double click the File selected.

After selecting a file, the system will automatically take the operator to the **Open Profile Notes** screen.

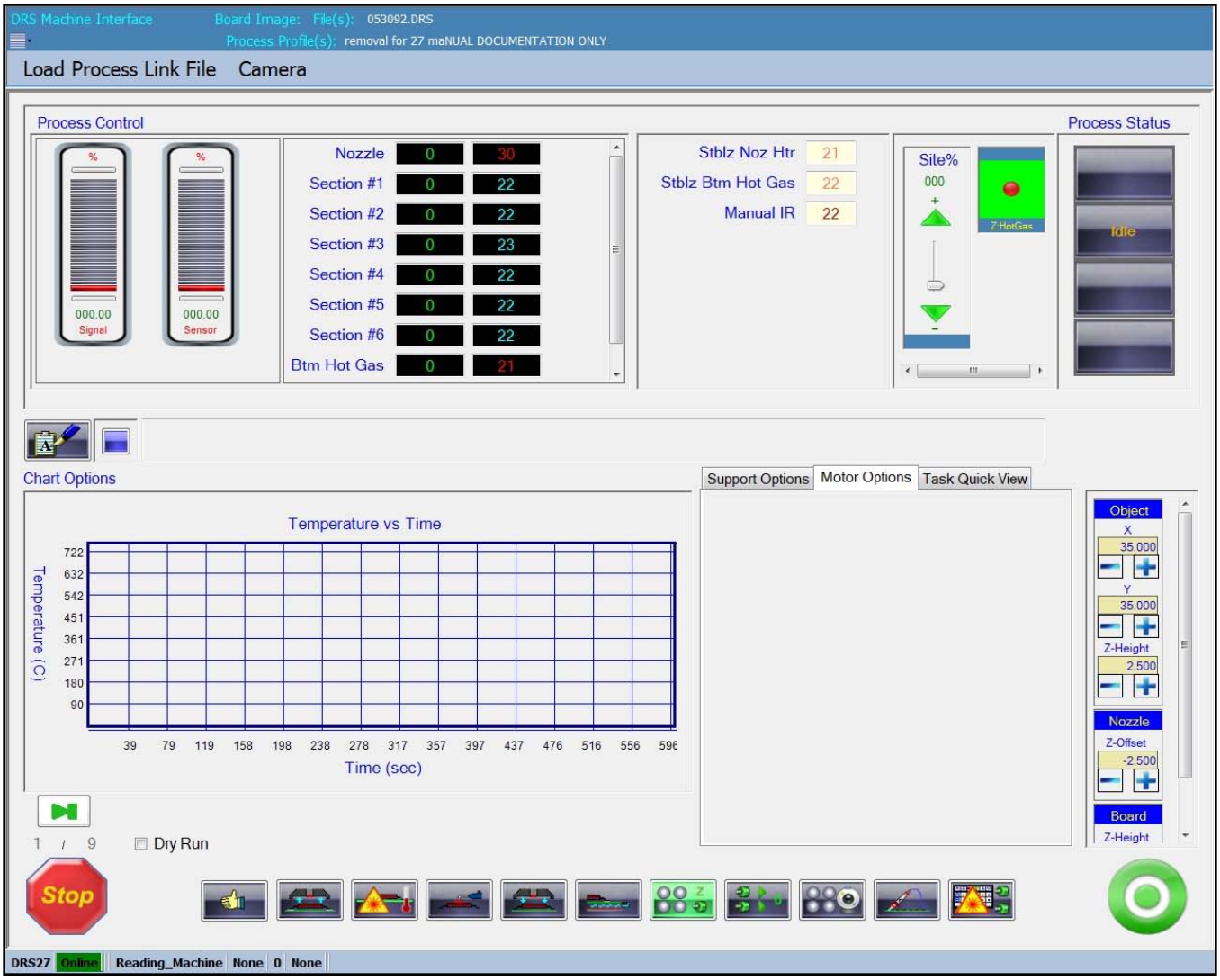



This screen is used to display general setup or process related information. Clicking on the **Ok** button will take the operator to the **Run** screen.

### Note

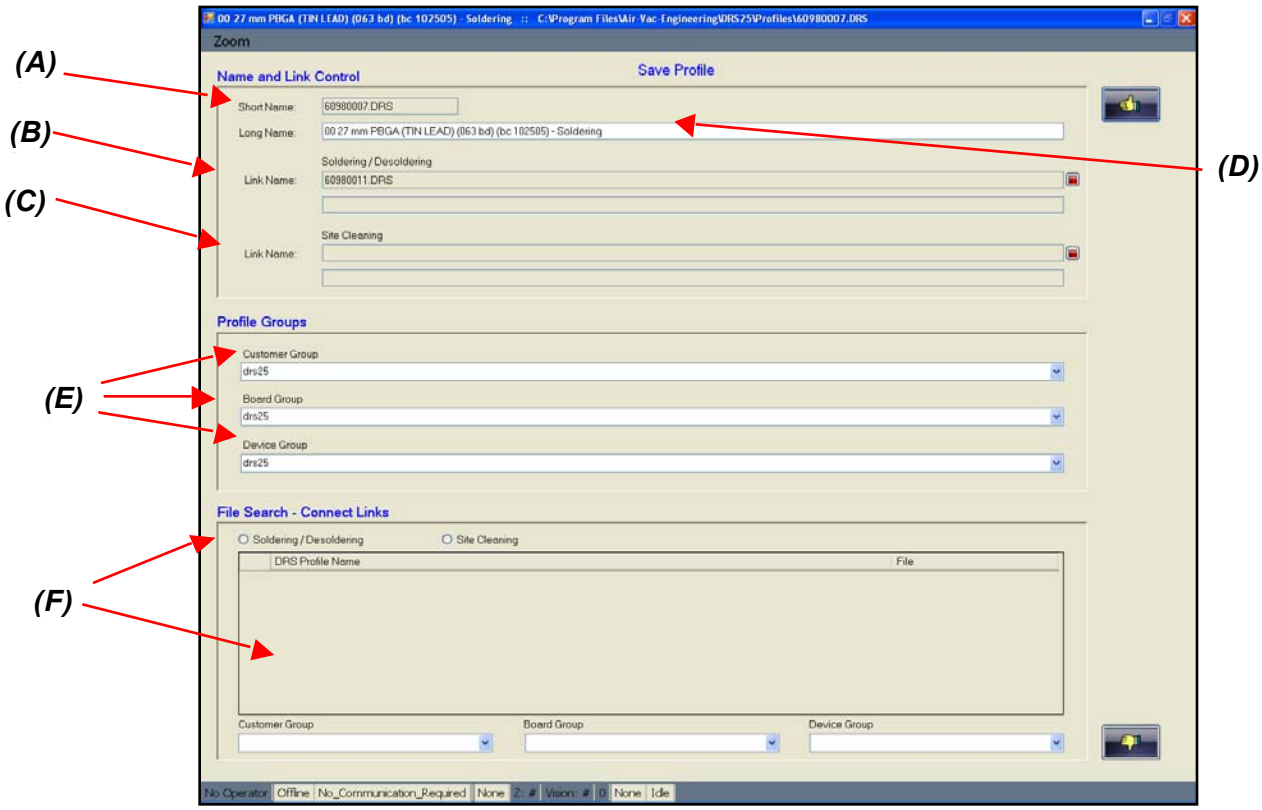
HIGH PRIORITY USER HAS THE OPTION TO CLICK ON THE CONTINUE TO RUN SCREEN BOX TO ADVANCE TO THE MAIN MENU – CLEAR BOX OR TEACH SCREEN – FILLED BOX.

This screen allows the operator to process an application. In general, this screen provides the operator with messages, heating and flow rate information, thermocouple readings and the overall progress of the cycle. Please see the **Run** screen section for detailed information.



**Save (restricted access):**

The **Save** option is used to save a new profile or re-save an existing profile.




- Short Name:

The **Short Name** *(A)* is used to uniquely identify the profile. The **Short Name** is automatically generated and is composed of two separate elements. The first four characters of the **Short Name** are taken from the DRS27 machine serial number. The remaining numbers represent a sequence number. This sequence number changes as new profiles are saved. The file extension for all short file names must be [.DRS].

- Link Name – Soldering/Desoldering:

A soldering/desoldering link *(B)* allows the operator to quickly open a related profile (soldering or desoldering) without leaving the **Run** screen. The **Link Name** is not automatically generated. The **Link Name** identifies (points to) to a previously created profile with process related functionality. Typically, a soldering profile has the desoldering **Short Name** entered as the Link Name.

- Link Name – Site Cleaning:

After the component has been removed, a **Site Cleaning** profile *(C)* is generally cycled to remove the excess solder from the site. The **Link Name** is not automatically generated. **The Link Name** identifies (points to) to a previously created profile with process related functionality. Typically, a desoldering profile has the site cleaning **Short Name** entered as the **Link Name**.

- Long Name:

The **Long Name** *(D)* is used to describe the overall function (purpose) of the profile. Long names are used by the **Open** option to help the operator accurately select a profile. The **Long Name** can be up to 60 characters long. The **Long Name** is not automatically generated. The operator must enter this information.

**Warning:**

CAREFUL NOT TO ENTER (EXACTLY) A LONG NAME THAT ALREADY EXISTS. THE SYSTEM WILL ALLOW IDENTICAL LONG NAMES TO EXIST IN THE PROFILE LIBRARY.

- Customer, Board and Device Group:

These groups *(E)* allow profiles to be organized using a combination of customer, board and device name. New groups can be easily created (see **Setup** – **Group**). Categorizing profiles by group can significantly improve the ability to find the correct application profile.

- File Search:

These controls allow the user to interactively search for the necessary file links. The group drop-down list boxes can be used to help the operator filter file listings.

When the user clicks on the thumbs up button to save a profile, the system may notify the user about the pending activity


To complete the save, click on the **Ok** button.

When the user completes the save function, the system will automatically return to the main menu.

### Save As (restricted access):

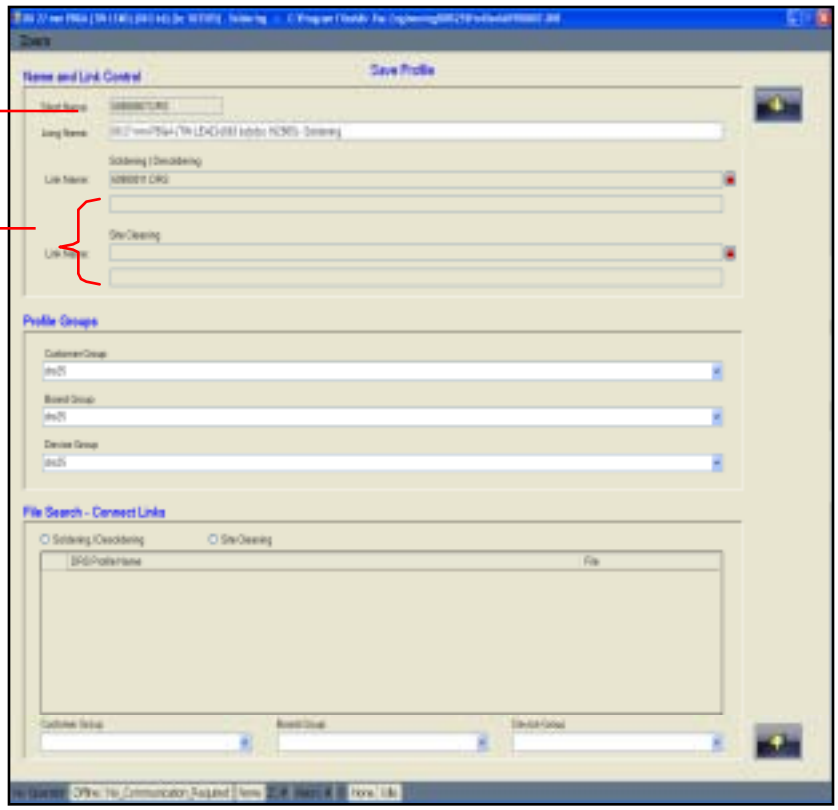
The **Save-As** option functions very similar to the **Save** option, however, the **Save-As** option also allows the user to make a copy of an existing profile. The Short name is always automatically updated (incremented) to the next available sequence number (see the **Save** option).

- The user can change the long name to reflect the new functionality of the profile.
- The user has the option to move the new profile to a different group.
- New link names can be added at any time.

The **Short Name** will automatically be updated with a new, unique name.

The user should edit the **Long name** to reflect the new functionality of the profile.

The **Link Names** for Soldering/Desoldering and Site Cleaning will automatically be cleared.



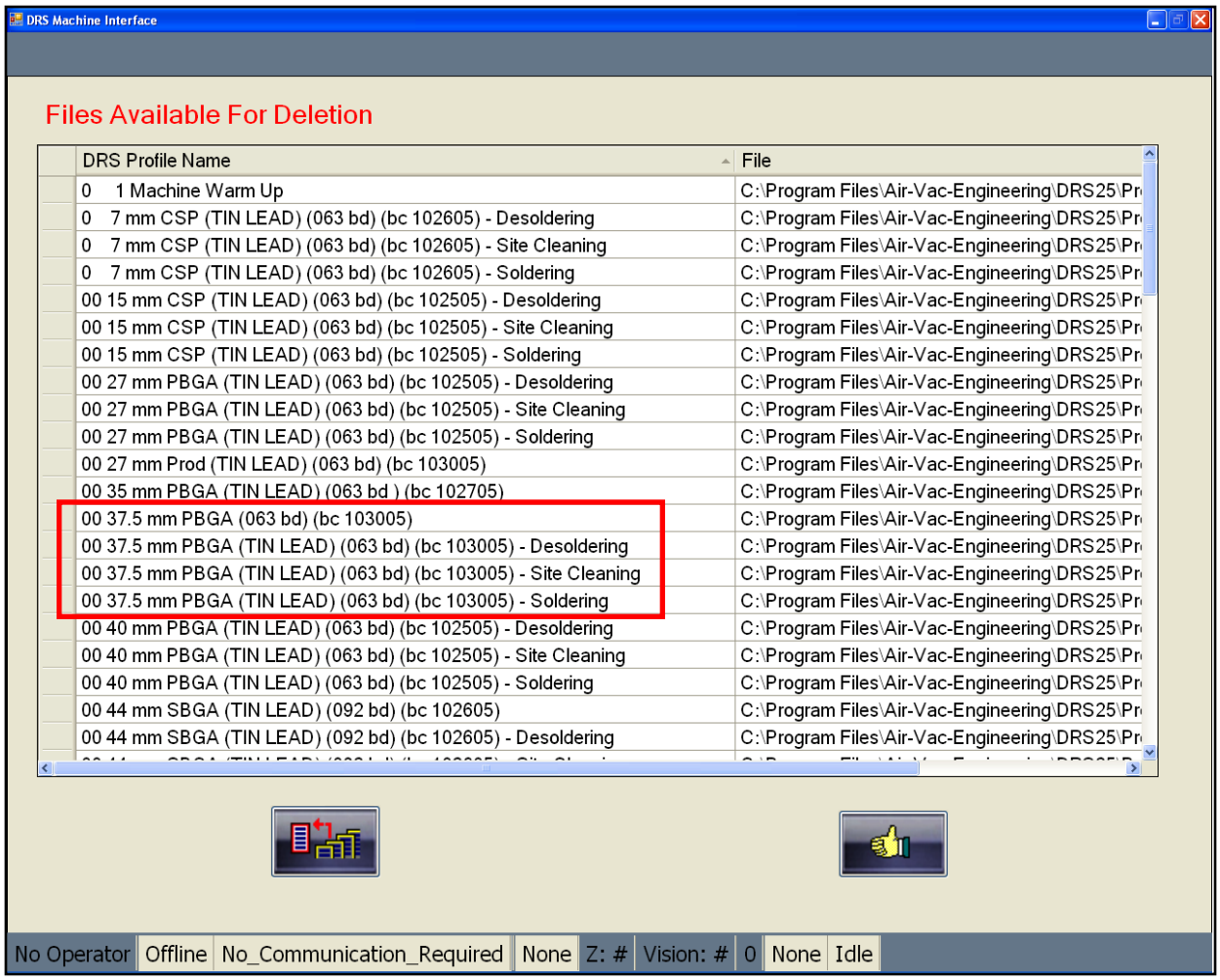

**Note:**

THE ORIGINAL PROFILE REMAINS UNCHANGED AND COMPLETELY INTACT.

THE USER SHOULD BE CAREFUL NOT TO ALLOW (EXACTLY) A LONG NAME THAT ALREADY EXISTS. THE SYSTEM WILL ALLOW IDENTICAL LONG NAMES TO EXIST IN THE PROFILE LIBRARY.

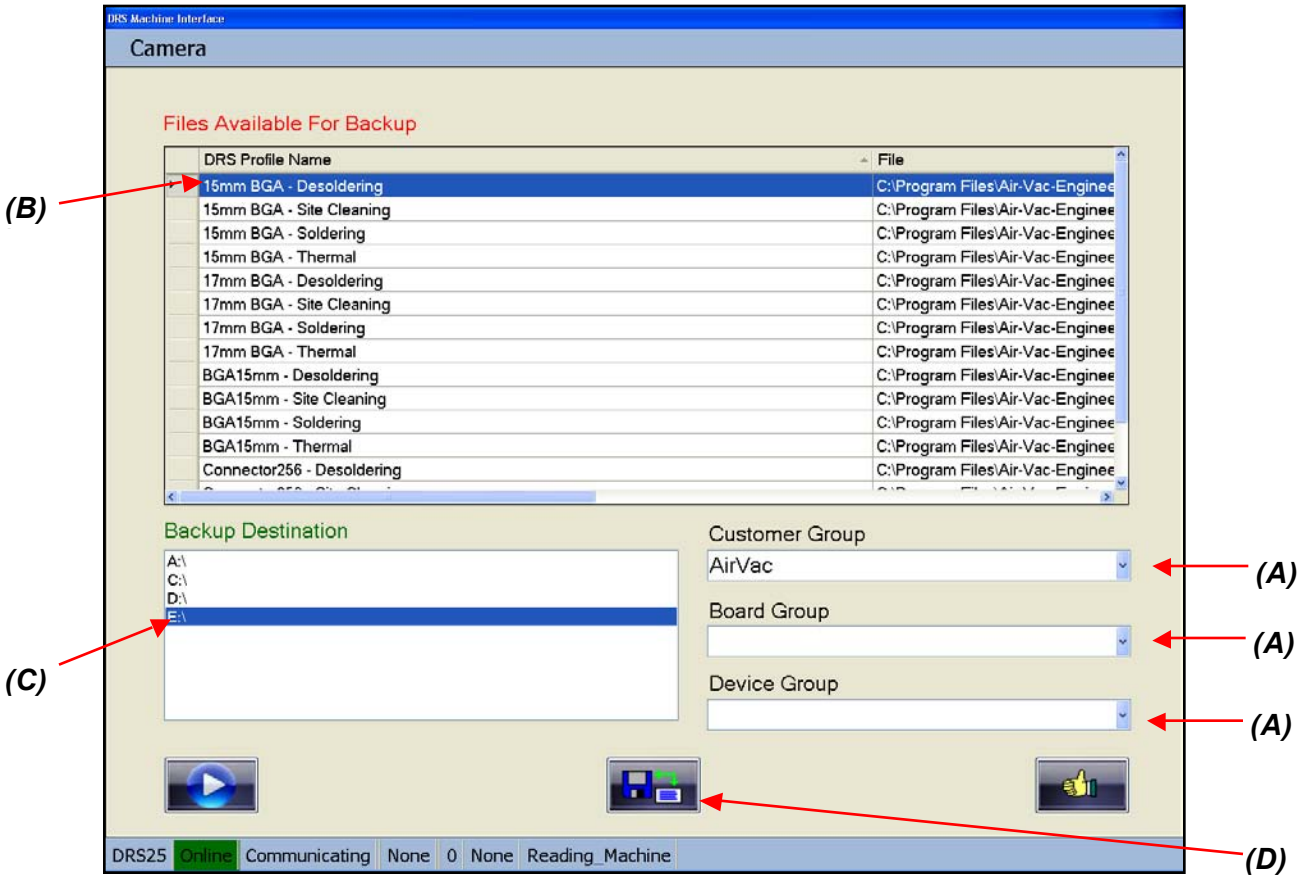
## Delete Profiles (restricted access):

The **Delete Profile** screen allows the user to delete files based on the Long Name (similar to the **Open** option). The user will be prompted before any files are removed.

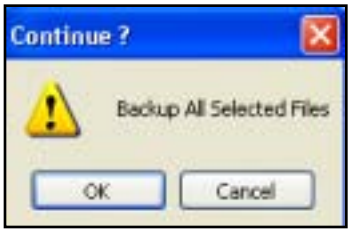



**Backup (restricted access):**

The Backup option allows profile(s) to be copied on USB Memory Storage Device.




(A) Select the Customer, Board and Device group of the profile(s) to be backed up.
(B) Select the profile(s) to be backed up (one or more).
(C) Select the USB Memory Storage Device for the profiles to be backed up to. (Plug into computer)
(D) Click on the backup icon to backup.
Click on Ok when asked to continue.
The profiles have been copied.

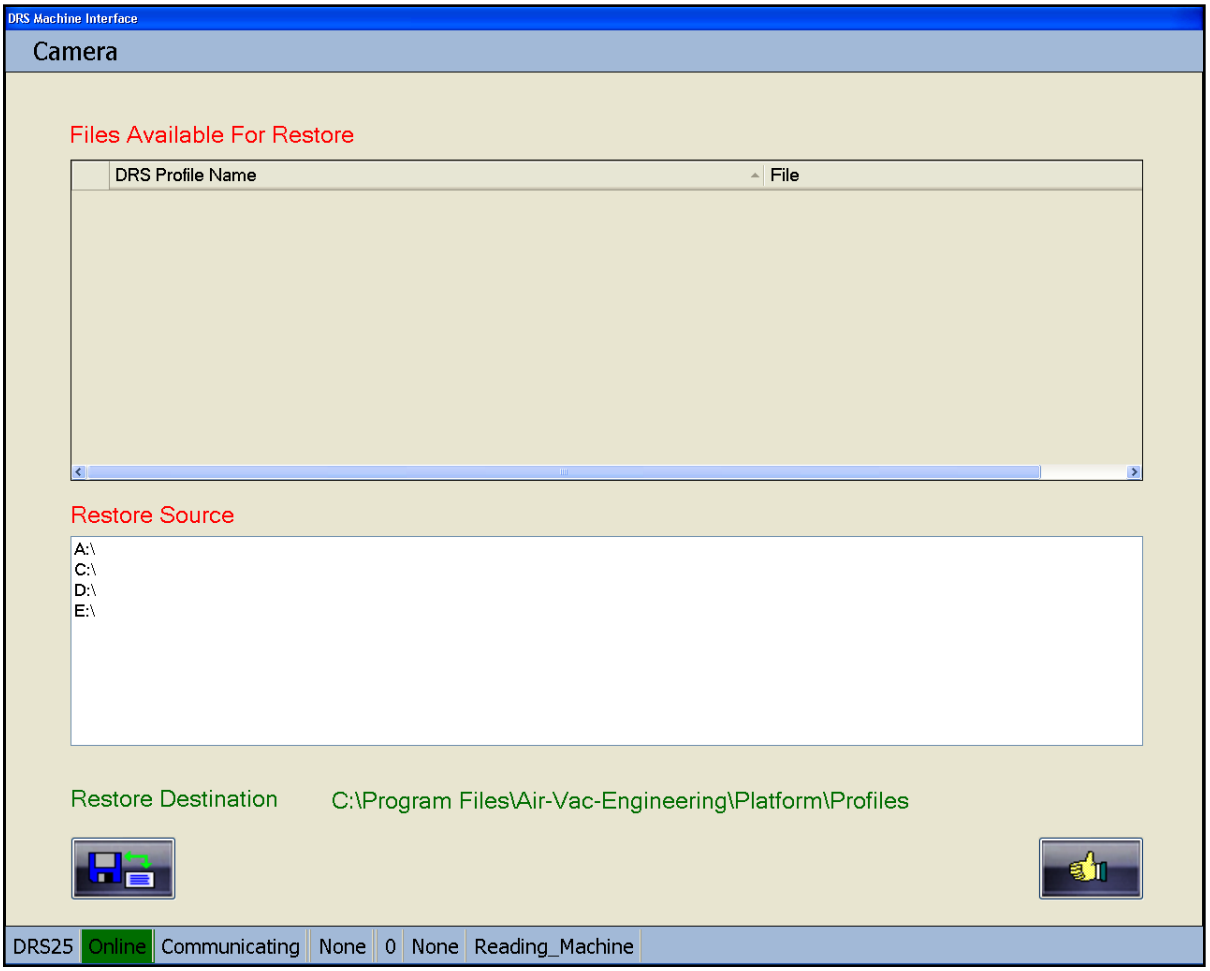



The triangle icon allows all the profiles of the machine to be accessed regardless of Customer, Board or Device group.

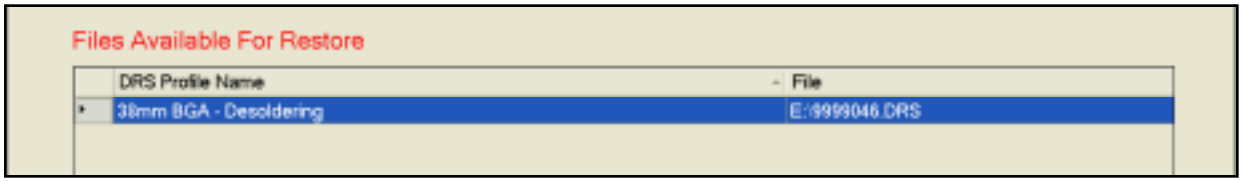
Select all profiles buttons.

**Restore (restricted access):**

The Restore option allows profile(s) to be restored from a USB Memory Storage Device.



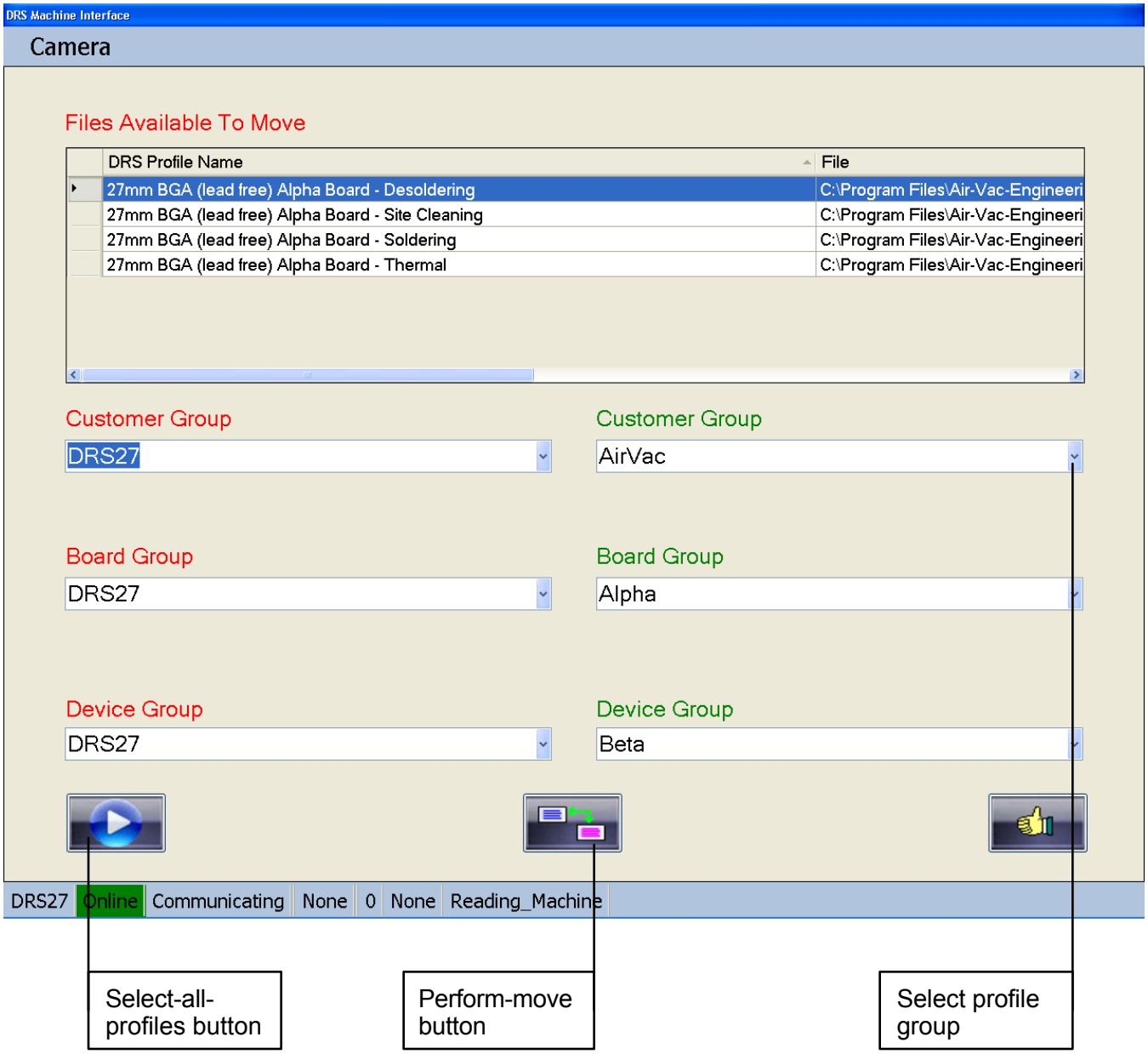

Select the Restore source. The files available for restore will appear.




Click the restore icon.

The profiles have been restored to the DRS27 in the appropriate customer, board and device group.

**Move Screen (restricted access):**

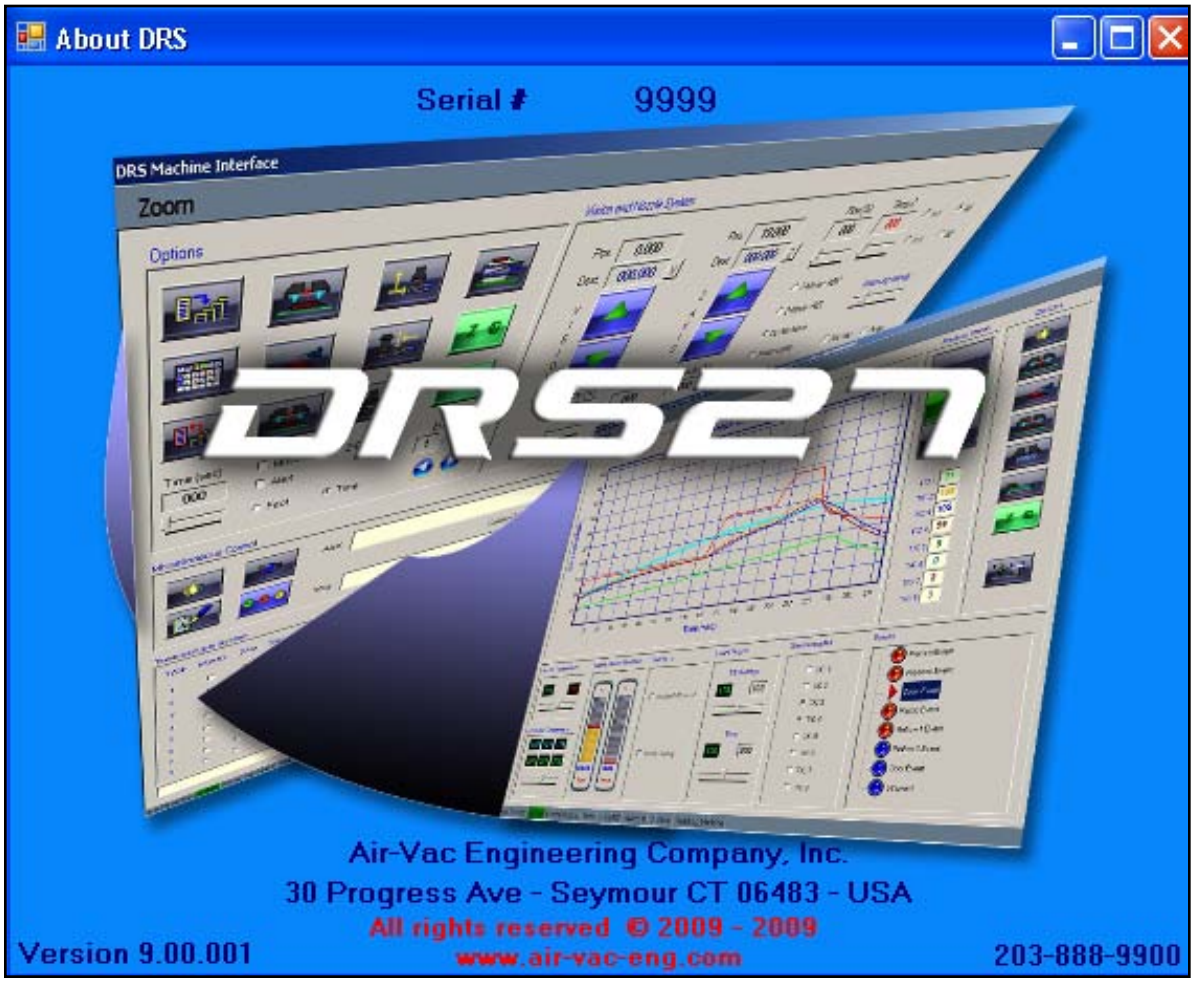



Procedure for moving profiles:

1. Select a target profile or click on the select-all-profiles button.
2. Highlight (left single click) profile long name(s) (multiple selections allowed).
3. Select a destination profile group.
4. Click on perform move button.

**About DRS (restricted access):**

The **About** screen contains general information about the current software version.



**Exit:**

It is ***very important*** to shutdown the DRS27 system correctly. Click on the **Options** menu and select the **Exit** option. This will close the DRS27 software and shut down any active devices (vacuum, air flow, etc). The **Windows Desktop** screen will be displayed.

Click on the **Windows icon** menu located in the lower left corner of the screen. Then click on **Shutdown.**

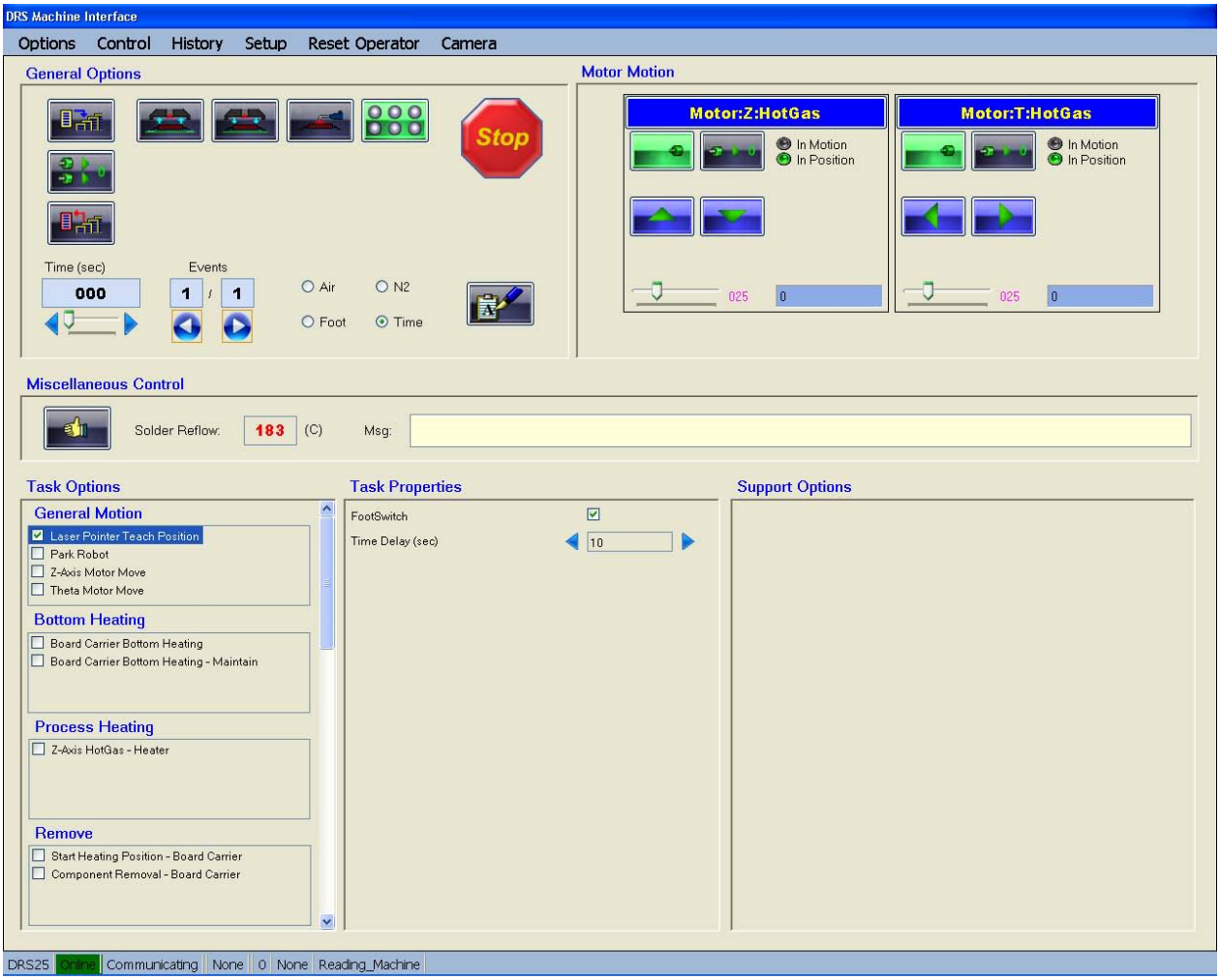
## 4.2 Control Menu Functions

***View of the Control Menu***

## Teach Process Events (restricted access): Programming Functions

Selecting the **Teach Process Events** option (from the **Controls** menu) will present the user with the **Teach** screen. Events can be added or deleted based on the application's processing requirements.

## Teach Process Events: Programming Functions




The Teach screen allows multiple Task Options to be processed in a single event. The Task Options have programmable Task Properties to provide process flexibility. The Task Options will be activated in order from the top to the bottom of the Task Options list.


The Event Insertion Icon adds events to the program.

All z-axis motion for task option processes are based on:

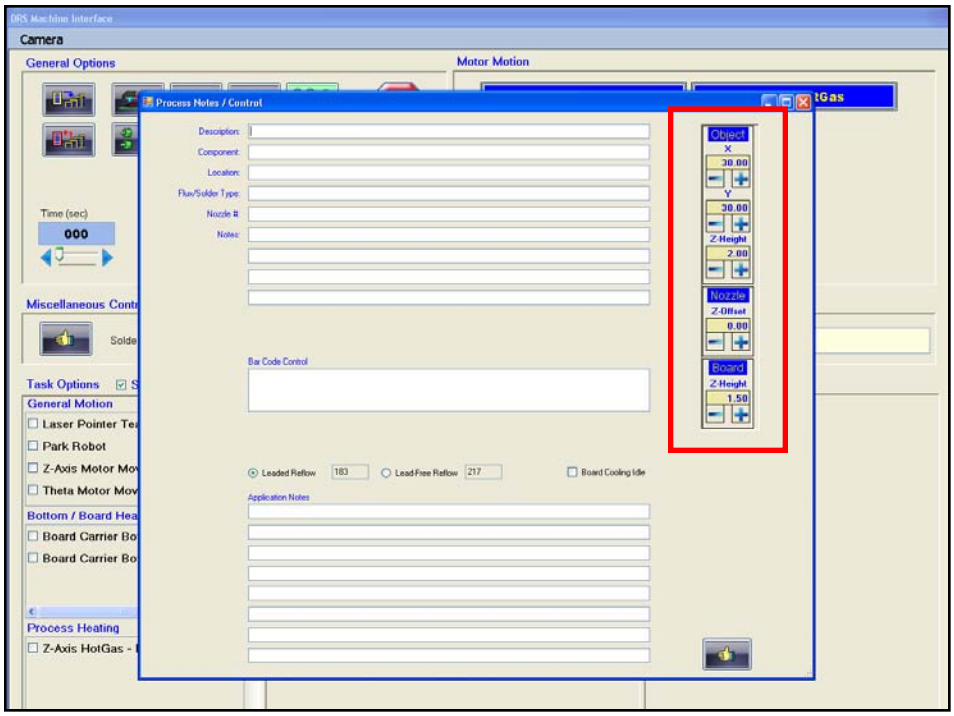
- Nozzle height, Component height, Board carrier height, and Feeder height

<u>It is vital that those parameters be set correctly.</u>

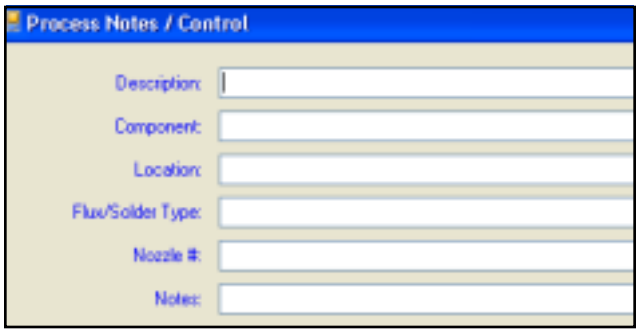
## Process Notes / Control

Provides process information to the operator. This information is made available to the operator during the Run cycle.

Click on the Process Note/Control Icon to access Process Notes/Control screen.



Sets critical component and z-axis set up parameters for all motion functions.




**Text:** Type pertinent information for program.

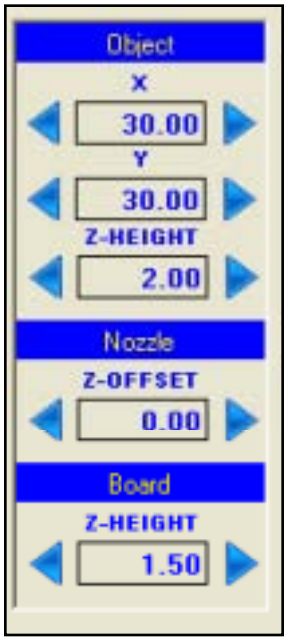
For example:

Component: BGA256

Location: U47

Nozzle #: N27EZ27

Notes: Install board with connector in front




**Object:**

X: Defines component width (mm). Dimension is applied to camera view (corner and edge) during component alignment in vision.

Y: Defines component depth (mm). Dimension is applied to camera view

Note: Reducing the x and y object dimension will shift the corners of object during alignment viewing which may provide viewing of a larger corner area.

Z-Height: Defines component height (mm).

**Nozzle:**

Z-Offset: Defines nozzle height in relation to 66 mm standard nozzle. For example, the standard EZ nozzle measures 62.5 mm. The offset is –2.50 mm. The standard site cleaning nozzle is 70.0 mm. The offset is +4.00 mm.

**Board:**

Z-Height: Defines the board height. If the board does not rest on the carrier, i.e., assembly has a frame and board is raised, then, the height of the board in relation to the board carrier edge supports is the z-height dimension.

**Critical: Object and board z-height and nozzle z-offset are used in calculation of z-axis movements. It is critical not to input undersized parameters.**

## Teach Screen: Basic Programming Functions

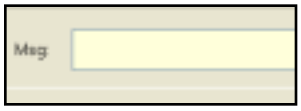

**Events:**

Indicates the current event of the Teach screen. The total number of events will be shown. The up/down arrows are use to go to specific event.



**Time:** Indicates time for the event. Time is programmed in the Time (sec) box. The slide bar or typing in the box will change the setting.

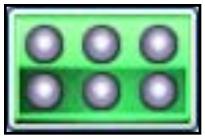

**Foot:** Indicates footswitch based event. Event will not advance in run screen until operator presses the footswitch. The time is limited to 10 minutes.




**Msg**: Message box provide operator information for event on run screen.

**Event Insertion Button:** The Insert event button allows the operator to temporarily add a new event in between two existing events. The inserted event will be an exact copy of the current event. The inserted event will be added ahead of the current event.

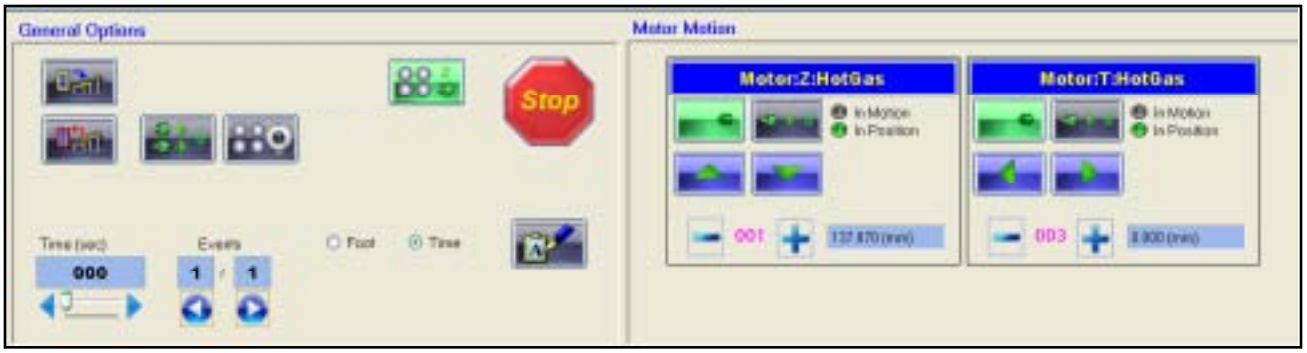
**Event Delete Button:** The Delete event button is used to temporarily remove the current event.



**Light Icon:** Turns on machine lights for event.

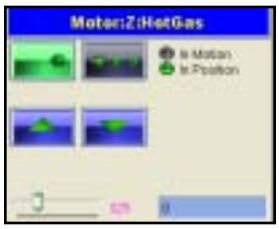
**OK / Thumbs Up Button**: Will exit the Teach screen and return to the Main screen.

### Active Icons in the Teach Screen:




**Home Icon**: Retracts z-axis to top position. Retracts vision axis to the rear position.


**Stop Icon:** Stops z-axis and vision axis motion.

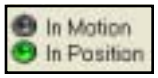



**Motor: Z :Hot Gas / Motor: T :Hot Gas**

**Motor: Z :** Controls z-axis, **Motor : T:** Controls theta axis

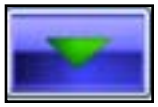
**Motor On/Off Icon:** Indicates z-axis motor is active.

**Motor Theta Icon:** Indicates theta motor is active.




**In Motion:** Indicates z-axis or theta motor is in use.

**In Position:** Indicates z-axis or theta motor is at the position.



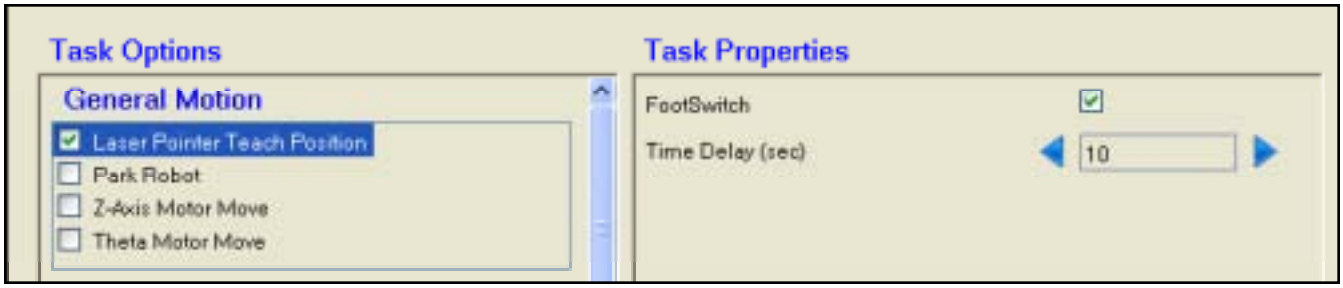
**Up/Down Arrows:** Used to activate motor


**+/1 Box:** Sets velocity of motor


**Blue Box:** Displays the position of the z-axis

## General Motion

### Laser Pointer Teach Position




**Function:** Provides operator a light (spot) reference to locate center of z-axis motion. For:

Removal: Center of component to remove.

Site Cleaning: Start position of heating cycle.

Soldering: Center of placement site.

**Action:** Vision system extends. Laser pointer located under vision system is activated. The laser pointer message "Locate Target Site Using Laser Pointer" is then shown on the run screen. The operator moves the laser pointer to the site and presses the footswitch. The vision system retracts.

Task Properties:

**Footswitch:** Allows laser light to be on until footswitch is depressed.

**Delay (sec):** Sets time mode and time for laser pointer to be activated during process.

### Park Robot

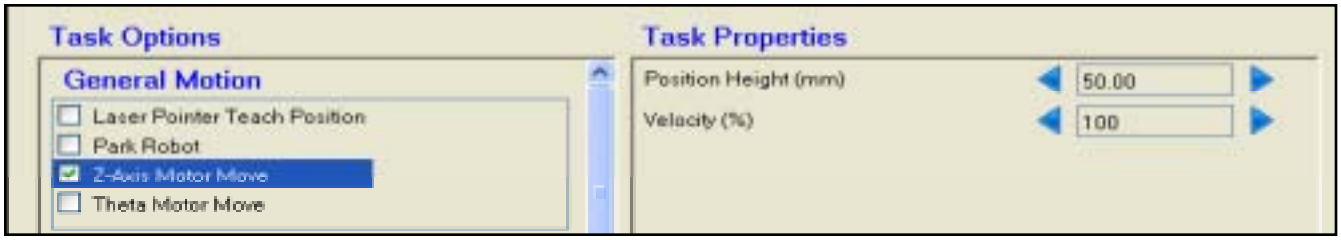

**Function:** Positions nozzle and vision system away from work area.

**Action:** Retracts z-axis to top position. Retracts vision axis to rear position.

Task Properties:

None

### Z-Axis Motor Move




**Function:** Positions nozzle height.

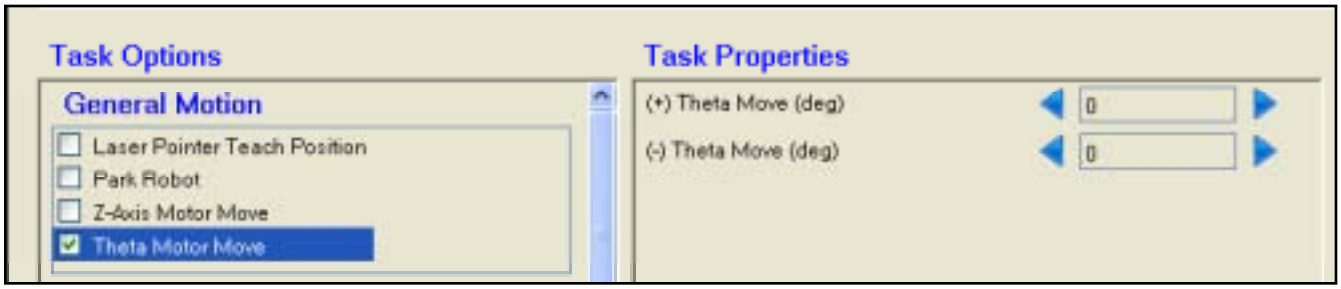
**Action:** Nozzle moves to set height (position height) relative to board carrier at the designated speed (velocity).

Task Properties:

**Position Height (mm):** Distance of nozzle in reference to board carrier position.

**Velocity (%):** Speed of z-axis, 0-100%.

### Theta Motor Move




**Function:** Rotates nozzle to shear bonded components from board.

**Action:** Nozzle rotates clockwise (+ theta move) and counterclockwise (- theta move). Can allow multiple cycles (loop sequence) (loop attempts).

Task Properties:

**(+) Theta Move (deg):** Nozzle rotates clockwise to set angle.

**( - ) Theta Move (deg):** Nozzle rotates counterclockwise to set angle.

## Process Heating

### Z-Axis Hot Gas - Heater


**Function:** Turns on or off the upper heater.

**Action:** The air flow (flow control) and temperature are selected. The upper heater is activated.

Task Properties:

**Flow Control (%):** Controls the air/nitrogen flow from the mass flow controller to the upper heater (20-100%). The settings generally correspond to the nozzle size. Recommended flows:

| Nozzle Size (mm) | Heater Flow (%) | |
|---|---|---|
| Less than 10* | 30 | *For MNX nozzles set the flow to 60% |
| 10-15 | 40 | |
| 16-26 | 50 | |
| 27-30 | 55 | |
| 31-34 | 65 | |
| 35-40 | 75 | |
| 40+ | 85 | |

**Use Heater By-Pass Control:** Indicates by-pass system is activated. Ambient air flows through the nozzle by passing the heating element. Generally, used to cool component, package and joints in the replacement program after peak reflow temperature is reached. This minimizes/controls the time from reflow 1 (peak temperature) to end of reflow 2 (just below melting temperature).

**Temperature (º C):** Sets the upper heater temperature.

**Wait For Heater In-Position:** Indicates wait for heater in-position function is activated. A separate thermocouple in the heater can be used to insure the temperature programmed is reached prior to a process.

**In-Position Delay (sec):** Used in conjunction with wait for heater in-position. Indicates the time after the temperature is reached prior to a process.

**Use Heater Ramp**: Indicates use heater ramp function is activated.

**Ramp (º C):** Used in conjunction with ramp. Indicates the programmed rate (º C /sec) for the heater.
Note: Heater will be activated until programmed to be turned off.

**Use Stabilizing Option:** Activates the stabilize function to heat or cool down to z-axis head.

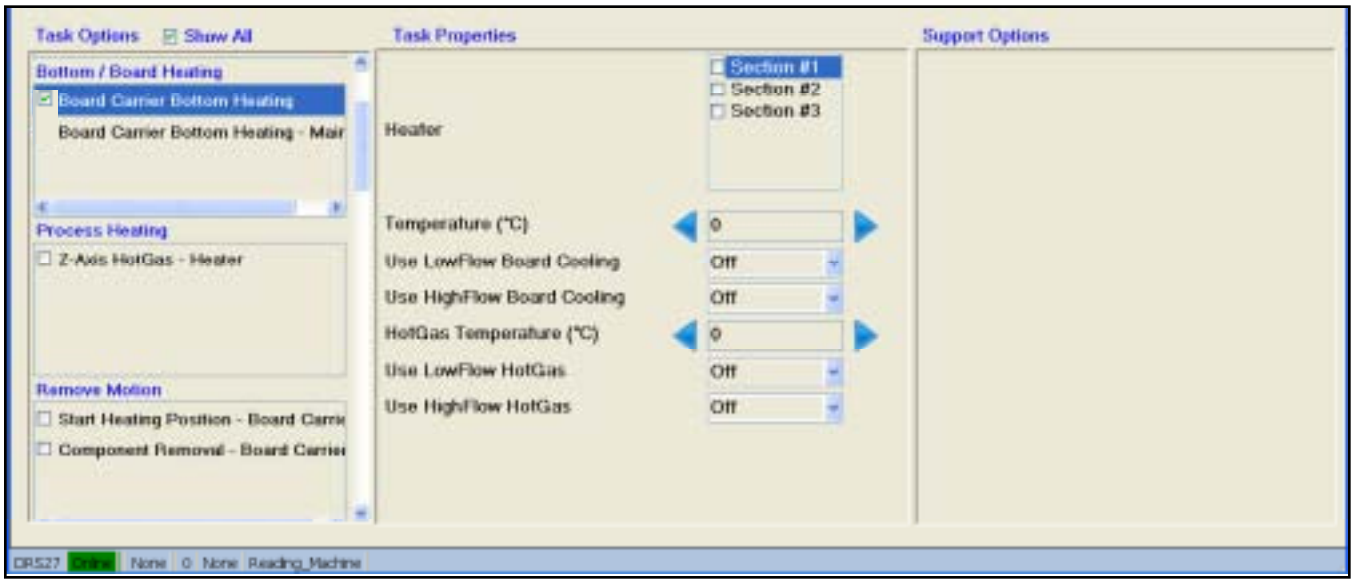
**Stabilize Channel/Nozzle Heater Stabilize:** Activates thermocouple attached to heater head.

**Stabilize Temperature (˚C):** 90˚ default. Sets temperature heater head. Go to (up/down) prior to event time activated (for heater).

**Stabilize Delay (sec):** 600 default. Sets maximum time allowed for Stabilize Temperature to occur. 600 second default allows 0 minutes for stabilize process to occur.

## Bottom/Board Heating

### Board Carrier Bottom Heating




**Function:** Activates bottom heaters and board cooling system.

**Action:** Bottom heater sections (heaters) can be selected to be activated to the target temperature (Temperature). Spot heaters can be activated to target temperature (HotGas Temperature). Flow can be set for low flow (Use LowFlow HotGas – On), high flow (Use HighFlow HotGas – On), and extra high flow (Use LowFlow HotGas – On and Use HighFlow HotGas – On). Board cooling system can be set to low flow (Use LowFlow Board Cooling) or high flow (Use HighFlow Board Cooling).

Task Properties:

**Heater:** Any or all section #1-#3 can be selected to be selected to be activated (#1 in front).

**Temperature (ºC):** The temperature of the bottom heaters can be programmed from 0-350ºC.

**Use LowFlow Board Cooling:** Turns on low flow air to cool board and/or bottom heaters (3 cfm).

**Use HighFlow Board Cooling:** Turns on high flow air to cool board and/or bottom heaters (7cfm).

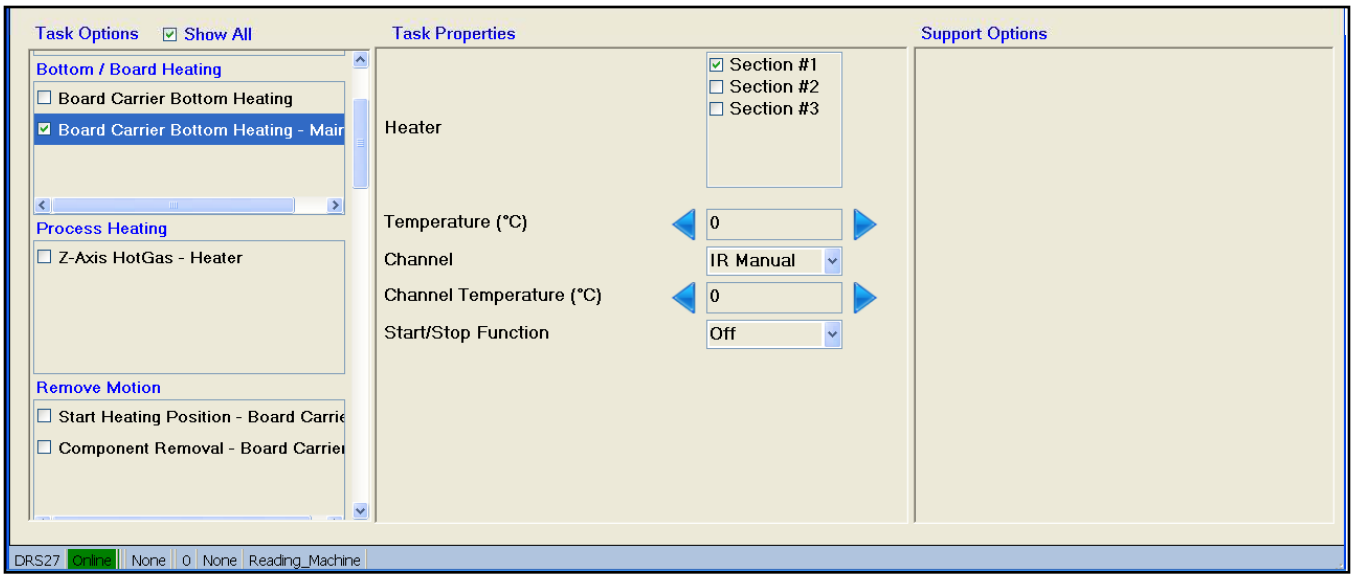
**HotGas Temperature (ºC):** The spot heater temperature can be programmed from 0 – 450˚C.

**Use LowFlow HotGas:** Turns on the low flow air to the spot heater (3 cfm).

**Use HighFlow HotGas:** Turns on the low flow air to the spot heater (7 cfm). Extra high flow setting can be set with both the LowFlow HotGas and HighFlow HotGas settings to On (10 cfm).

Note: Process parameters will be activated until programmed to be turned off.

## Board Carrier Bottom Heating-Maintain




**Function:** Activates the closed loop maintain function of the bottom heaters based on a thermocouple input to control and limit board temperature through out the process.

**Action:** The process is activated and turned off by the start/stop function. The bottom heater (heater) sections are selected to the target temperature of the heaters (temperature). The selected thermocouple input (channel) controls the process by monitoring the board and when the temperature is reached (channel temperature (°c) the bottom heaters (heater) are turned off. If the channel temperature is exceeded the low flow board cooling system is then turned on until the board is cooled a few degrees below the channel temperature. When the board temperature is lower than the channel temperature the board cooling system will be off and the heaters reactivated.

Task Properties:

**Heater:** Section #1-#3. Activates the 3 sections of the bottom heater. (#1 in front)

**Temperature (° C):** Sets the bottom heater temperature for all sections selected.

**Channel:** IR Manual, TC01-TC08. Indicates and selects the IR temperature sensor or a thermocouple channel for board temperature monitoring.

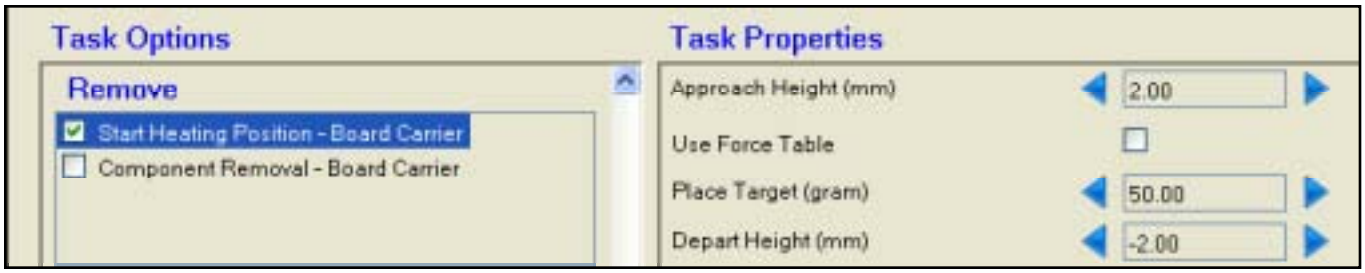
**Channel Temperature (° C):** Sets the target and limit temperature of the object/board. If the channel temperature is exceeded the flow board cooling system is then turned on until the board is cooled a few degrees below the channel temperature. When the board temperature is lower than the channel temperature the board cooling system will be off and the heaters reactivated.

**Start/Stop Function:** Activates and turns off the maintain function.

Note: Maintain function will be activated until programmed to be turned off.

## Remove

### Start Heating Position – Board Carrier




**Function:** Positions nozzle prior to heating process using a force sensing mode above board carrier.

**Action:** Nozzle moves above component on the board (approach height) for the removal process. The table force system (use force table) is activated and the nozzle moves until it registers a force (place target) programmed. The nozzle moves up (depart height).

Task Properties:

**Approach Height (mm):** Sets the initial distance of the nozzle to the component.

**Use Force Table:** Activates use of load cells (force measurement) of board carrier (50-2000g).

**Place Target (grams):** Sets force of nozzle against component to be reached prior to departure from component. Used in conjunction with depart height.

**Depart Height (mm):** Sets the distance of nozzle to component after the place target is reached.

## Remove: Component Removal – Board Carrier


**Function:** Process used to activate vacuum sensor, force based, shear or object detection removal procedures to remove component from board.

**Action:** Most common sequence – vacuum sensor stop (use vacuum sensor stop). The nozzle moves up (sensor stabilize height) after the component heating events. The nozzle vacuum is turned on and its vacuum force measurement is recorded for reference. The nozzle moves down until the nozzle vacuum force (internal parameter) is reached (or force system (place target)). The nozzle moves up (depart height).

Task Properties:

**Approach Height (mm):** Position for nozzle to internally calibrate vacuum sensor. Height is based on distance from board carrier.

Note: Sufficient air passage is critical.

**Use Vacuum Sensor Stop:** Stops downward movement based on vacuum change.

**Pick Velocity:** Speed of nozzle moving down.

**Safety Target (gram):** Maximum force as backup.

**(+) Theta Move (deg):** Nozzle will rotate clockwise to set angle.

**( - ) Theta Move (deg):** Nozzle will rotate counterclockwise to set angle.

**Depart Height (mm):** Sets distance of the component to the board after place target is reached.

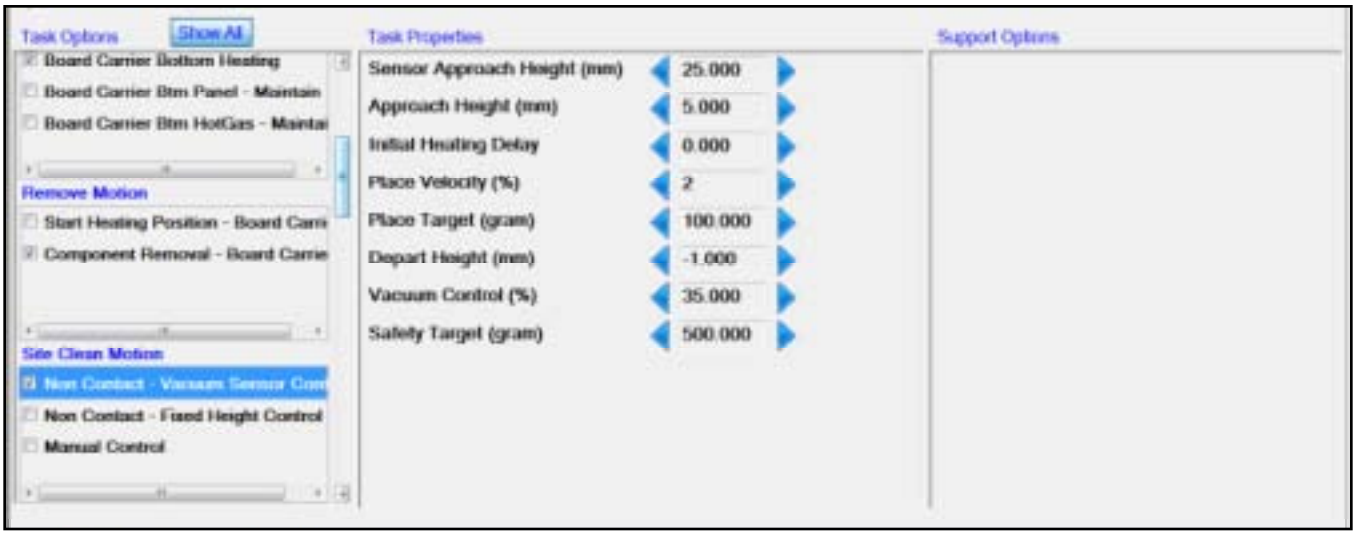
**Depart Delay (sec):** Time between nozzle vacuum activates and motion prior to component removal (for any of the defined procedures).

**Move to Safe Height:** Moves nozzle automatically above the vision system.

**Depart Velocity (%):** Speed of nozzle depart.

## Site Clean Motion

### Non Contact – Vacuum Sensor Control




**Function:** Sets site cleaning tool tip height in reference to pads of the site on the board.

**Action:** The site cleaning nozzle moves up (sensor approach height). The site cleaning vacuum sensor is activated. The nozzle moves down above the site (approach height) where the initial site heating is applied (from process heating task option). The event time or initial heating delay can be used to control the time. The nozzle touches the board and moves up a set distance (depart height). The site cleaning tip distance to the board adjusts according to the vacuum sensor initialize reading (vacuum motion) (vacuum control). The higher the setting the higher the tip is positioned above the solder pads.

Task Properties:

**Sensor Approach Height (mm):** Positions the nozzle above the board to internally calibrate vacuum sensor range of the site cleaning nozzle. Note: Sufficient air passage is critical.

**Approach Height (mm):** Sets initial distance of nozzle relative to board prior to process/heating.

**Initial Heating Delay:** Time nozzle heating is applied at the sensor approach height prior to x/y operator movement of the site cleaning tip. Note: It is important that the residue solder be molten prior to vacuum control being applied.

**Place Velocity (%):** Speed of nozzle tip moving down to board.

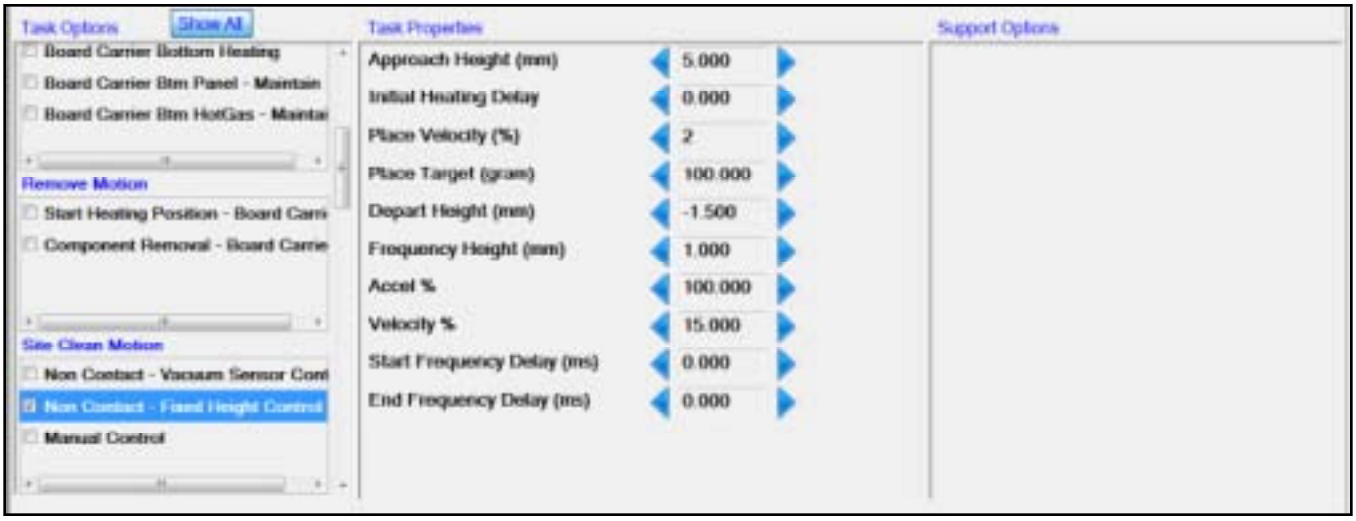
**Place Target (gram):** Force touch of tip to board.

**Safety Target (gram):** Force backup to vacuum sensor control of tip height.

**Depart Height (mm):** Sets distance of the nozzle after the initial heating delay and prior to activation of vacuum height adjustment.

**Vacuum Control (%):** Sets the distance of nozzle tip to the board during the process, the larger the number the higher the distance. The vacuum control is used throughout the operator movement of the tip across the site. The nozzle will adjust (move up/down) as per the site cleaning vacuum sensor and vacuum control setting.

## Non Contact- Fixed Height Control




**Function:** Sets the site cleaning mode for fixed height control

**Action:** After the site cleaning nozzle alignment by the laser pointer the site cleaning nozzle moves over the site (sensor approach height). The site cleaning sensor is activated. The nozzle moves down (approach height) where the initial site heating is applied (initial heating delay). The nozzle moves down to the cycle start height (depart height) (start frequency delay). The nozzle oscillates (frequency height) (velocity). The operator presses the footswitch when the process is finished (end frequency delay).

<u>Task Properties:</u>

**Approach Height (mm):** Sets initial distance of nozzle relative to board prior to process/heating.

**Initial Heating Delay:** Time nozzle heating is applied at the sensor approach height prior to x/y operator movement of the site cleaning tip. Note: It is important that the residue solder be molten prior to vacuum control being applied. The nozzle tip must seal to register a correct vacuum force measurement used in conjunction with the sensor initialize reading.

**Place Velocity (%):** Speed of nozzle tip moving down to board.

**Place Target (gram):** Force touch of tip to board.

**Depart Height (mm):** Sets distance of the nozzle in relation to the board.

**Frequency Height (mm):** Controls the up/down motion of the nozzle during the process, the larger the number the larger the movement.

**Accel (%):**Accelerate of the nozzle frequency.

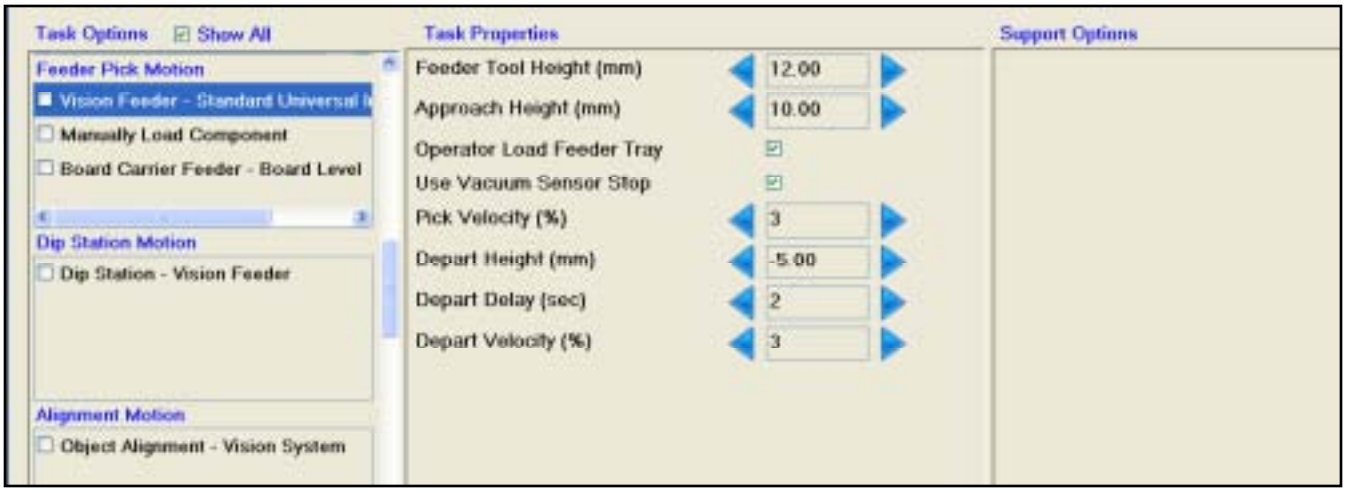
**Velocity (%):** Speed of the nozzle frequency.

**Start Frequency Delay (ms):** Time before frequency motion starts.

**End Frequency Delay (ms):** Time after frequency motion ends.

## Feeder Pick Motion

### Vision Feeder – Standard Universal Insertion Tool




**Function:** Allows component to be positioned in the nozzle using the standard universal insertion tool in the vision system feeder prior to component alignment in the vision system.

**Action:** A message is presented to the operator to load the feeder tray (optional) (operator load feeder tray). The vision system moves until the feeder is under the nozzle. The nozzle moves above the feeder tool (approach height). Nozzle vacuum is applied and moves to the component in the feeder (pick velocity). When component is sensed by the nozzle vacuum (use vacuum sensor stop) the nozzle pauses (depart delay) and moves up (depart height, depart velocity). Optional object detection may be applied.

<u>Task Properties:</u>

**Feeder Tool Height (mm):** Sets the height of the universal feeder tool. Note: the feeder tool pick motion is based on the nozzle height, component thickness and feeder tool thickness. Incorrect information can result in damage to the machine and/or component.

**Approach Height (mm):** Sets the initial distance of the nozzle relative to the feeder tool platform.

**Operator Load Feeder Tray:** Activates message on run screen for operator to load the component to the load feeder tray.

**Use Vacuum Sensor Stop:** Activates use of nozzle vacuum sensor. The nozzle vacuum is turned on and stops when the component seals against the nozzle o-ring/vacuum cup (based on minimum internally set vacuum force being reached).

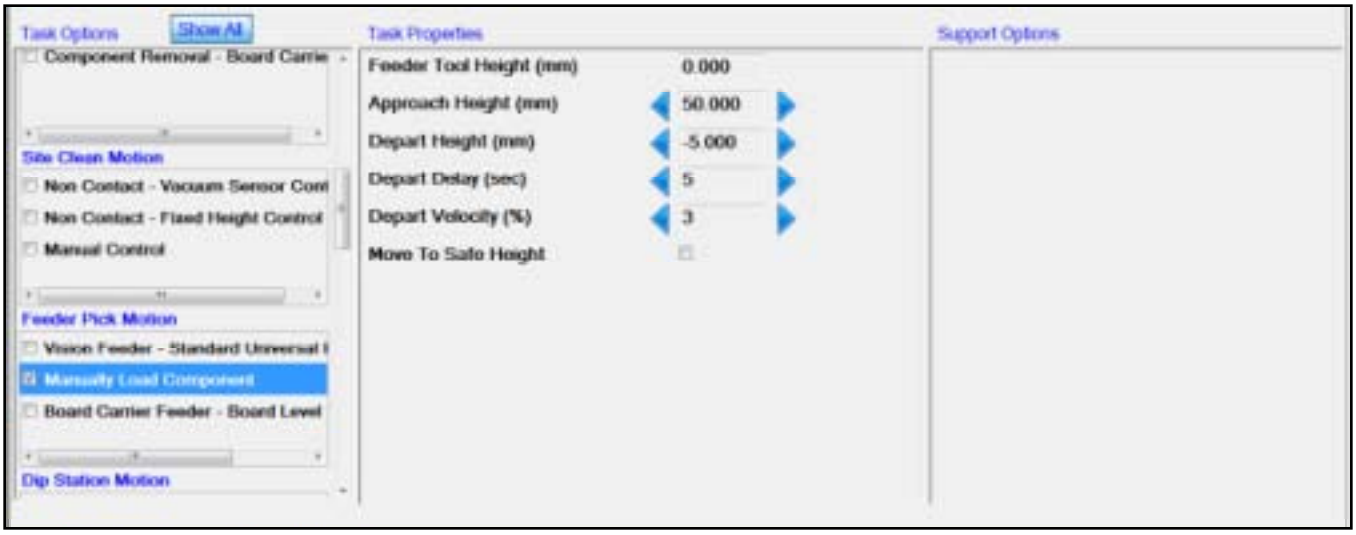
**Pick Velocity (%):** Speed the nozzle goes from the approach height to the component.

**Depart Height (mm):** Distance the nozzle moves from the feeder tool platform after the component is sensed with the vacuum sensor stop. Or the distance the nozzle/component moves up based on the nozzle, component and feeder tool height when use vacuum sensor stop is not activated.

**Depart Delay (sec):** Time prior to the nozzle/component moves to the depart height (mm) after the nozzle vacuum is activated.

**Depart Velocity (%):** Speed the nozzle/component moves away from the feeder tool to depart height.

## Manually Load Component




**Function:** Allows the operator to manually load the component to the nozzle.

**Action:** The nozzle moves to a position above the board carrier (approach height) and the nozzle vacuum is applied. The nozzle movement is paused (depart delay) and then moves up (depart height).

Task Properties:

**Feeder Tool Height (mm):** Sets the height of the feeder tool (not active)

**Approach Height (mm):** Sets the distance the nozzle moves relative to the board carrier prior to the nozzle vacuum activated.

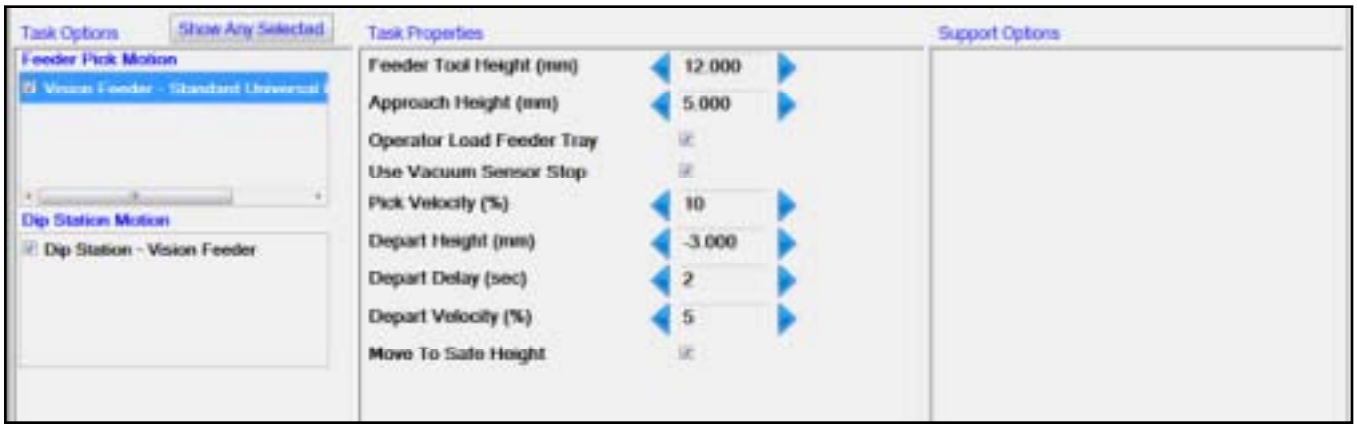
**Depart Height (mm):** The distance the nozzle moves after the nozzle vacuum is applied.

**Depart Delay (sec):** The time the between the nozzle going from the approach height (mm) to the depart height (mm).

**Depart Velocity (%):** Speed of depart.

## Feeder Pick Motion

### Board Carrier Feeder – Board Level




**Function:** Allows component to be positioned in the nozzle in reference to a board carrier feeder.

**Action:** A message is presented to the operator to load the feeder tray (optional) (operator load feeder tray). The vision system moves the feeder under the nozzle. The nozzle moves above the feeder tool (approach height). The nozzle vacuum is applied and moves to the component in the feeder (pick velocity). When component is sensed by the nozzle vacuum (use vacuum sensor stop) the nozzle pauses (depart delay) and moves up (depart height, depart velocity). Optional object detection may be applied.

Task Properties:

**Feeder Tool Height (mm):** Sets the height of the feeder tool based on the board carrier z-height position. Note: The feeder pick motion is based on the nozzle height, component thickness and feeder tool thickness. Incorrect information can result in damage to the machine and/or component.

**Approach Height (mm):** Sets the initial distance of the nozzle relative to the feeder tool with the component in place.

**Use Vacuum Sensor Stop:** Activates use of nozzle vacuum sensor. The nozzle vacuum is turned on and stops when the component seals against the nozzle o-ring/vacuum cup (based on minimum internally set vacuum force being reached).

**Pick Velocity (%):** Speed the nozzle goes from the approach height to the component.

**Safety Target (gram):** Sets force of nozzle against component to be reached prior to nozzle vacuum being activated. Used as back up system for vacuum sensor stop removal process.

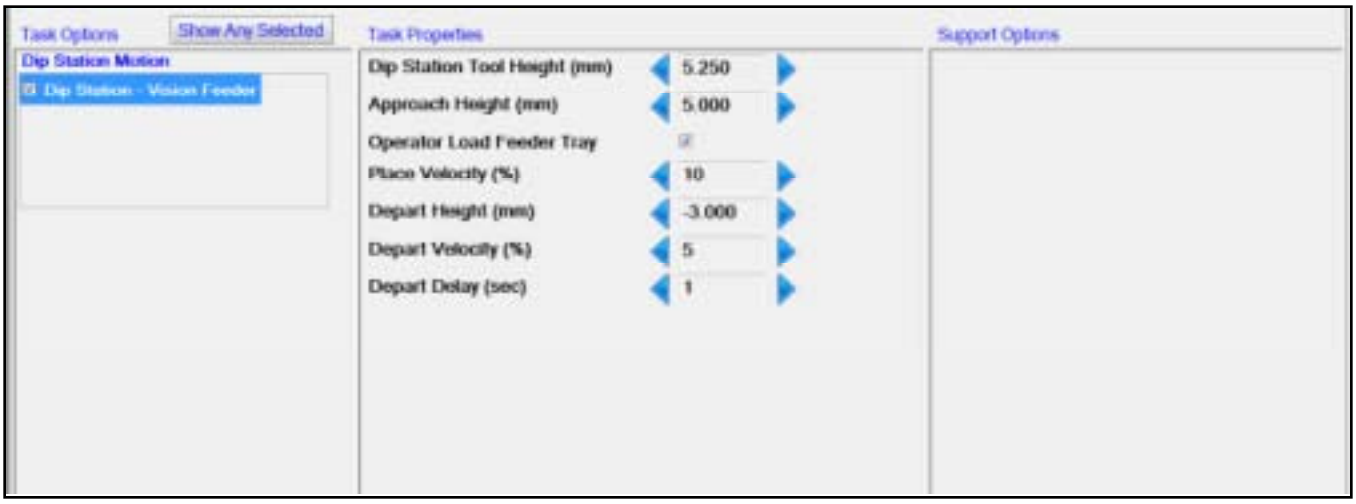
**Depart Height (mm):** The distance the nozzle/component moves from the feeder tool after the component is sensed with the vacuum sensor stop or based on the nozzle touching the component on the feeder tool when use vacuum sensor stop is not activated.

**Depart Delay (sec):** Time prior to the nozzle motion to the depart height after the vacuum is activated.

**Depart Velocity (%):** Speed the nozzle/component moves away from the feeder tool to depart height.

## Dip Station Motion

### Vision Feeder




**Function:** Allows component leads/balls to be dipped into flux or solder.

**Action:** A message is presented to the operator to load the dip station (optional)(operator load feeder tray). The vision system moves the dip station under the nozzle. The nozzle moves above the dip station (approach height). Nozzle moves component into undercut or dip station where flux or solder is applied (based on the dip station tool height). Nozzle/component moves away from dip station (depart height).

Task Properties:

**Dip Station Tool Height (mm):** Sets height of dip station tool. NOTE: The dip station-vision feeder motion is based on the nozzle height, component thickness and feeder tool thickness. Incorrect information can result in damage to the machine and/or component. NOTE: Measure the z-height of the Dip Tray (approx. 6.25mm) and subtract 1.0mm to obtain compression.

**Approach Height (mm):** Sets the initial distance of the component relative to dip station tool.

**Operator Load Feeder Tray:** Activates message on run screen for operator to load the load feeder tray.

**Place Velocity:** Dip entry speed.

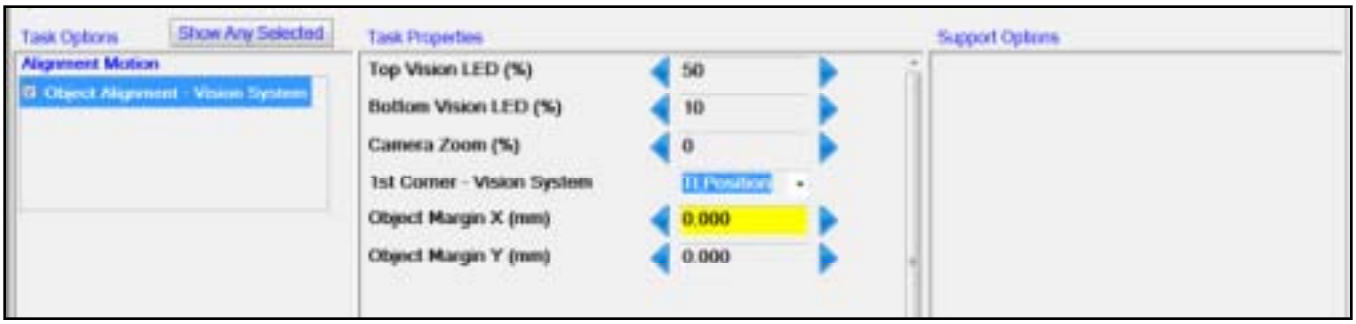
**Depart Velocity:** Dip exit speed.

**Depart Delay:** Time delay in dip station.

**Depart Height (mm):** The distance the nozzle moves from the dip station tool height (mm) after dipping process.

## Alignment

### Object Alignment – Board Carrier




**Function:** Allows operator to align component to board.

**Action:** Nozzle moves up and the vision system is positioned (1st corner – vision system) based on the position (MM position) using the laser pointer teach position and component dimension programmed. The vision system camera is turned on to the programmed LED intensity (top vision LED, bottom vision LED) and magnification (camera zoom).

Task Properties:

**Top Vision LED (%):** Controls the intensity of the top LED for component leads viewing.

**Bottom Vision LED (%):** Controls the intensity of the bottom LED for the top of the site/board viewing.

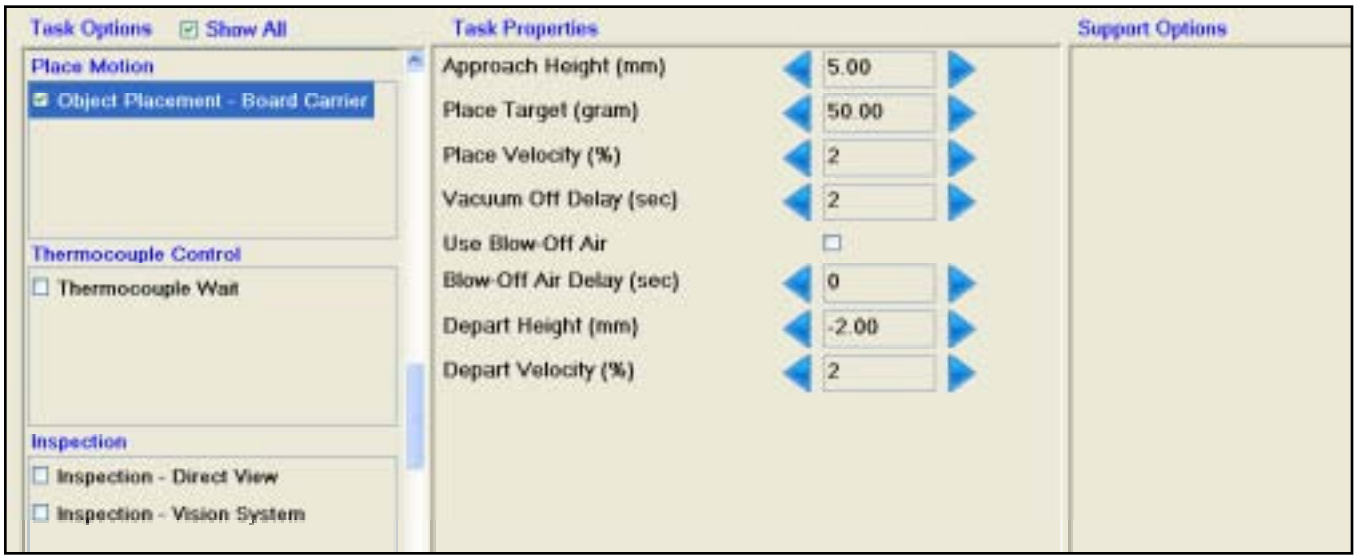
**Camera Zoom (%):** Controls magnification of the camera.

**1st Corner – Vision System:** Sets the first position of the camera to the site based on the center of the laser pointer teach position and component dimension programmed. Options include top left, top right, bottom left and bottom right corners.

**Object Margin X (mm) & Object Margin Y (mm):** If the corner view in vision is too small, enter positive margins to increase the corner image size.

## Place Motion

### Object Placement – Board Carrier




**Function:** Places component to the site.

**Action:** Component moves above site (approach height). The nozzle moves the component down (place velocity) to the board until the (place target) force is reached. The nozzle vacuum is turned off (vacuum off delay). Optional air pressure is normally applied to insure component does not stick to nozzle o-ring (use blow-off air) for programmed time (blow-off air delay). The nozzle moves from the board (depart height)(depart velocity).

Task Properties:

**Approach Height (mm):** Sets the initial distance of the component relative to the board.

**Place Target (gram):** Sets force of the component against the board to be reached prior to nozzle vacuum being turned off.

**Place Velocity (%):** Speed nozzle moves component to board.

**Vacuum Off Delay (sec):** Time the nozzle vacuum is off after place target (gram) is reached.

**Use Blow-Off Air:** Activates air pressure through nozzle vacuum o-ring/vacuum cup before nozzle retracts. Uses blow-off air delay before depart (sec) time setting.

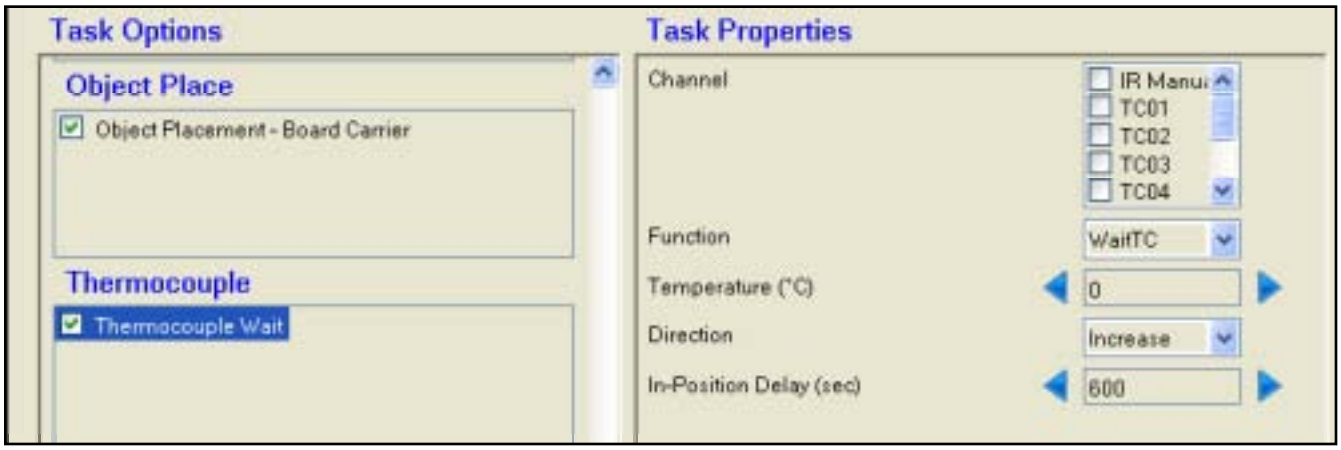
**Blow-Off Air Delay (sec):** Time air use blow-off air system is activated.

**Depart Height (mm):** Distance nozzle moves up after component is placed on board.

**Depart Velocity (%):** Speed the nozzle moves away from component after component is placed on board.

## Thermocouple

### Thermocouple Wait




**Function:** Provides thermocouple feedback for a temperature based process. It is mainly used for process control preheating of the board from the bottom heater. It can be used to provide thermal feedback to create the thermal portion of removal or replacement programs.

**Action:** With the bottom preheater on, the designated (wait TC) thermocouple (channel) monitors top-side board temperature. When the target temperature (temperature) is reached (direction), the process is complete.

Task Properties:
**Channel:** Indicates the thermocouple channel(s) used, which is typically the IR Sensor.

**Function:** Wait TC sets the mode for one thermocouple usage.

**Temperature (ºC):** Sets the target temperature for the thermocouple to be reached.

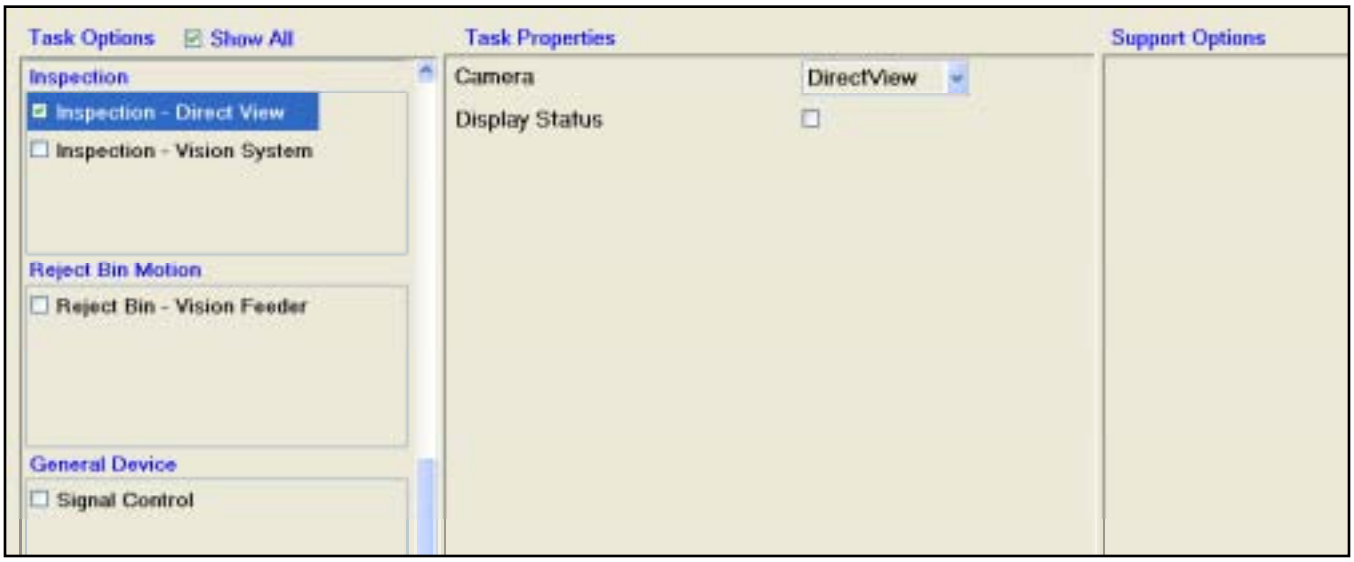
**Direction:** Sets the direction for the target temperature to be reached. Increase mode is used for heating applications. Decrease mode is used for cooling applications.

**In-Position Delay (sec):** Sets the time the function is in use. Normally not used as this is a temperature based event, but is used if a time limit needs to set. If target temperature is not reached and time has expired, program will continue to next step at the set time. If target temperature is the goal set time to 600 seconds.

**Note:** If target temperature cannot be reached in maximum in-position delay setting, 600 seconds, two events must be created and target temperatures set to reachable goals within 600 seconds.

## Inspection

### Inspection – Direct View




**Function:** Turns on direct view camera.

**Action:** The computer screen is switched from the run screen to the camera screen. The direct view camera (camera – direct view) is turned on (display status).

Task Properties:

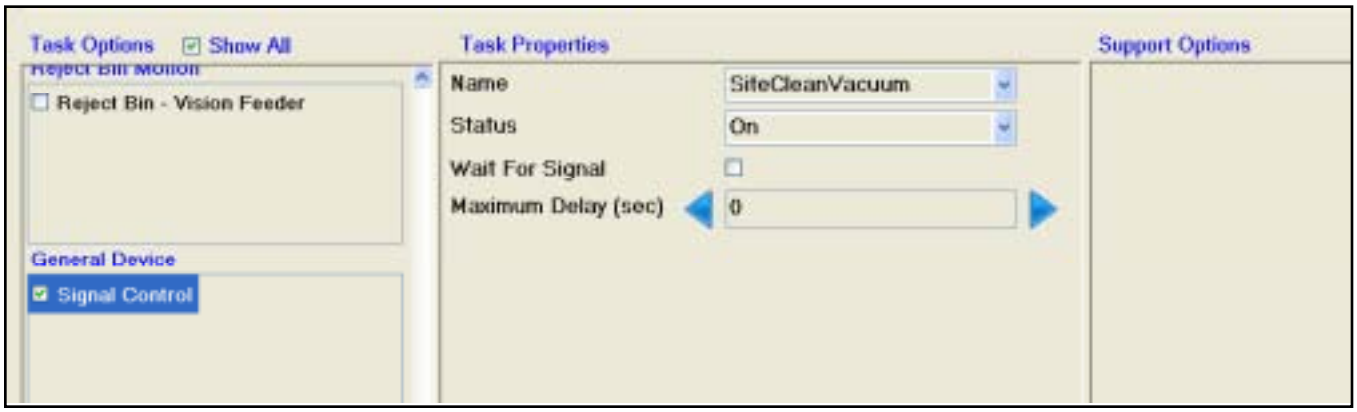
**Camera/Direct View:** Determines camera to be activated – direct view camera.

**Display Status:** Turns on – no check in box or off – check in box camera.

**Note:** Operator can switch back and forth from run screen to camera view screen at any event in the program when display status is on.

## General Device

### Signal Control




**Function:** Turns on device programmed.

**Action:** For site cleaning, the site clean vacuum device (site clean vacuum) is selected. Status indicates device is activated.

Task Properties:

**Name:** Selects device for signal control:

Site Clean Vacuum
Nozzle Vacuum
Probe Vacuum
Manual IR Probe Home Sensor

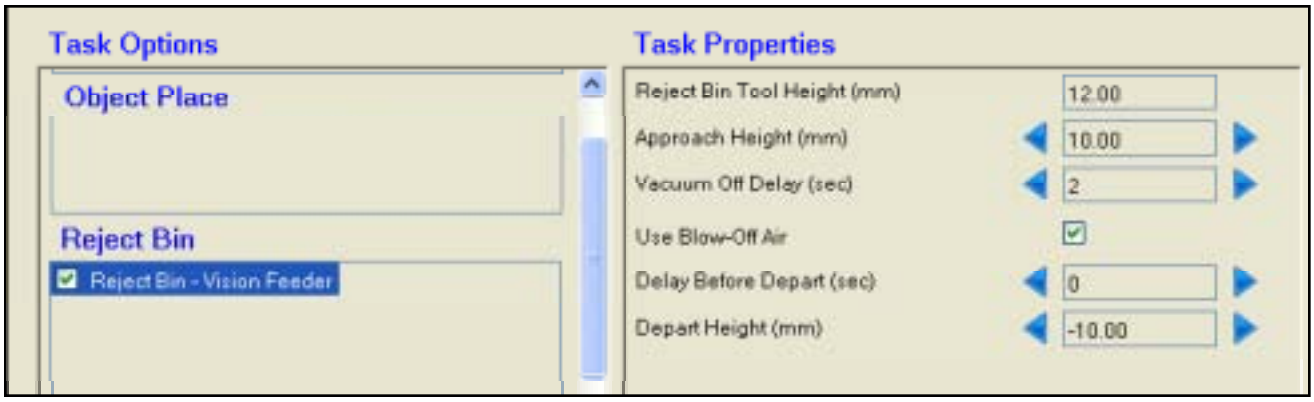
**Status:** Turn signal on or off.

**Wait for Signal:** Can be used to delay signal control function if another device is activated.

**Maximum Delay (sec):** Allows delay of signal control for set time.

## Reject Bin

### Reject Bin – Vision Feeder




**Function:** Provides a position on the vision feeder for reworked component to be dropped off.

**Action:** A message is presented to the operator to empty the reject bin. The vision system moves until the reject bin is under the nozzle. The nozzle moves above the reject bin (approach height). The nozzle vacuum is turned off (vacuum off delay). Low pressure air (use blow-off air) is applied (delay before depart) to enhance component/o-ring separation. The nozzle moves away from the reject bin (depart height).

Task Properties:

**Reject Bin Tool Height (mm):** Sets height of reject bin. Note: The reject bin tool motion is based on the nozzle height, component thickness and reject bin tool thickness. Incorrect information can result in damage to the machine and/or component.

**Approach Height (mm):** Distance from component to reject bin.

**Vacuum Off Delay (sec):** Time nozzle vacuum is turned off after approach height is reached.

**Use Blow-Off Air:** Activates air pressure through nozzle vacuum o-ring/vacuum cup before nozzle retracts. Uses blow-off air delay before depart (sec) time setting.

**Delay Before Depart (sec):** Time from component drop off to nozzle movement away from reject bin.

**Depart Height (mm):** Distance nozzle travels after going to reject bin and vacuum/pressure functions are applied.

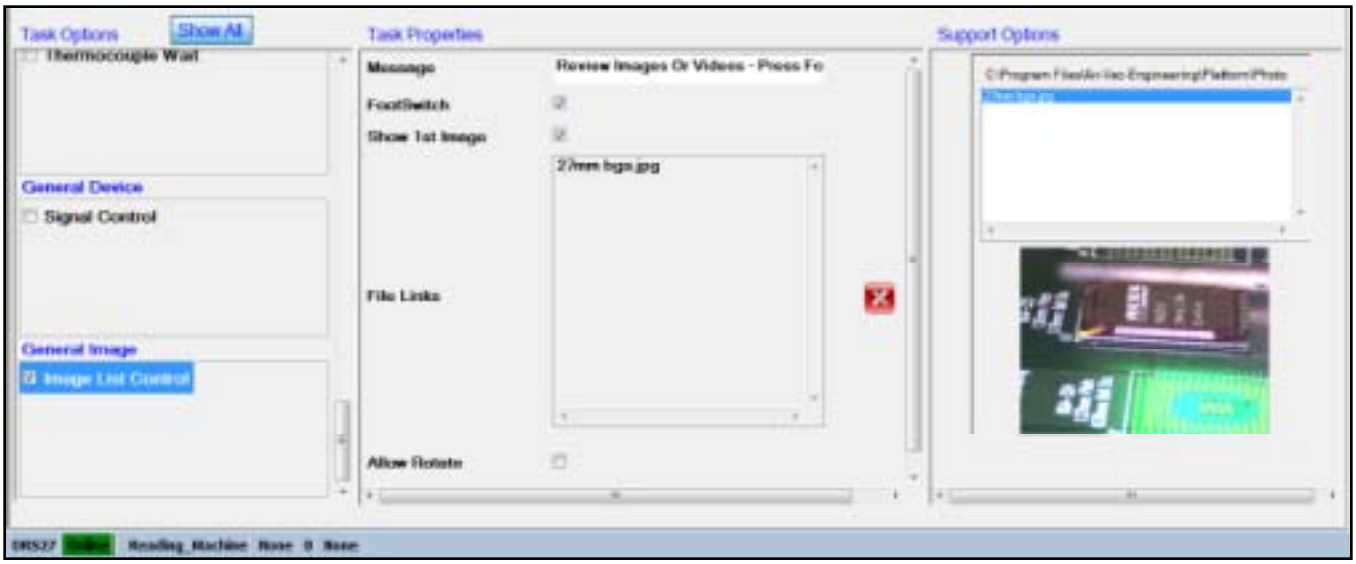
Notes:

It is advised to use tray provided to insure molten solder/solder balls do not dislodge/drop onto universal insertion tool or on the assembly.

If component sticks to nozzle o-ring/vacuum cup increase delay before depart time and use blow-off air to assist in separation.

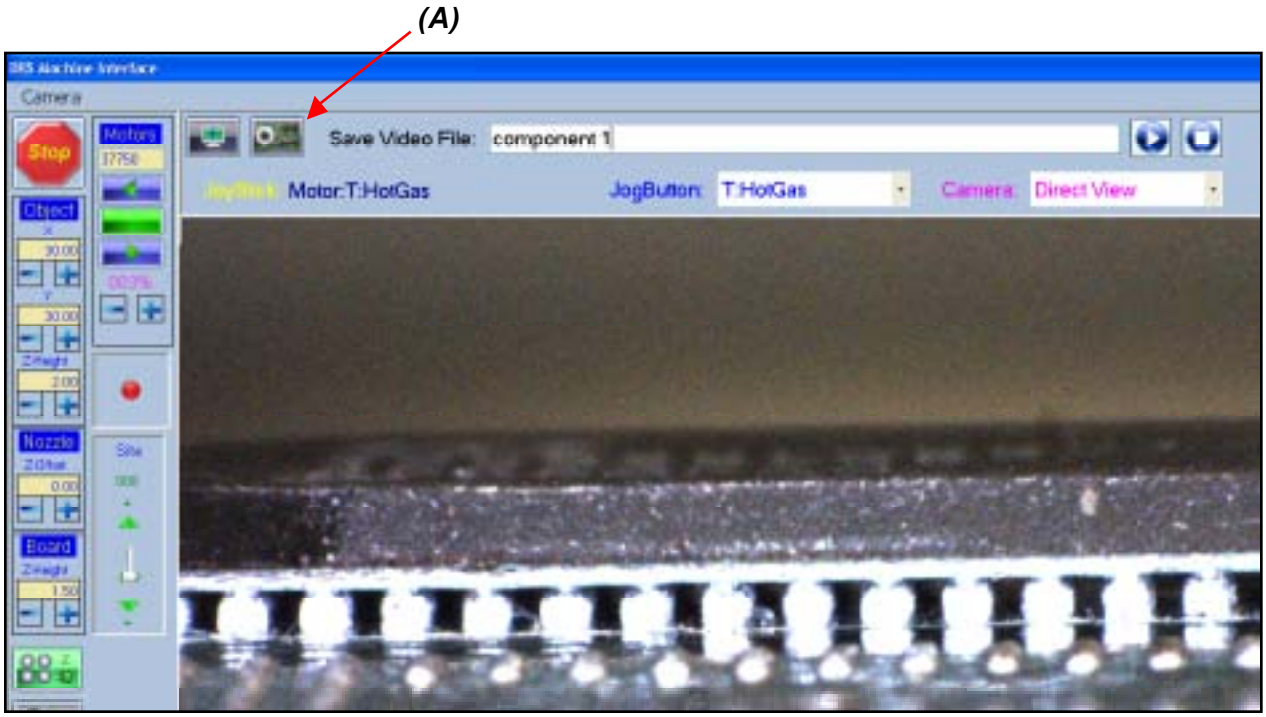
## General Image

### Image List Control




**Function:** Allows saved image or video to be displayed during an event of the program.
**Action:** An image or video is saved using the camera screen.

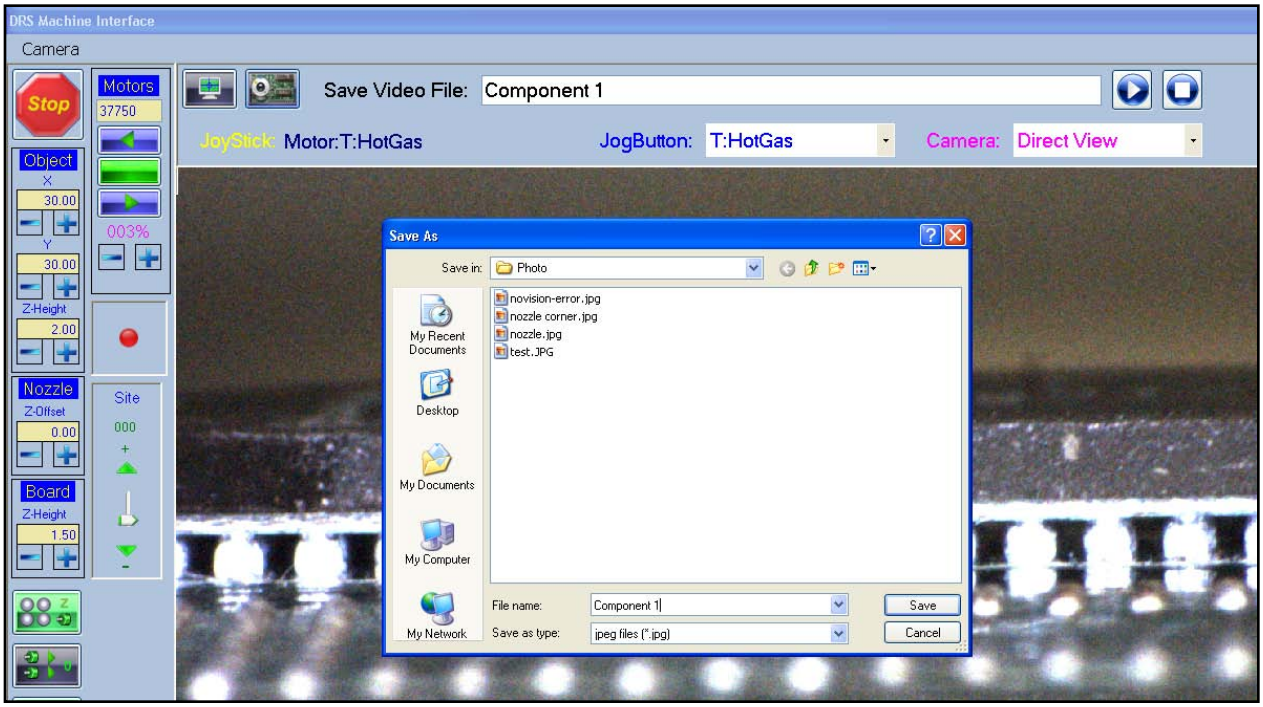
The camera screen will appear.



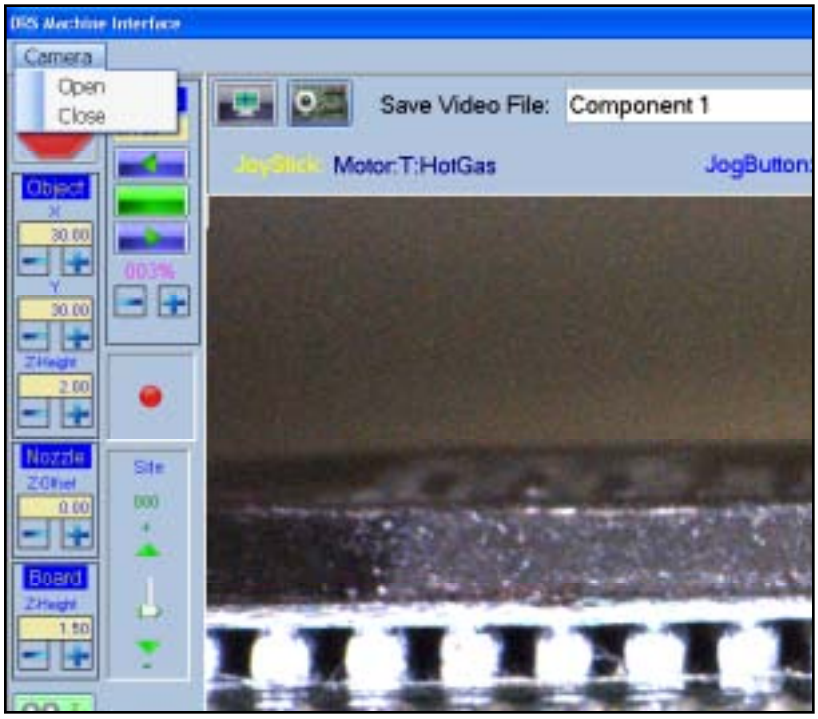

1 – Select Direct View or Vision System Camera **(A)**.

2 – For photo, click Save Camera Video image icon. For video, click Start Video/Stop Video icons.

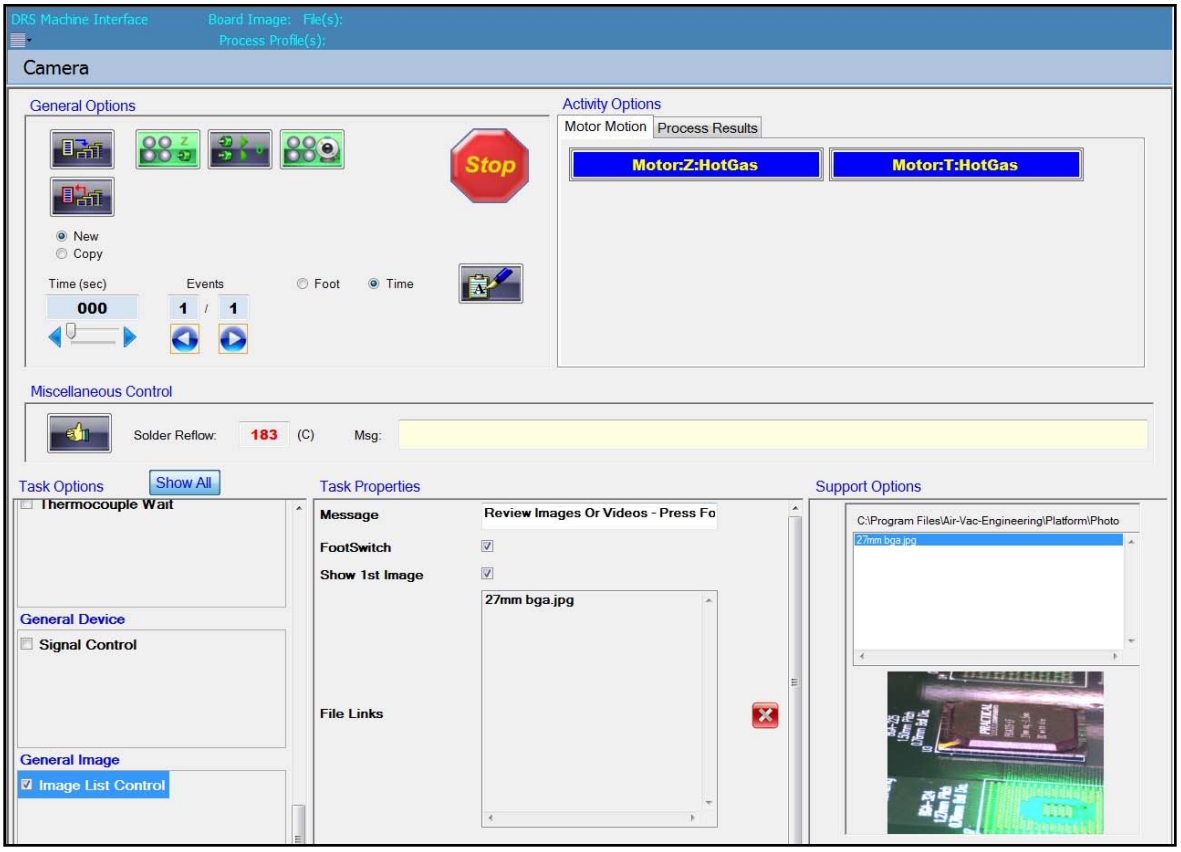
3 – Name image in Save Video file box.



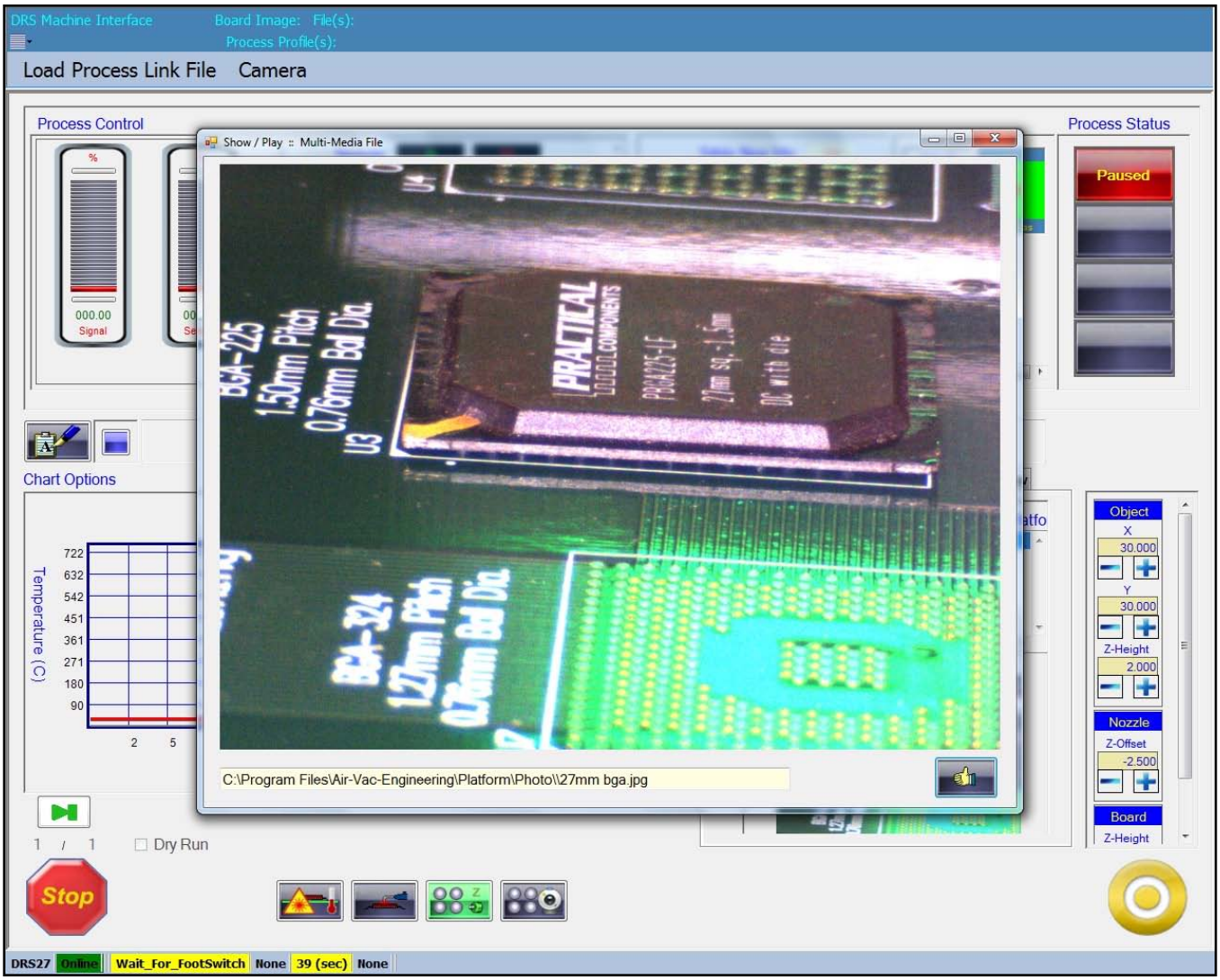
4 – Close Screen




5 – Go to Teach Screen and select Photo/Video for any event(s) of program to be displayed.



6 – Saved Photo/Video will be shown in Run Screen in Support Options.

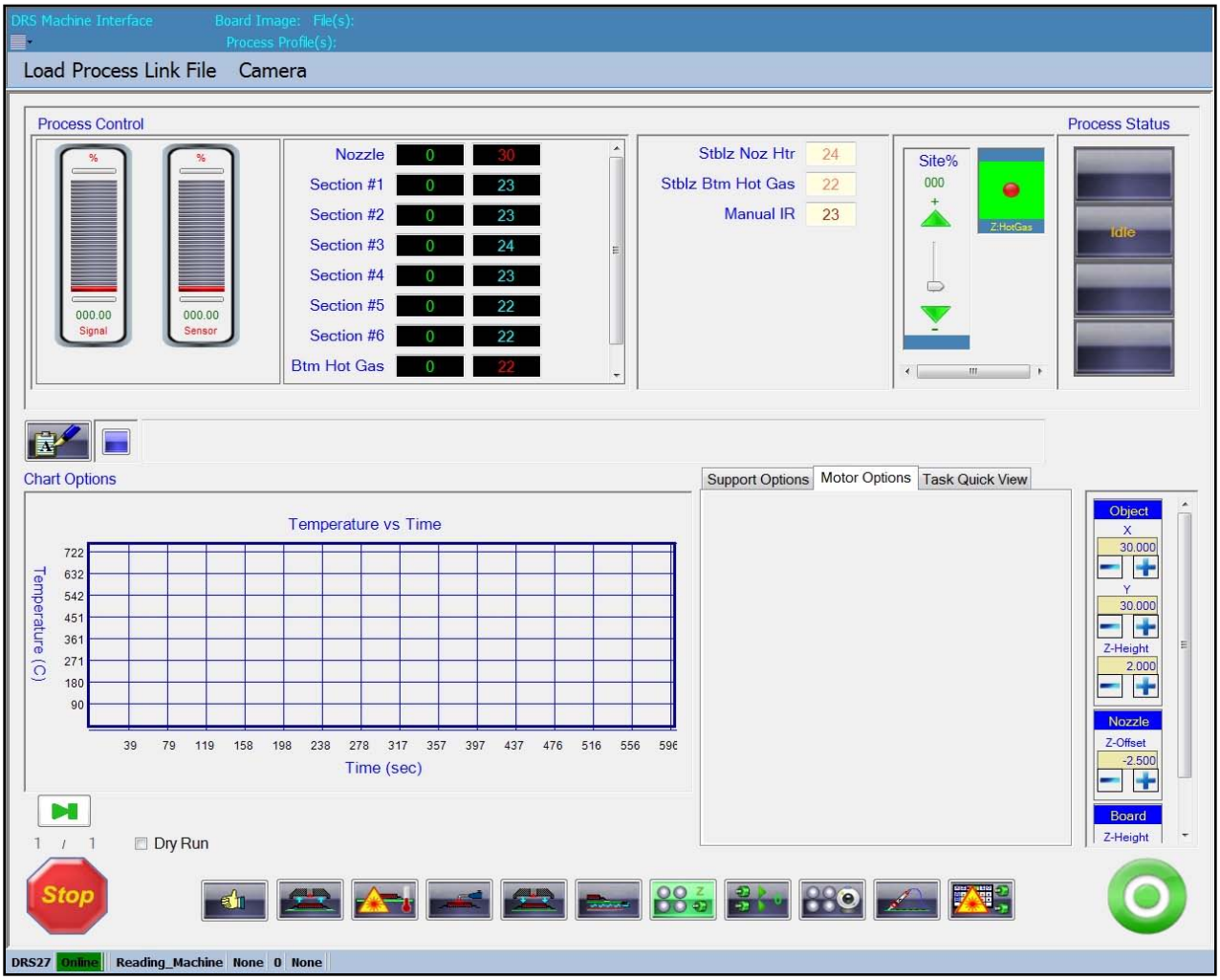


## Run Process:

The **Run** screen allows the operator to cycle a process profile. A profile must first be opened using the **Open** option or created using the **Tutor / Teach** options. During each event of the cycle, the system continuously monitors and reports the following control information:

- Heater and thermocouple temperatures, Nozzle and diffuser flow rates, Force placement (removal) procedures, Foot switch control, and Alarm conditions.

Event messages and temperature plotting graphically show the progress of a cycle.




The **Cycle Start/Stop** button is used to activate or terminate the process cycle. This button will display a green background when the cycle is active or a gray background when the cycle is not active. Clicking on this button when the background is green will terminate the cycle.

**Note:**

DURING THE CYCLE, THE OPERATOR MAY BE PROMPTED TO PRESS THE FOOT SWITCH BEFORE ANY PROCESSING CAN CONTINUE. SOME EVENTS ARE DESIGNED TO ALLOW THE OPERATOR TO PERFORM A MANUAL TASK (FINAL COMPONENT ALIGNMENT).

## Alarm Control

The DRS27 constantly monitors the controlling sub-systems. If any sub-system fails due to a process or hardware issue, the system will respond with an alarm.

There exist 2 types of software alarms:

1. Machine Hardware Alarms
2. Process Alarms

Machine Hardware Alarms

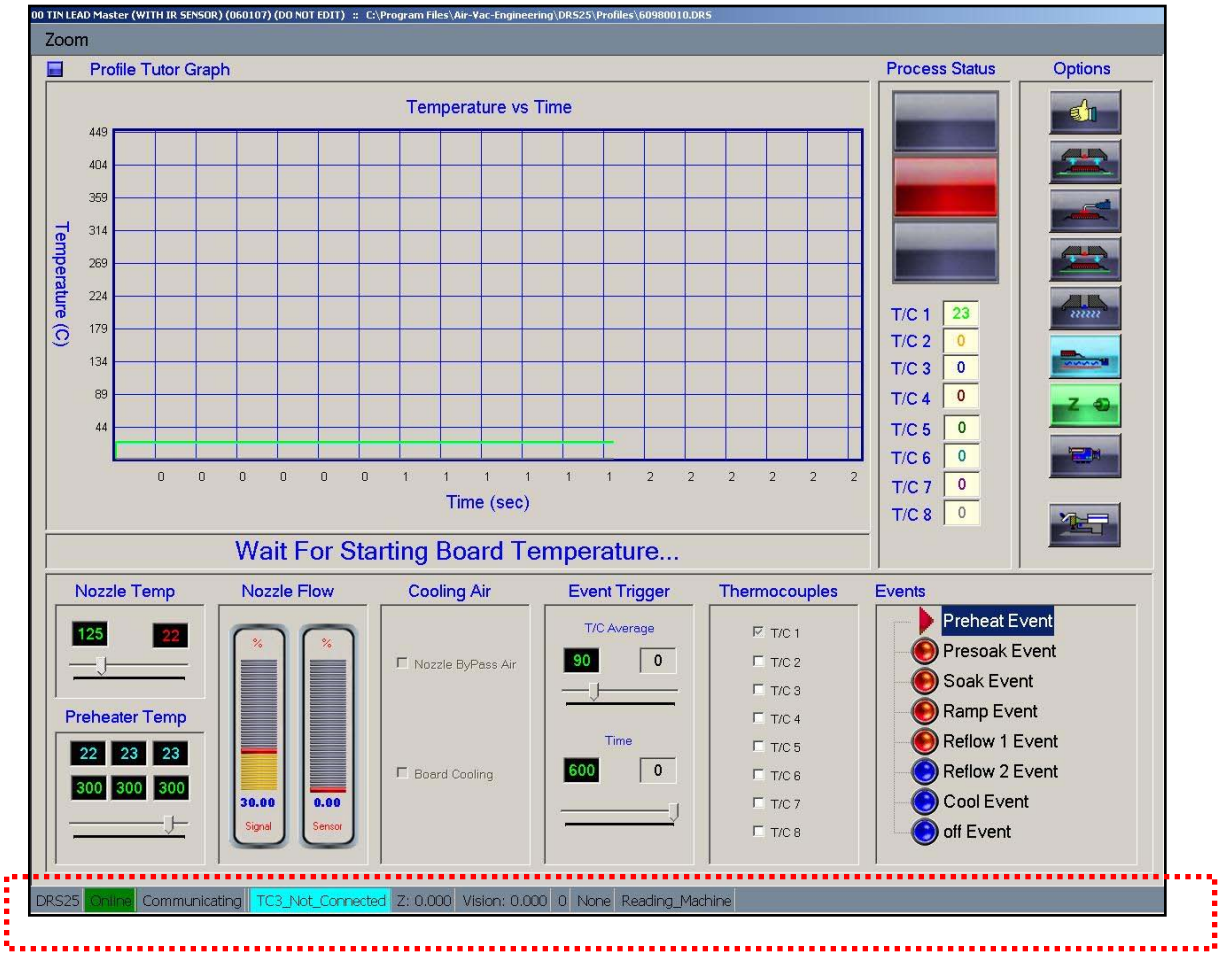
This alarm type occurs when one of the following conditions is detected:

```
SerialPort_Failure
Z_Axis_Motor_Comm_Restart
Vision_Axis_Motor_Comm_Restart
Nozzle_TempControl_Comm_Restart
Left_Preheat_TempControl_Comm_Restart
Right_Preheat_TempControl_Comm_Restart
Center_Preheat_TempControl_Comm_Restart
DeviceIO_Communication_Restart
Low_Pressure_Air_Regulator
Low_Pressure_N2_Regulator
```

## Process Alarms

This alarm type occurs when one of the following conditions is detected:

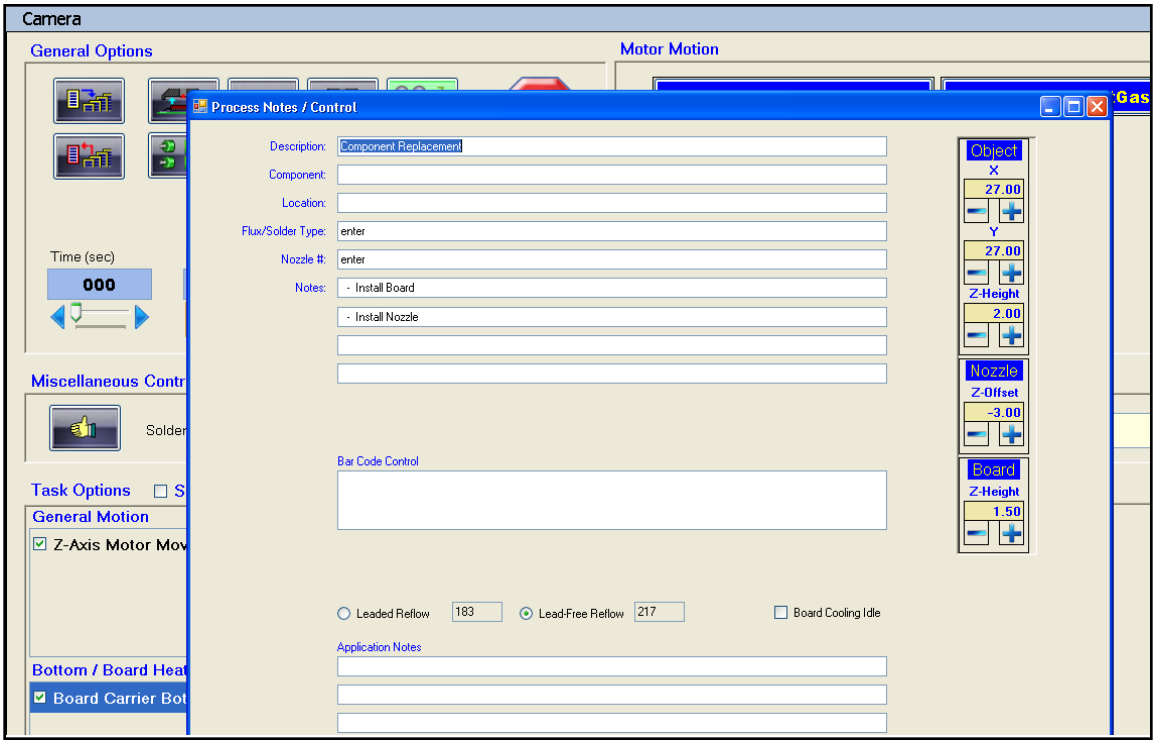
```
Nozzle_Temperature_Limit,
Nozzle_TC_Error,
Left_Preheater_Temperature_Limit,
Left_Preheater_TC_Error,
Right_Preheater_Temperature_Limit,
Right_Preheater_TC_Error,
Center_Preheater_Temperature_Limit,
Center_Preheater_TC_Error,
Below_Minimum_Nozzle_Flow_Rate,
Nozzle_Flow_Sensor_In_Position_Failed,
Exceeded_Max_FootSwitch_Delay,
Exceeded_Max_TC_Control_Delay,
TC1_Not_Connected,
TC2_Not_Connected,
TC3_Not_Connected,
TC4_Not_Connected,
TC5_Not_Connected,
TC6_Not_Connected,
TC7_Not_Connected,
TC8_Not_Connected,
Site_Clean_Tool_Clogged
```



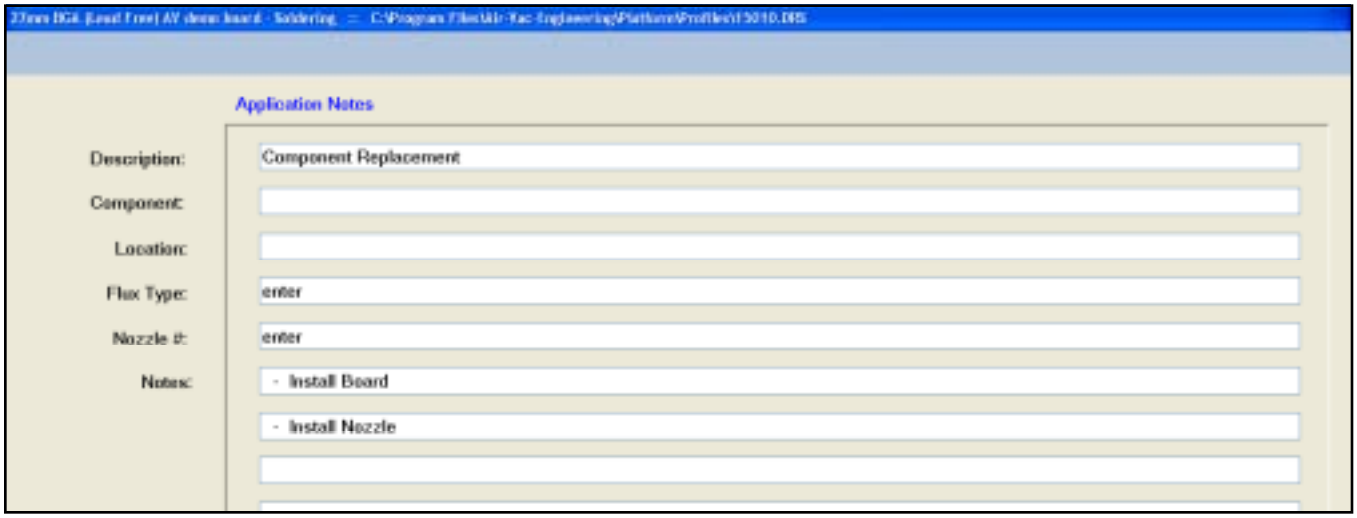
## Profile Notes Page

The **Profile Notes** button allows the operator to refer to any application related notes that may have been setup by the process engineer. The operator cannot access these notes while a cycle is active.

In the Teach Screen, notes can be provided for the operator. In addition, vital object, nozzle and board dimensions are stored and set.



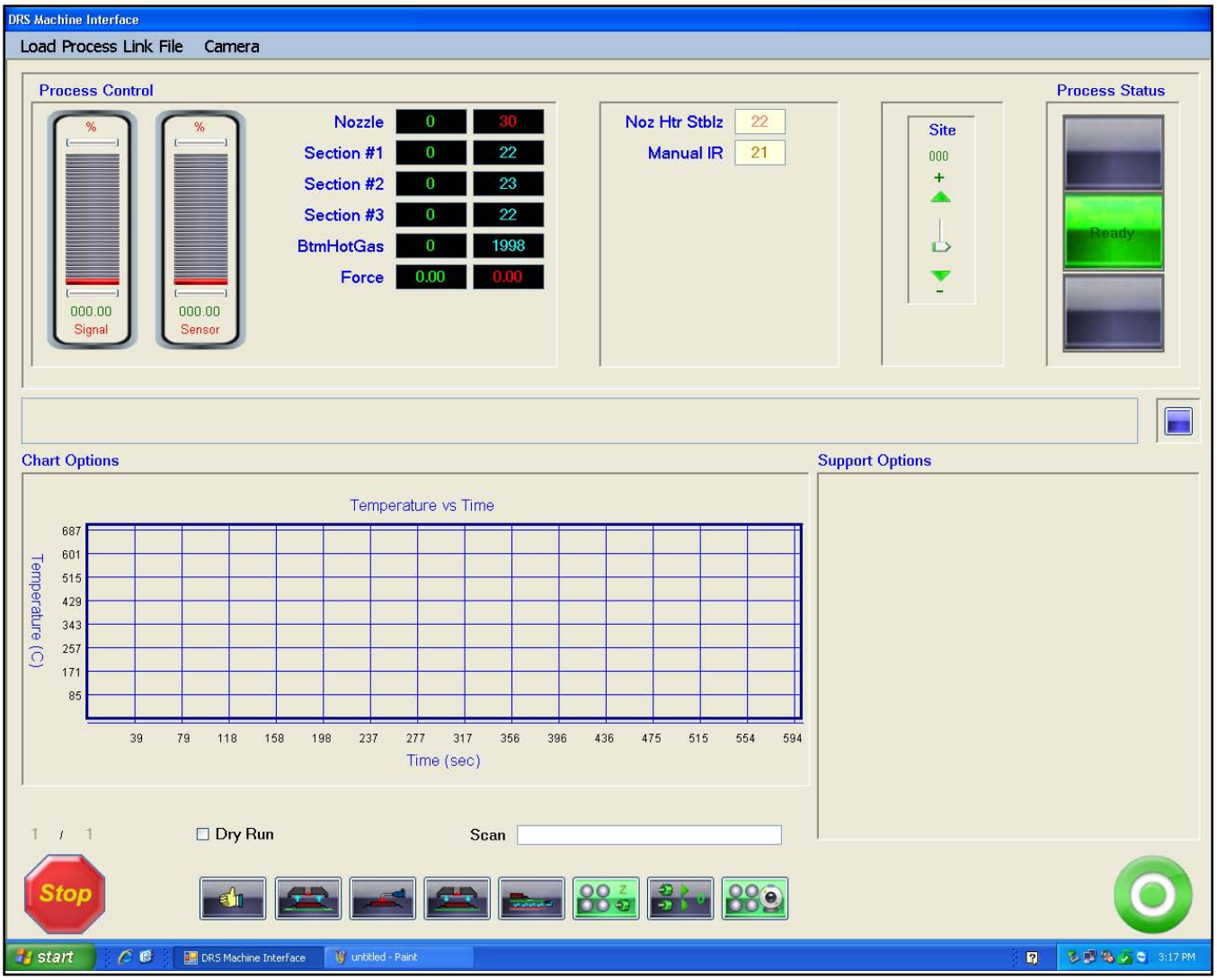

The Profile Note Screen is activated when the program is selected prior to the Run Screen. The object, nozzles and board dimensions are not shown to the operator.



**General Run Screen Layout:**

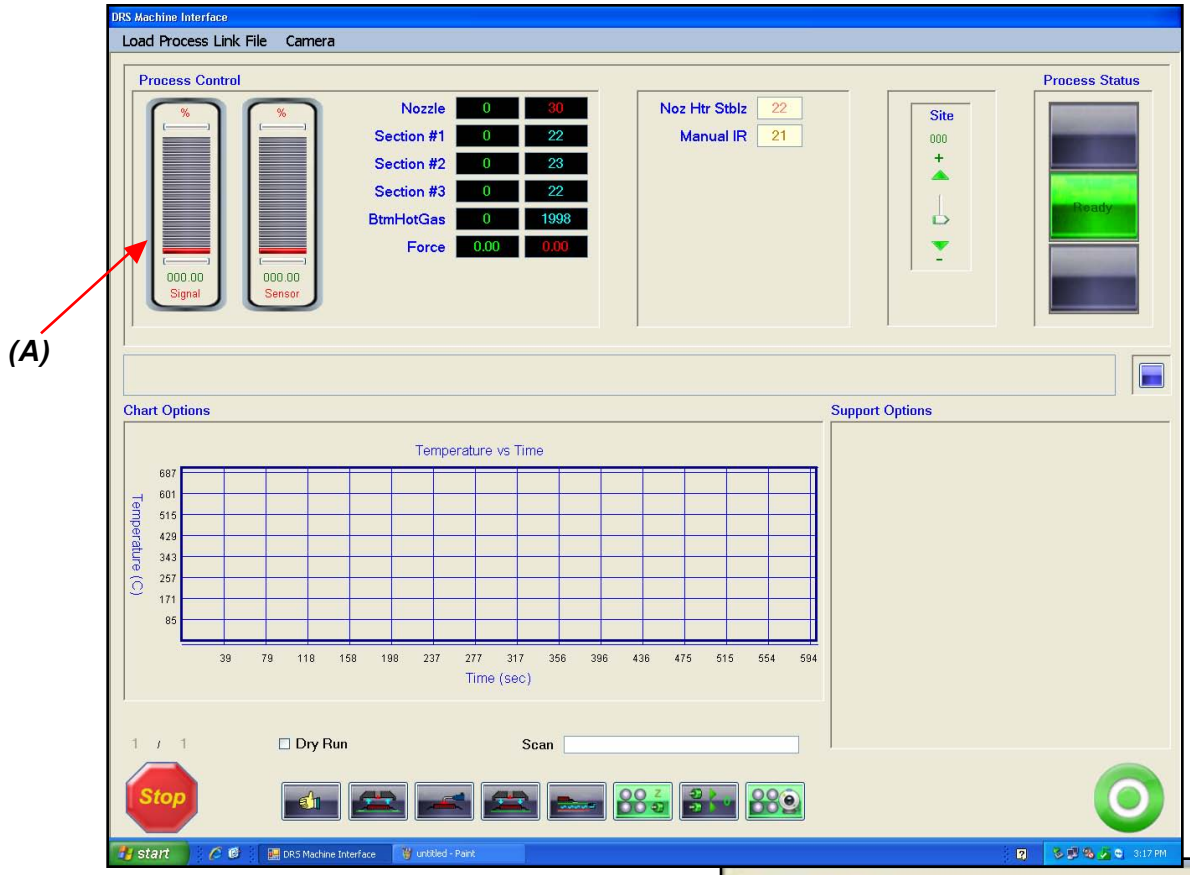
The Run screen is organized into the following sections:

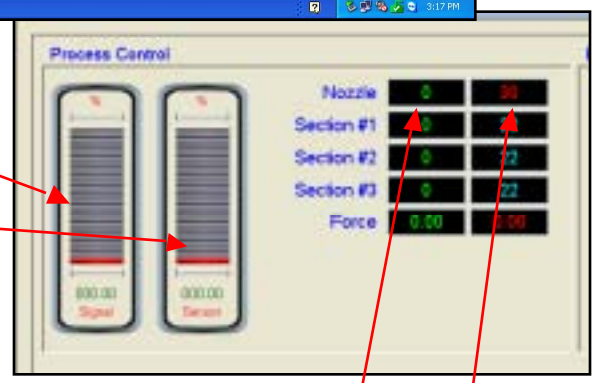
- Numeric Process Information
- Profile Event / Alert / Foot Switch Messages
- Graph Process Information
- Event Time
- Event Counter
- Process Time
- Button Functions
- Software/Hardware Communication Link Error Status
- Bar Code / Board Serial Number Tracking
- Menu Functions



## Numeric Process Information (A)

This section of the **Run** screen displays numeric information associated with process temperature, flow rate, force and thermocouples.




(A)

(B)

(C)

(D)

### Nozzle and Preheater System:

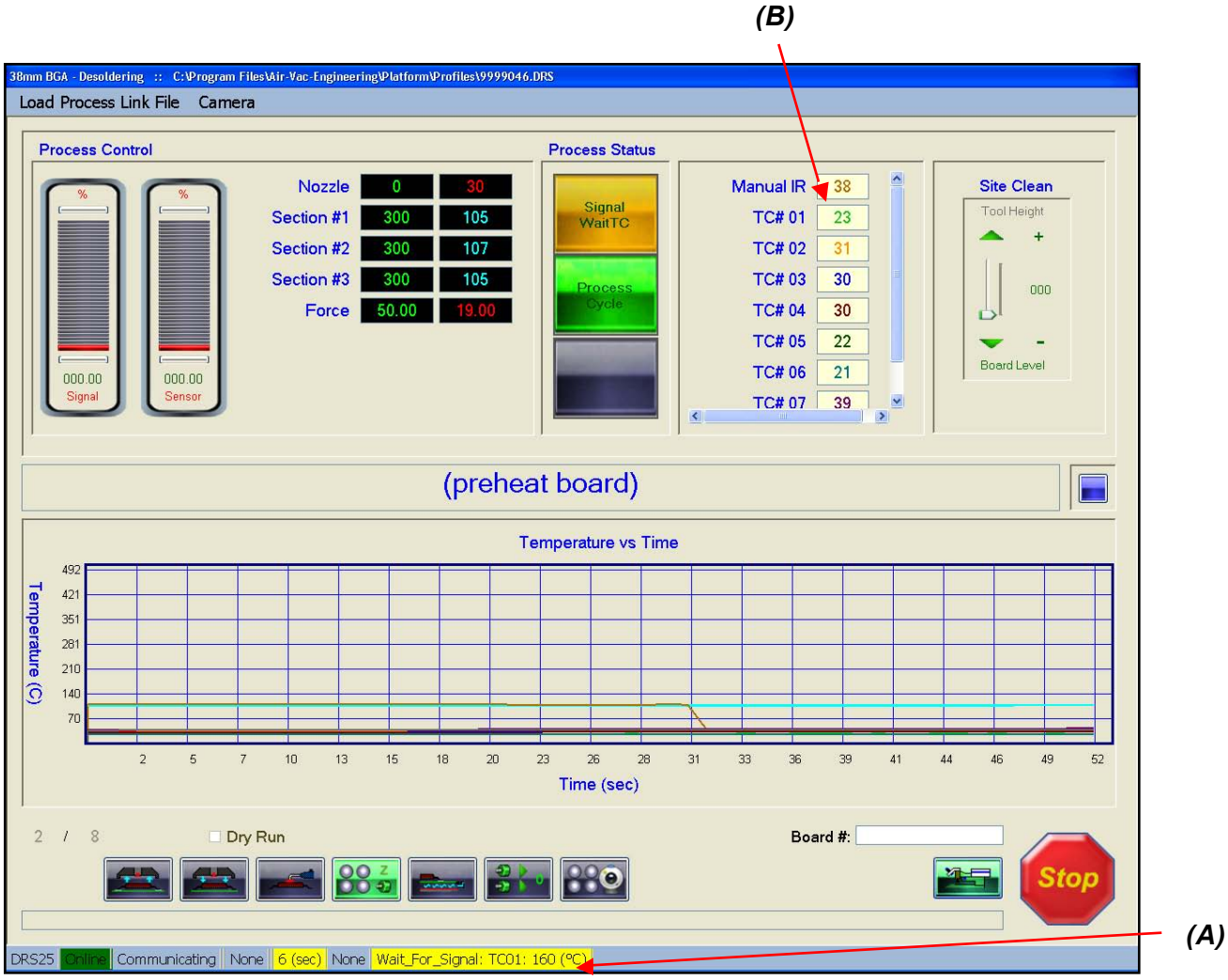
The **Nozzle System** (upper heater) graphically displays the following control parameters:

- Nozzle flow rate percentage (set point) *(A)* – yellow needle
- Nozzle flow rate actual percentage *(B)* – blue needle
- Nozzle target temperature (set point) *(C)* – green number
- Nozzle actual temperature *(D)* – red number

### Thermocouple System:

The **Thermocouple System** has maximum of eight thermocouple channels. Only pre-programmed (active) channels will be displayed. Each channel will display an actual and a set point temperature. Each thermocouple channel has an identification number positioned between the set point and actual displays.

When a thermocouple channel is controlling the process, a yellow **T/C Control** *(A)* message will be displayed at the bottom of the screen. This message will define the type of thermocouple activity and the temperature target. A real-time display offers the current temperature of all thermocouple channels (B).




**Note:**

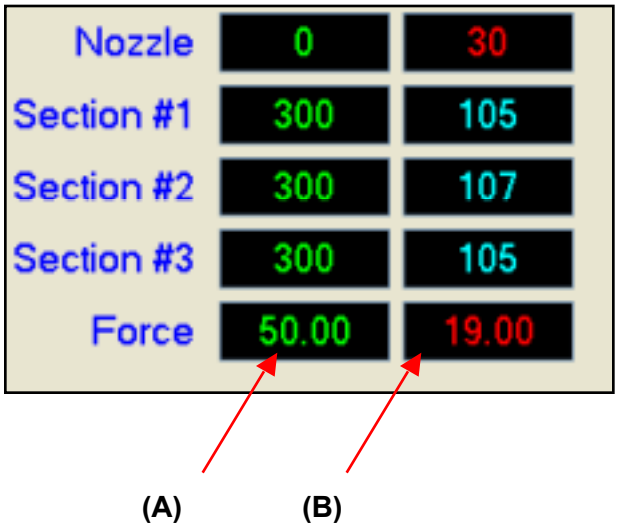
ALL ACTIVE THERMOCOUPLE CHANNELS MUST BE CONNECTED TO A THERMOCOUPLE SENSOR BEFORE THE PROCESS CYCLE IS STARTED. FAILURE TO DO SO WILL RESULT IN AN ALARM CONDITION.

**Force System:**

This system monitors and controls the activities associated with component force placement, force removal or force adjustment.

The **Force System** graphically displays the following control parameters:

- Force target (set point - green). **(A)**
- Force actual (applied force - red). **(B)**

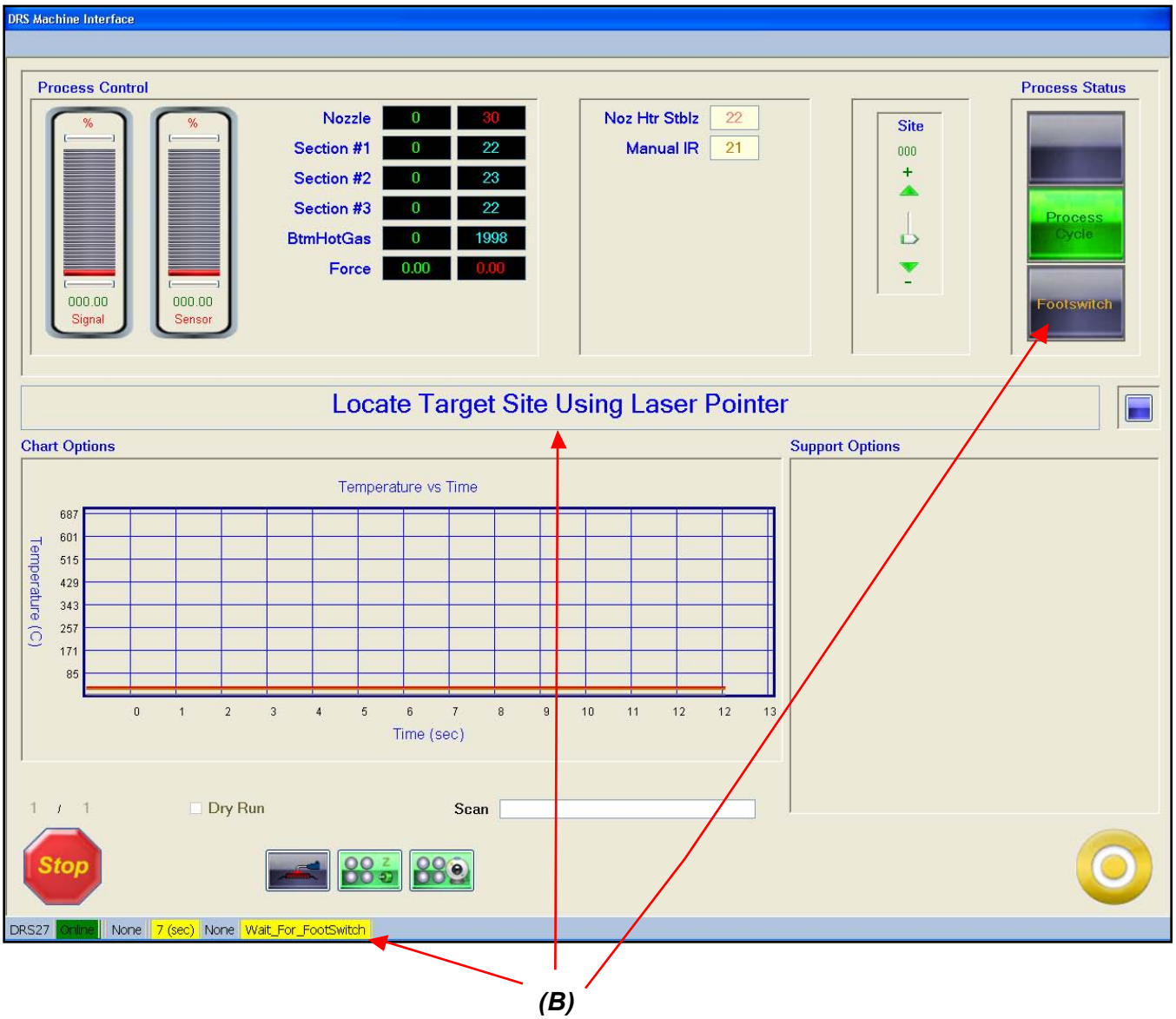



**Note:**

DURING ANY FORCE-CONTROLLED ACTIVITY (PLACEMENT/REMOVAL/ADJUSTMENT), THE OPERATOR SHOULD NOT TOUCH ANY PART OF THE MACHINE.

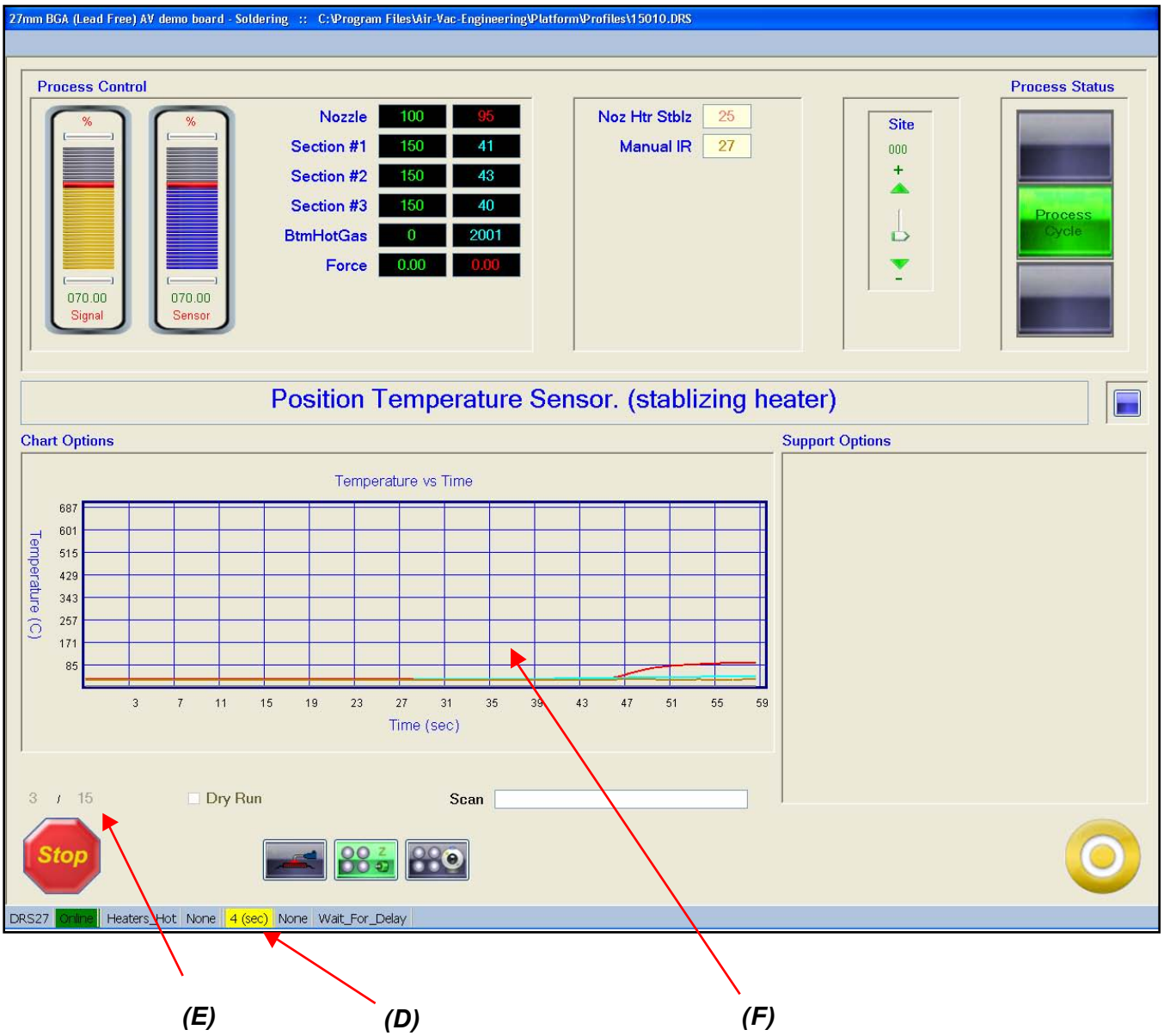
### Profile Event and Foot Switch Messages (B)

This section of the **Run** screen displays system (foot switch) messages or pre-programmed event/alert messages. Messages are used to inform the operator when machine interaction is required, or to communicate the general progress of the profile cycle.



## Graph Process Information (C)

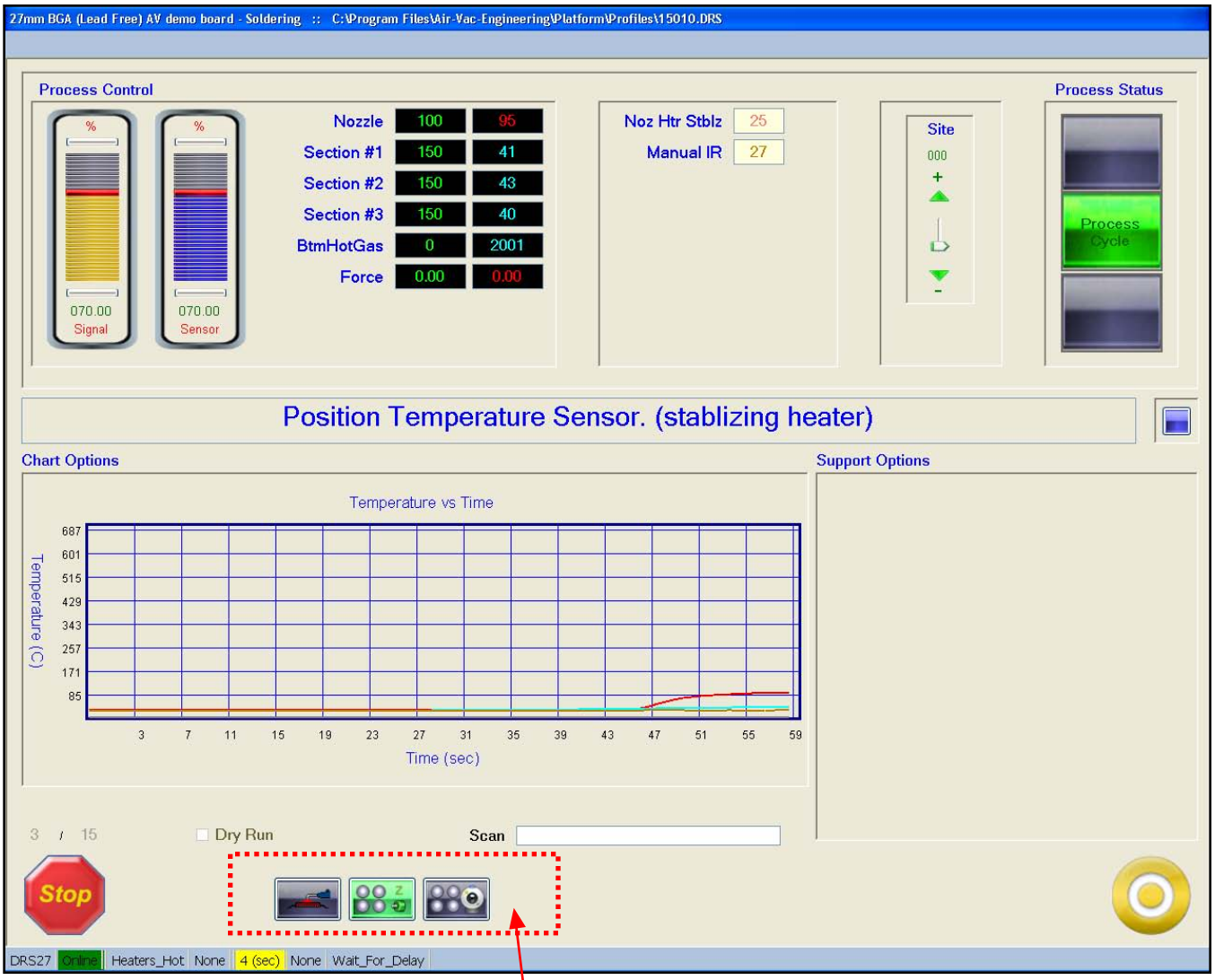
This section of the **Run** screen displays the **Temperature vs. Time** graph.




- Event Time **(D)** – Time remaining in the current event.
- Event Counter **(E)** – Current and maximum profile event counters.
- Process Time **(F)** – Total (overall) cycle time (all events) is plotted on the chart display.

## Function Buttons (G)

This section of the **Run** screen displays the function buttons that are available to the operator.




.

***(G)***

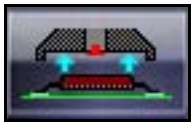

*Cycle Start/Stop*


The **Cycle Start/Stop** button is used to activate or terminate the process cycle. This button will display a stop sign symbol when the cycle is active or a machine symbol when the cycle is not active. Clicking on the button when the stop sign symbol is visible will terminate the cycle.

*Thumbs Up / OK / Exit*

This button will exit the **Run** screen and return the operator to the **Main** screen.

*Nozzle Vacuum*



The **Nozzle Vacuum** button will activate or deactivate the nozzle vacuum. When this function is active, the button background will be display in green.

*Nozzle Device Separation (Blow Off)*

The **Device/Nozzle Separation** button will activate a small volume of air back through the nozzle vacuum tube (helps to separate the component from the nozzle). When this function is active, the button background will be display in green.

*Probe Vacuum*

The **Probe Vacuum** button will activate or deactivate the special vacuum probe port (used with component handling tool).

*Laser Pointer*

Turns the Laser Pointer on the IR Probe on (green) and off.

*Z Axis Lights*


This button will turn on the lights of the Z axis.

*Board Cooling (High / Low Flow Rate)*

This button will activate (toggle) through the available board cooling flow rates (low, high and off).

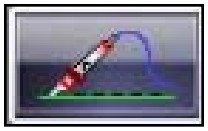
*Home All Motors*

This button will home all Z and Vision motor axis.

*Direct Vision Lights (option)*

This button will turn on the lights of the direct view camera option.

*Site Cleaning Vacuum*



The Site Cleaning Vacuum button turns the Site Cleaning Vacuum on and off.

*Laser Pointer Teach Position*

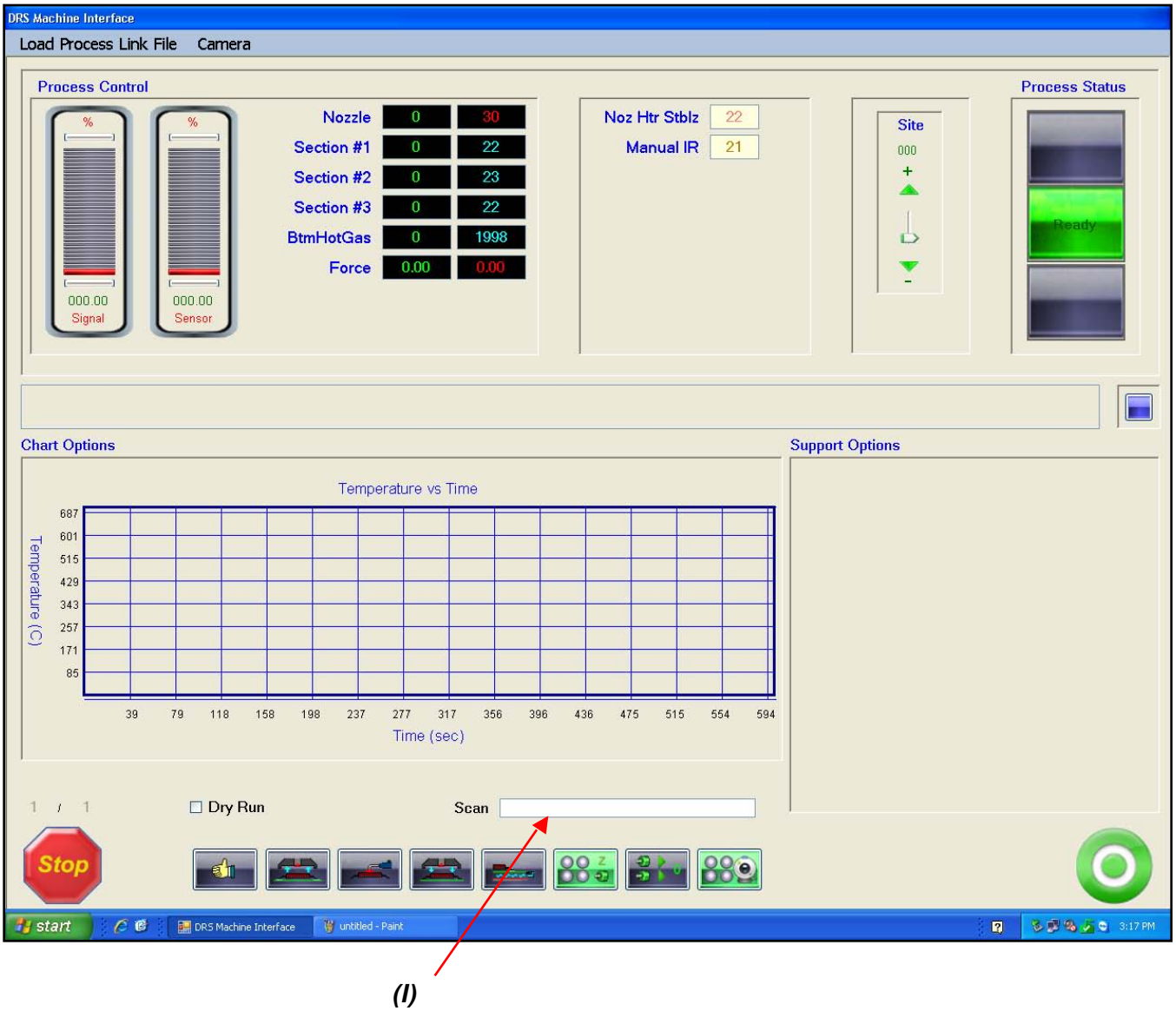
Activates the Laser Pointer in the Vision Housing to teach the component location.

*Dry Run*


Activating this will allow the profile to run without heat.

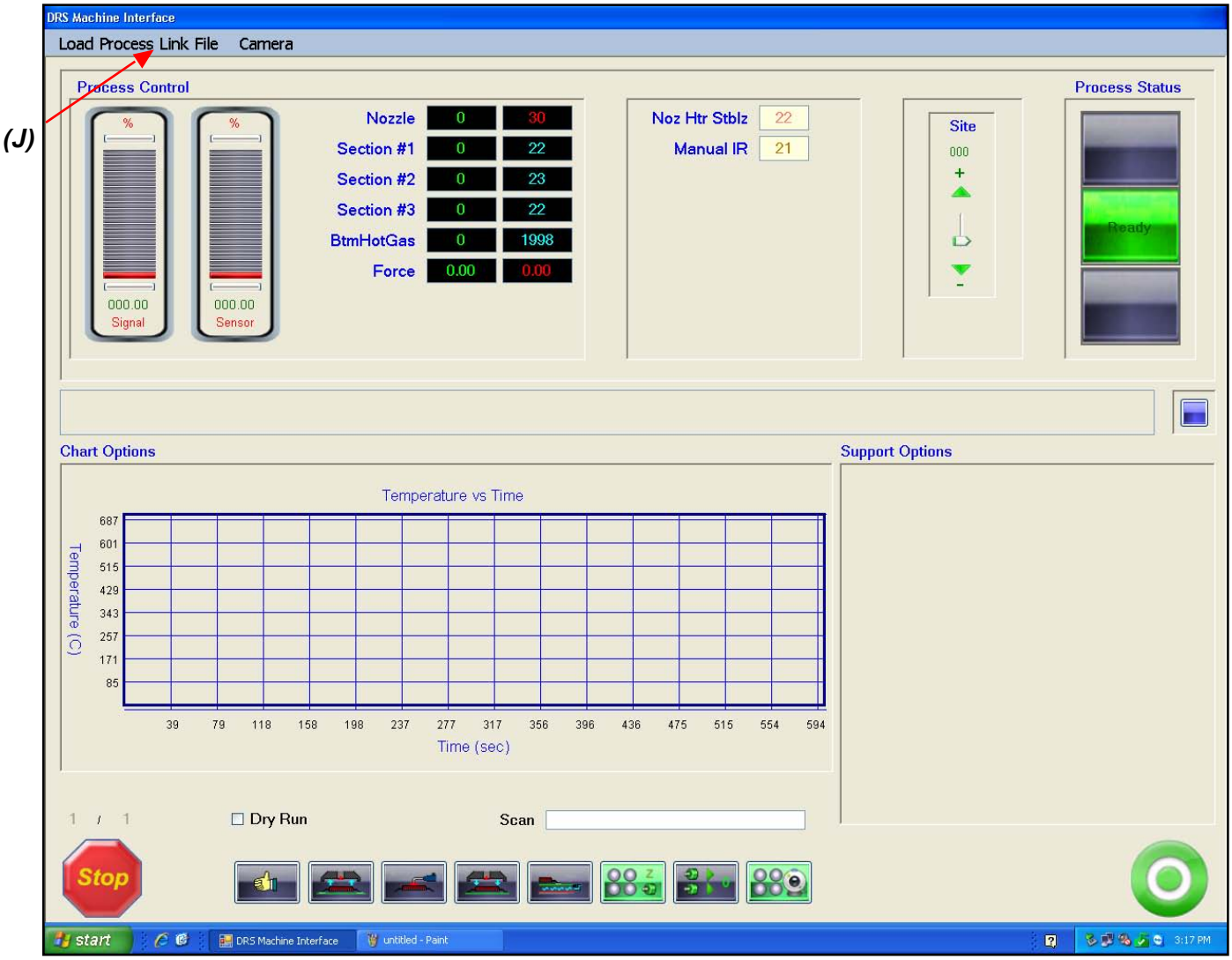
## Bar Code / Board Serial Number Tracking (I)

This section of the **Run** screen allows a board serial number to be tracked and recorded in the cycle history file. The operator has the option to enter this information using the standard keyboard or to use the optional bar code scanner.



## Menu Functions

This section of the **Run** screen displays the function menus that are available to the operator.

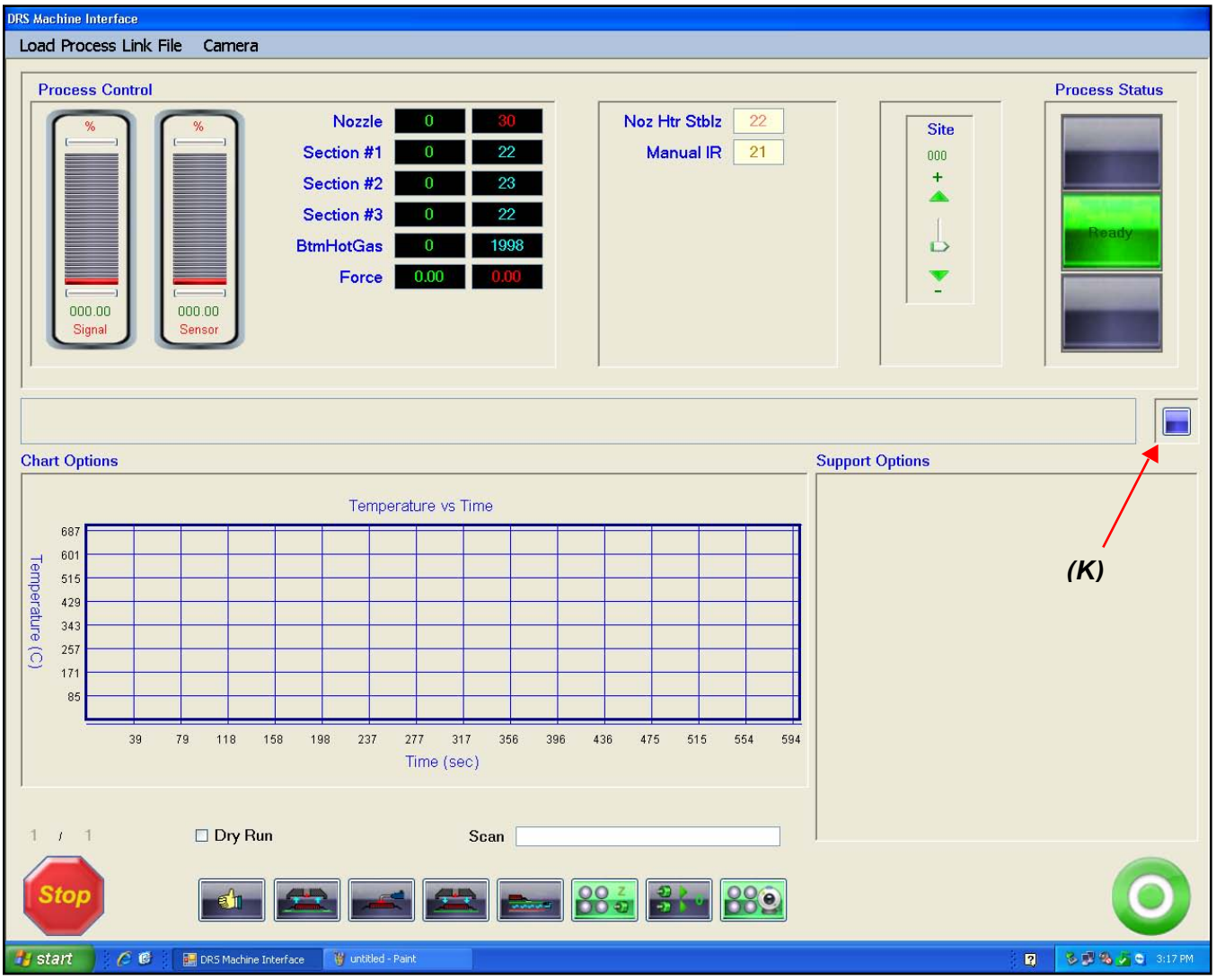



### Load Process Link File Menu Option:

The **Load Process Link File** menu (J) allows the operator to toggle between the soldering, desoldering and site cleaning profiles. This allows related profiles to be cycled without leaving the **Run** screen. This menu option is only available when the process is not cycling.

**Chart Data and Export History Option:**

Graph data can be saved to the export folder.



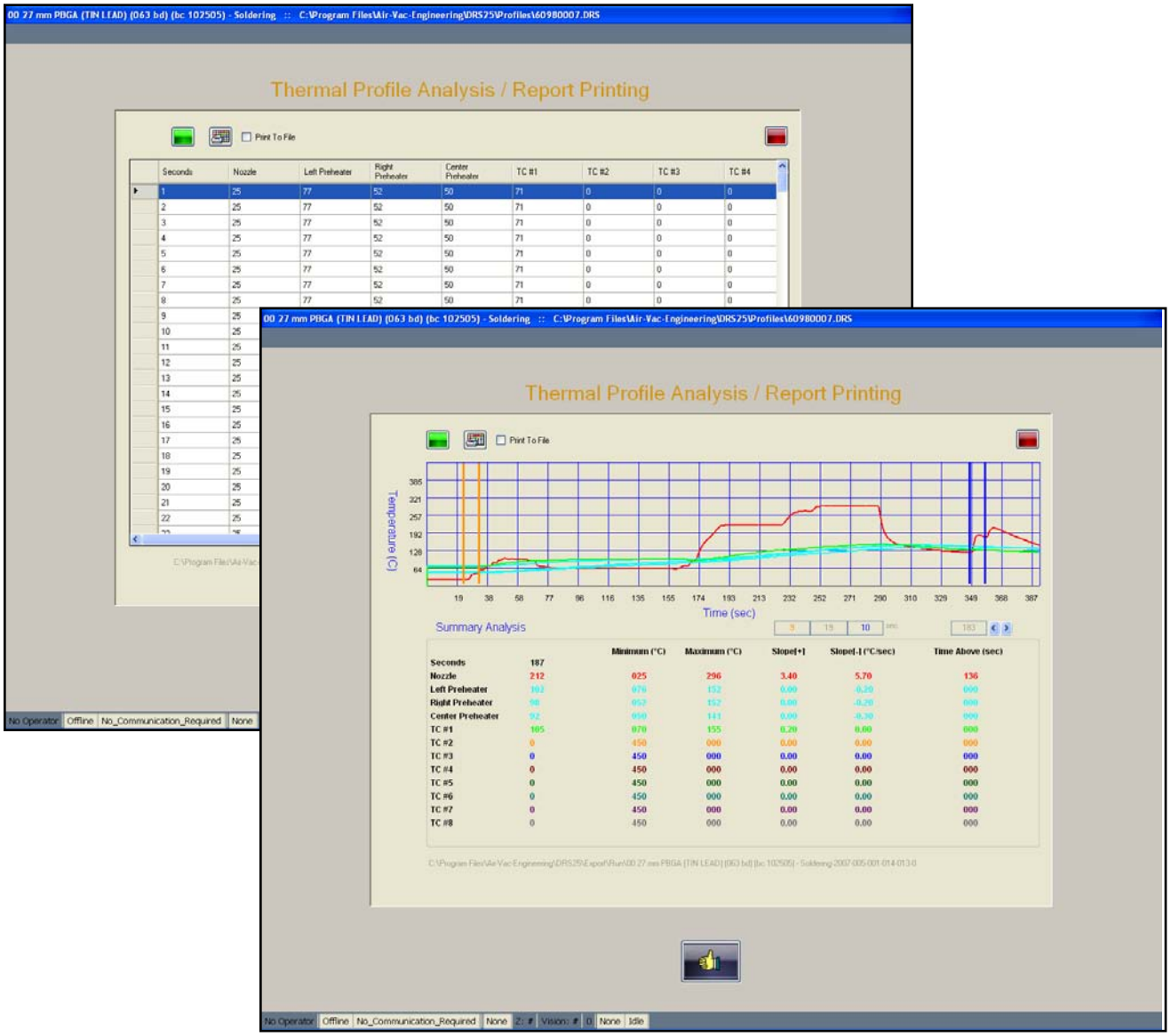

- Clicking on the small blue button (K) will export the chart data to the export folder **Export** directory:

  C:\Program Files\Air-Vac-Engineering\DRS27\Export\Run

- This information can be retrieved at a later time using the **Thermal Profile Analysis** utility.
- A help message will inform the operator that the graph data was successfully saved.

### Thermal Profile Analysis / Printing:

This import menu allows the operator to reload and analyze historical graph data. Graph data is organized and stored using an 8 digit file sequence number.




- Clicking on the green button will present a file browse window allowing the operator to select chart data files from one of the following folders:

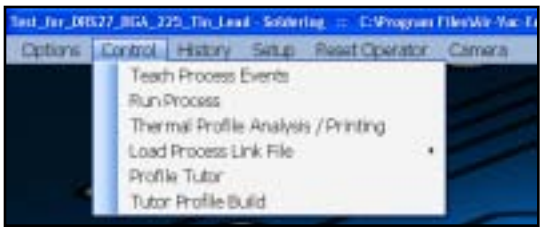
  C:\Program Files\Air-Vac-Engineering\DRS27\Export\Run

  C:\Program Files\Air-Vac-Engineering\DRS27\Export\Tutor

- Clicking on the red button will toggle the display from line graphics to a to data point table.

### Thermal Profile Analysis / Printing

This import menu allows the operator to analysis historical graph data.



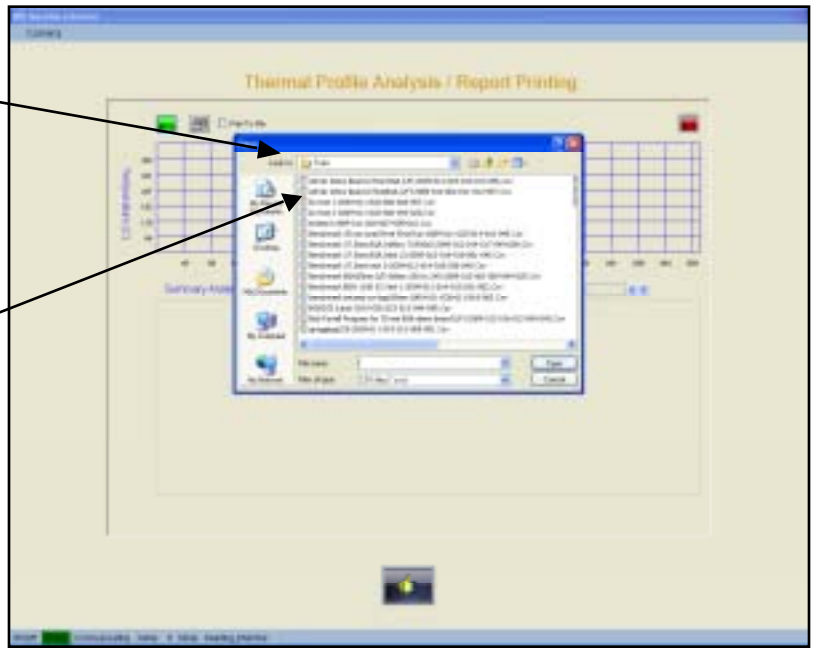

Clicking on Control / Thermal Profile Analysis / Printing will display the following screen.

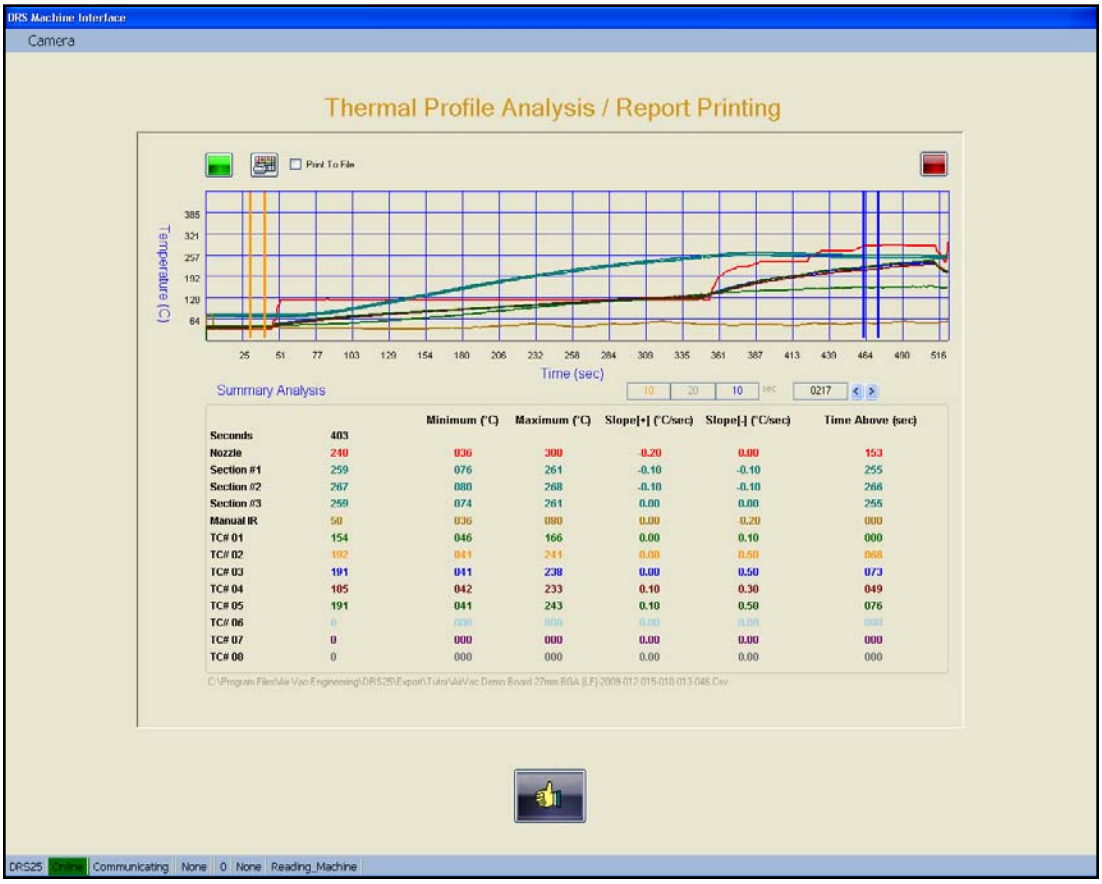
Clicking on the green button will present a file browse window allowing the operator to select chart data files from one of the following folders.


C:\Program Files\Air-Vac-Engineering\DRS27\Export\Tutor

Or, C:\ Program Files\Air-Vac-Engineering\DRS27\Export\Run

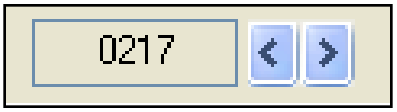
Click on the File to analysis.



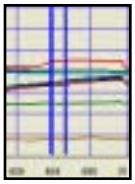



Various thermal analysis can be reviewed such as maximum joint temperature, maximum package temperature, time over set temperature, etc.

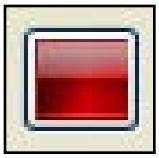
To change set temperature input desired temperature in box




To view specific slopes move vertical bars

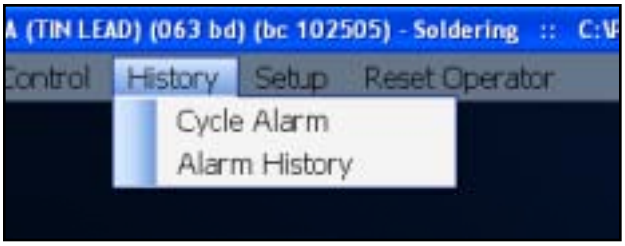


Clicking on the red button will toggle the display from line graphics to a data point table.



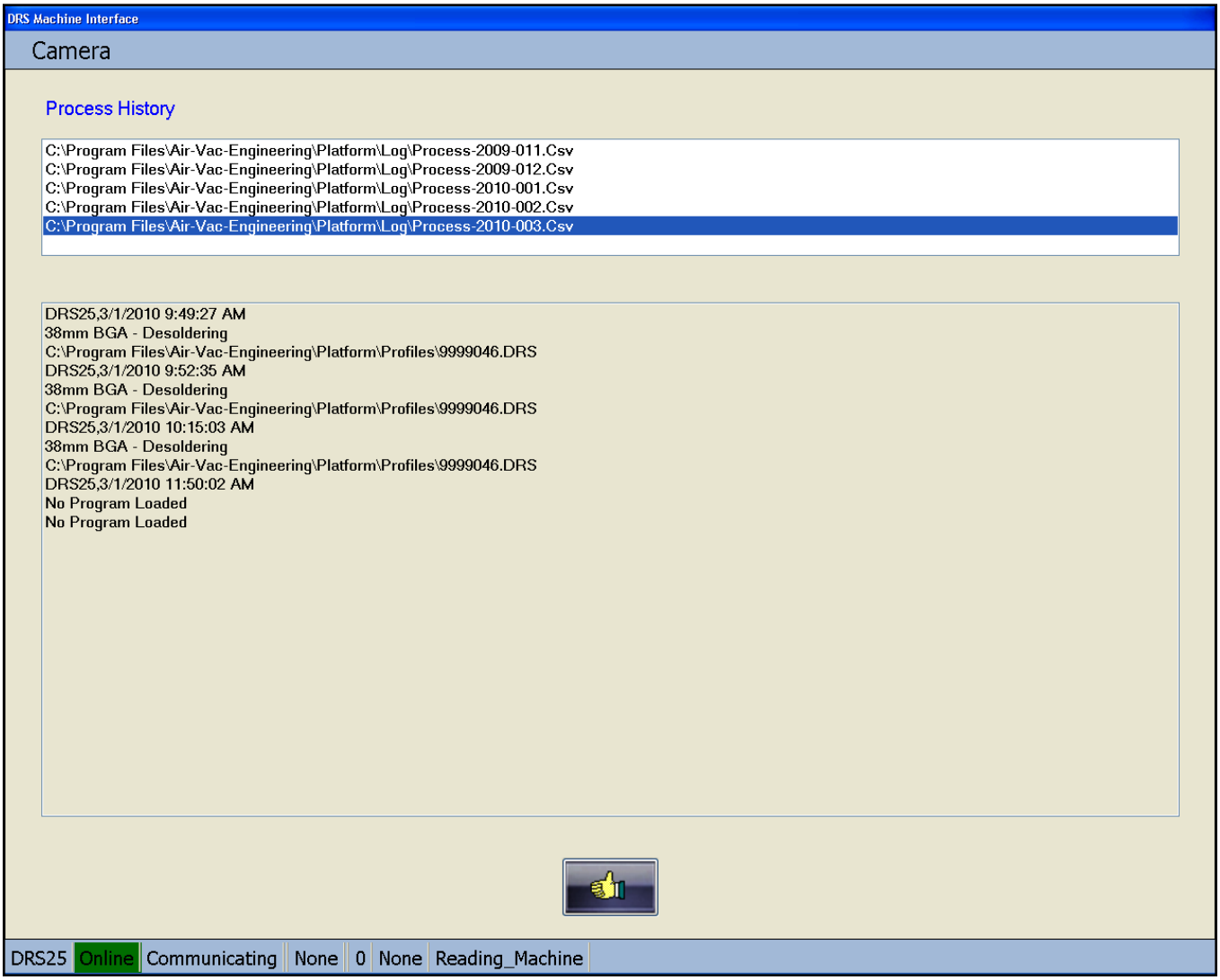
## 4.3 History Menu

The **History** menu has two options: **Cycle** and **Alarm**.



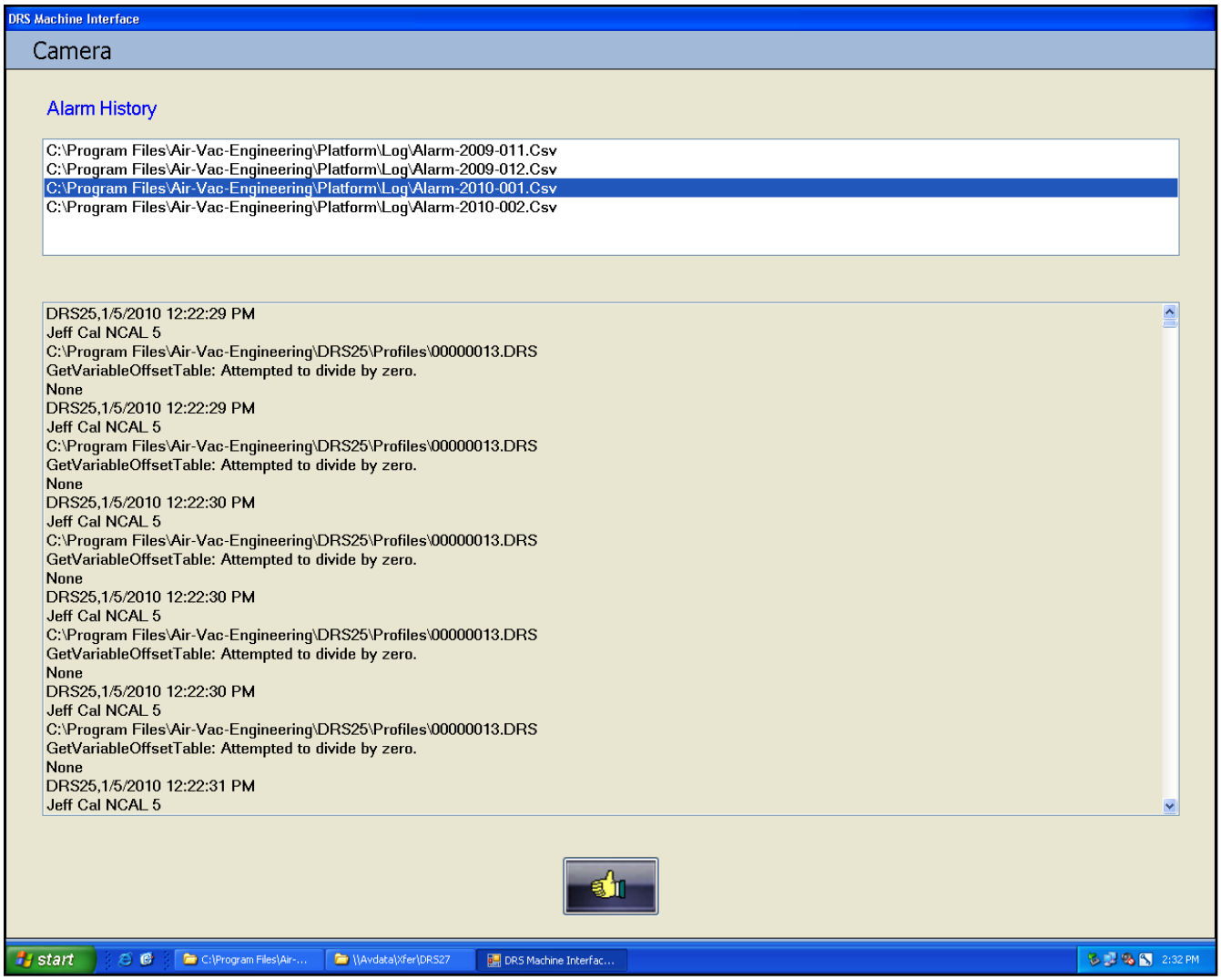

**Cycle History:**

A **History** file entry is recorded each time the operator cycles a process profile.



## Alarm History:

The software continuously monitors the controlling sub-systems. If an alarm condition occurs for any process or hardware issue, an **Alarm** file entry will be recorded.

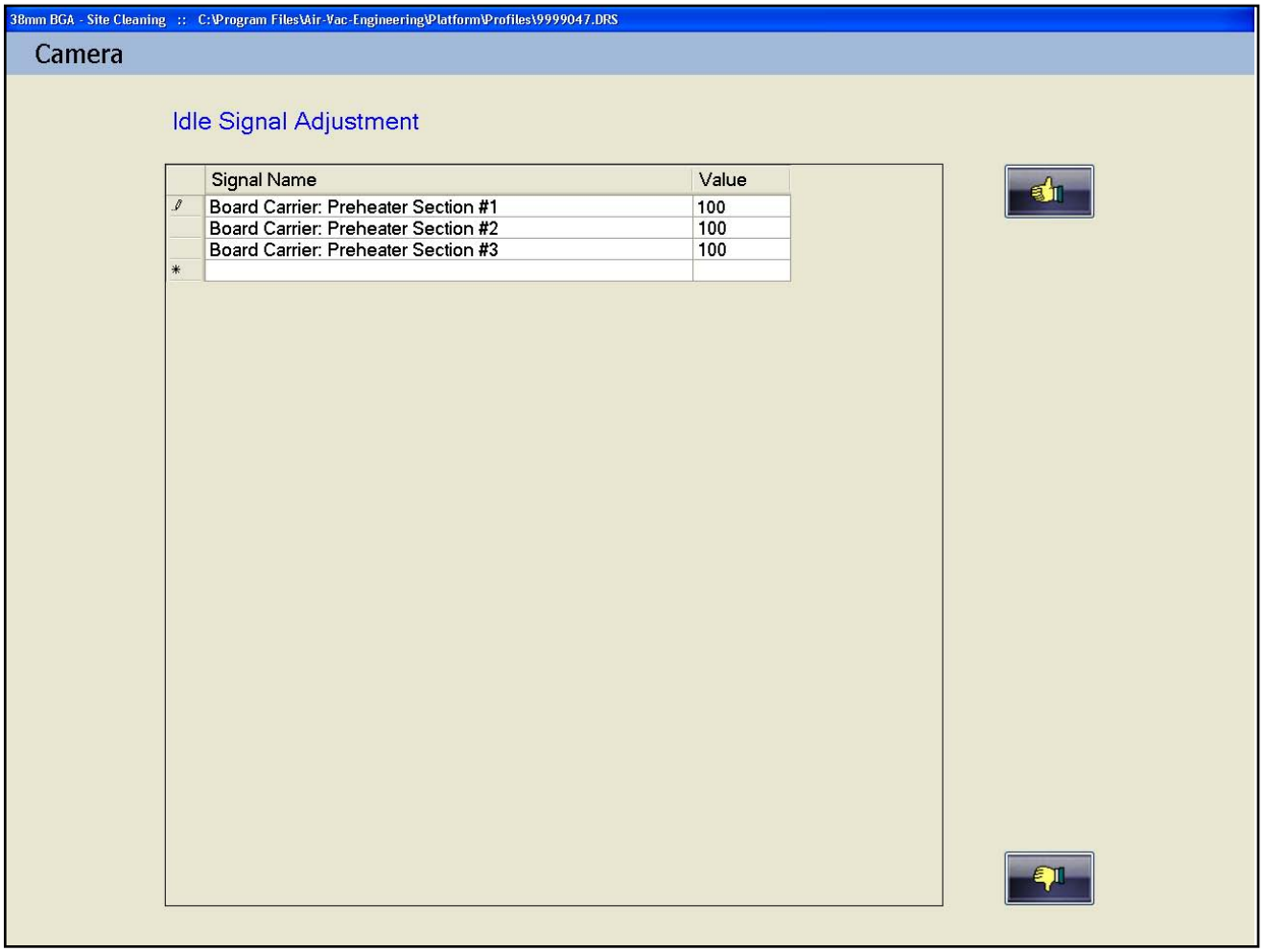


## 4.4 Setup:

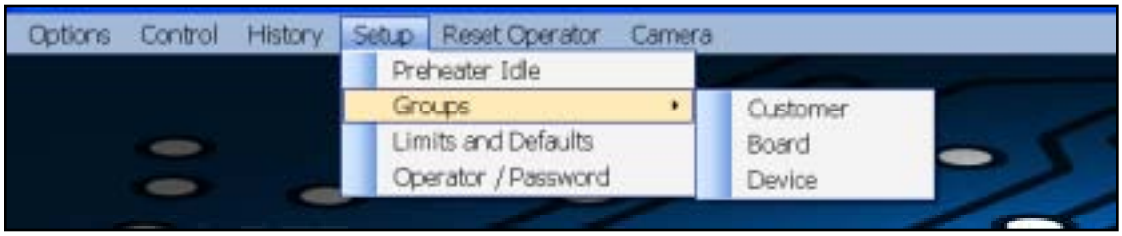
The standard **Setup** menu allows the operator to adjust machine related setup or control parameters. These options are only available to high priority operators.


### Preheater Idle:

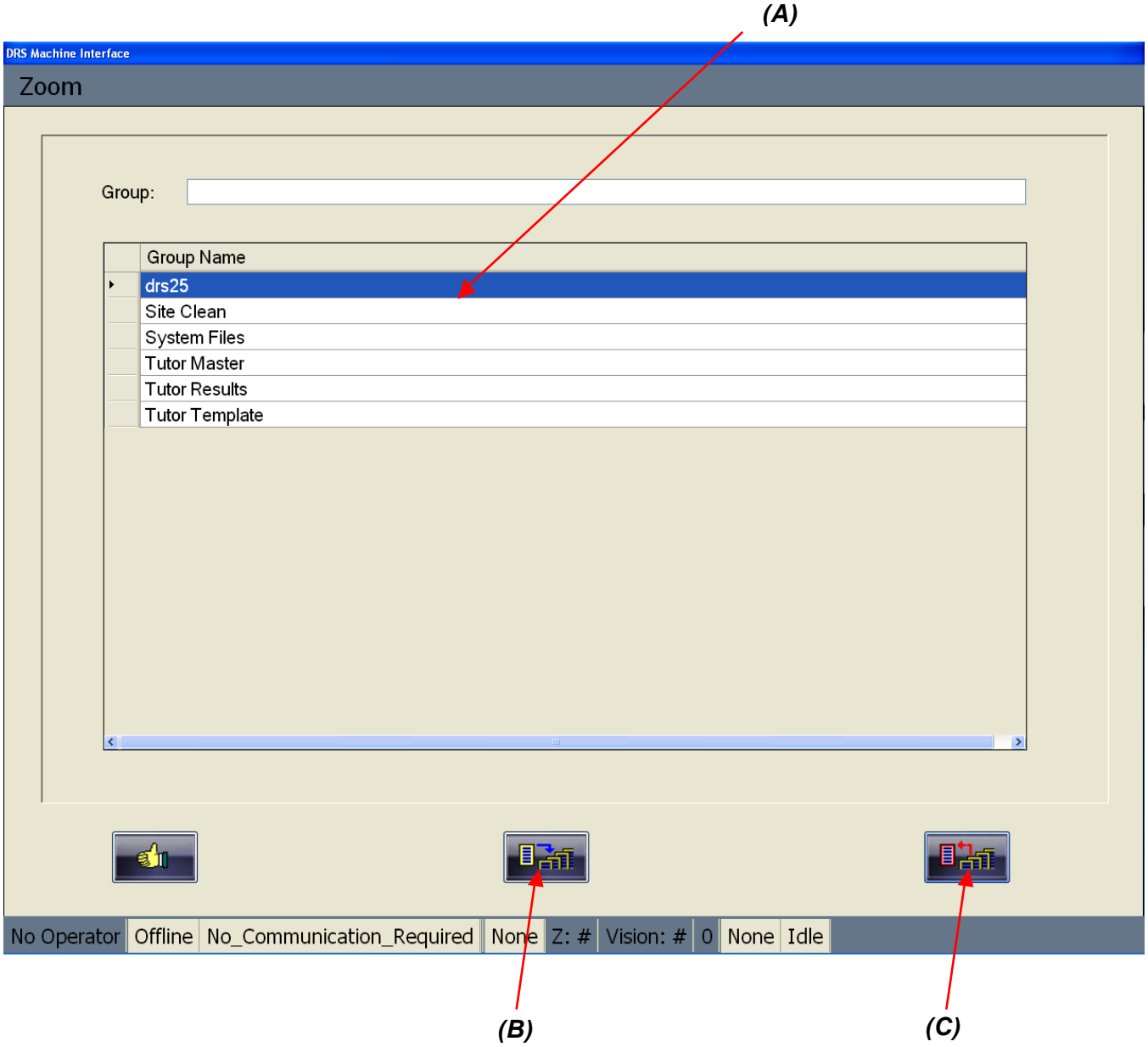
Selecting the **Preheater Idle** from the **Setup** menu will present the operator with the **Preheater Idle Control** screen. These settings are global and will control the preheater during all screens <u>except</u> the **Run** screen. Individual profiles will control the preheater based on process requirements.



### Customer, Board and Device Group Setup Screens:



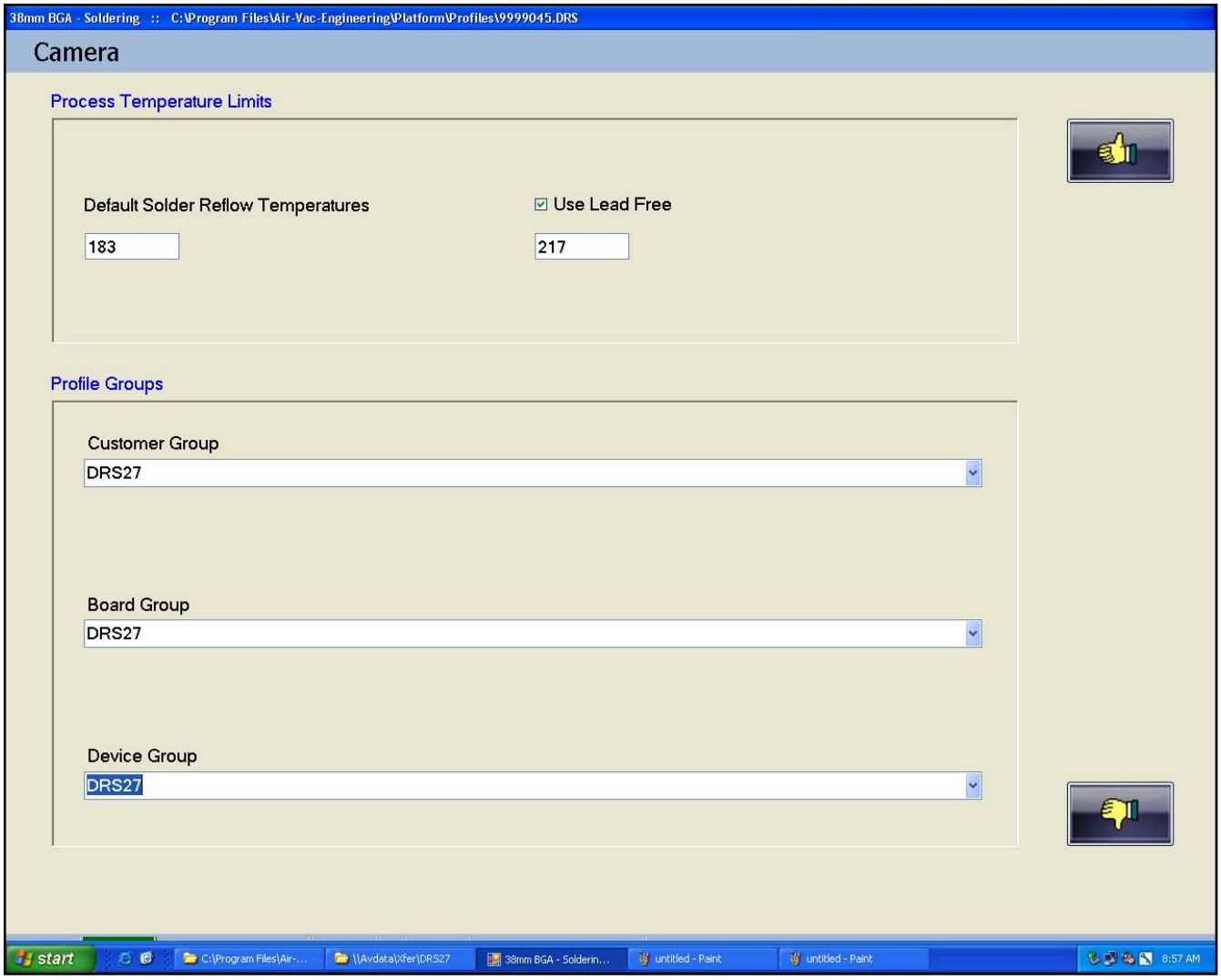

The group maintenance screens allow the operator to create or delete a group. To create a new group name, type the desired group name into the group edit box (A). Click on the **New / Add Entry** button to insert the new group into the existing list (B). To delete a group, the operator must first highlight the group. Next, the operator can click on **the Delete Highlighted Entry** button (C) to remove the entry from the list. To save these changes, click on the **Thumbs Up** button. To cancel any changes, click on the **Thumbs Down** button.



**Limits and Defaults:**

This screen is used is primarily used to modify the default profile groups used by the Open profile option.

The process temperature limits are for reference only.



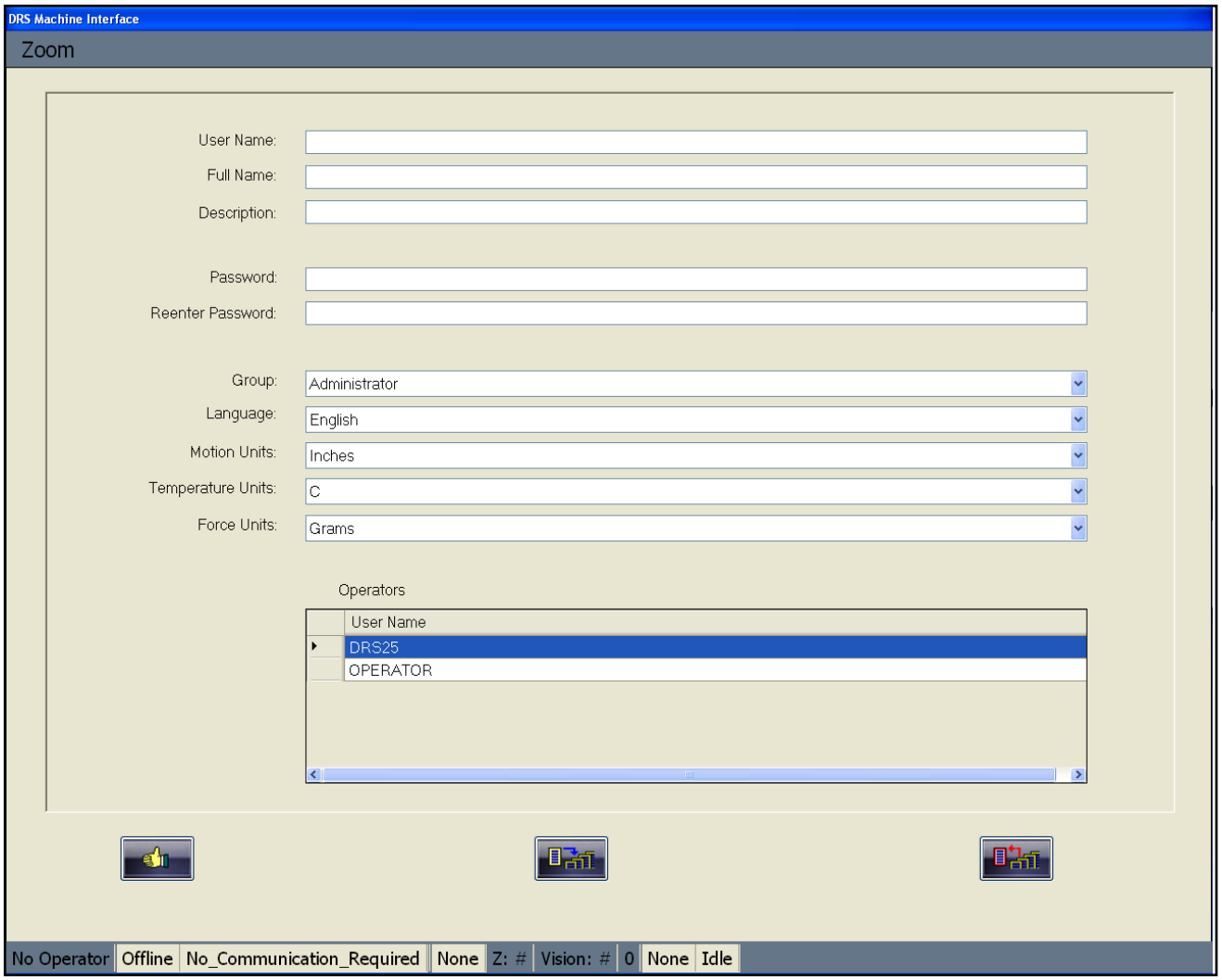
**Operator / Password Setup Screen:**

This screen is used is used to modify the registered operator list. Operators are grouped into two categories:

High priority (Administrator): These operators have access to all screens. Caution should be taken when defining these operators. All critical machine parameters or process profiles can be adjusted.

Low priority (Operator): Operators can only run existing profiles and are not allowed to make process adjustments.

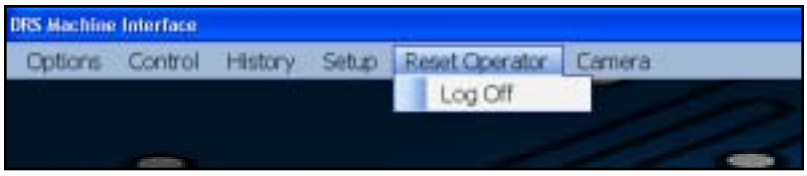
The password edit boxes are used is used to enter/modify/verify the password associated with each operator priority level.




Users can have different machine units (Motion, Temperature and Force) defined as a login preference.

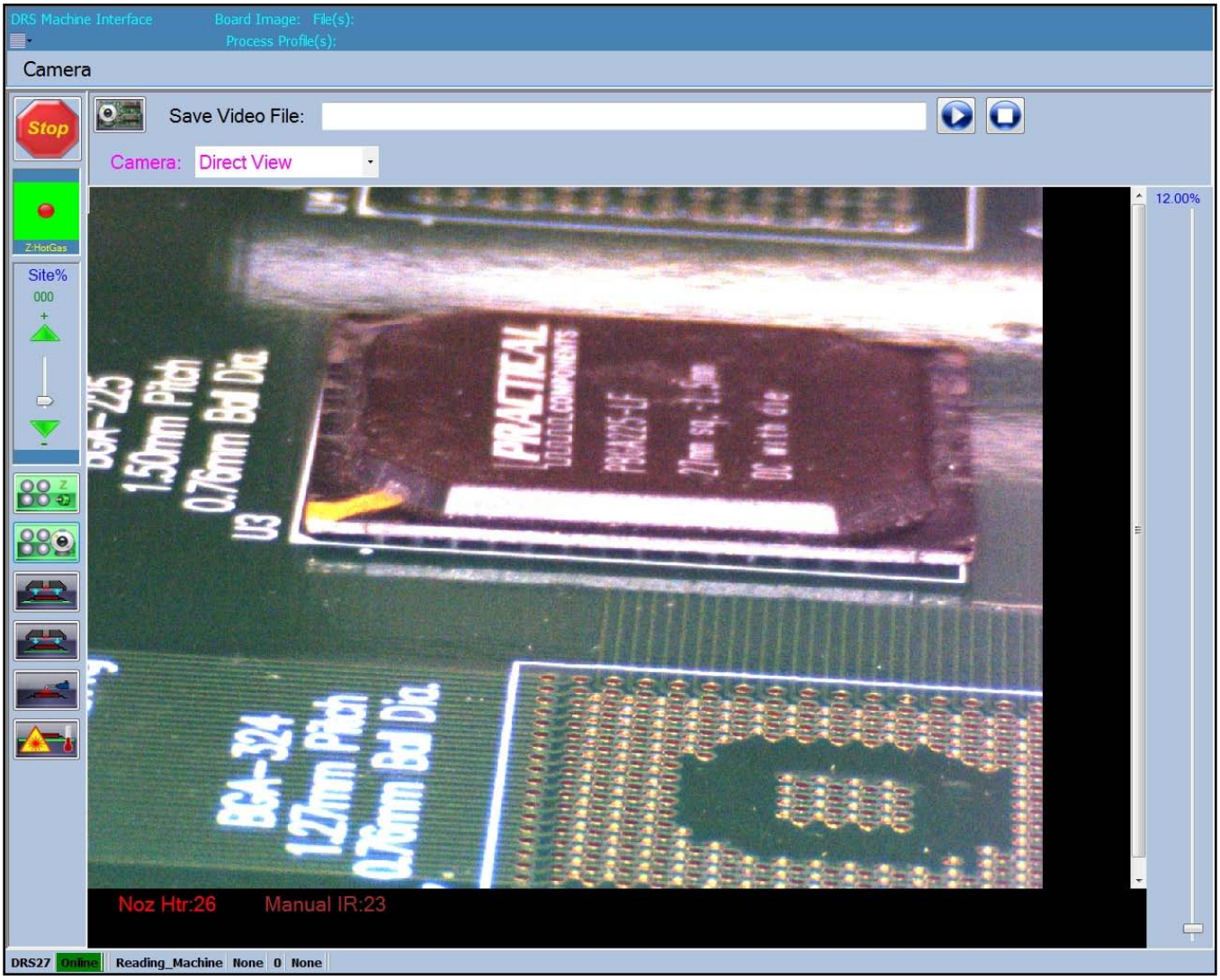
## 4.5 Reset Operator:

Click on the **Reset Operator / Log Off** option on the menu bar and the **Operator Login** screen will be displayed. Log in again followed with your security access code to gain access to the DRS27 machine.




## 4.6 Camera:


Click on the **Camera** option on the menu bar and the **Camera** screen will be displayed. The screen is to access the Vision System or Direct View (option) camera. The Camera screen will automatically be displayed when the Alignment Motion-Object Alignment-Board Carrier, Inspection-Inspection-Board Carrier, or Inspection-Inspection-Direct View box in the teach screen is activated.

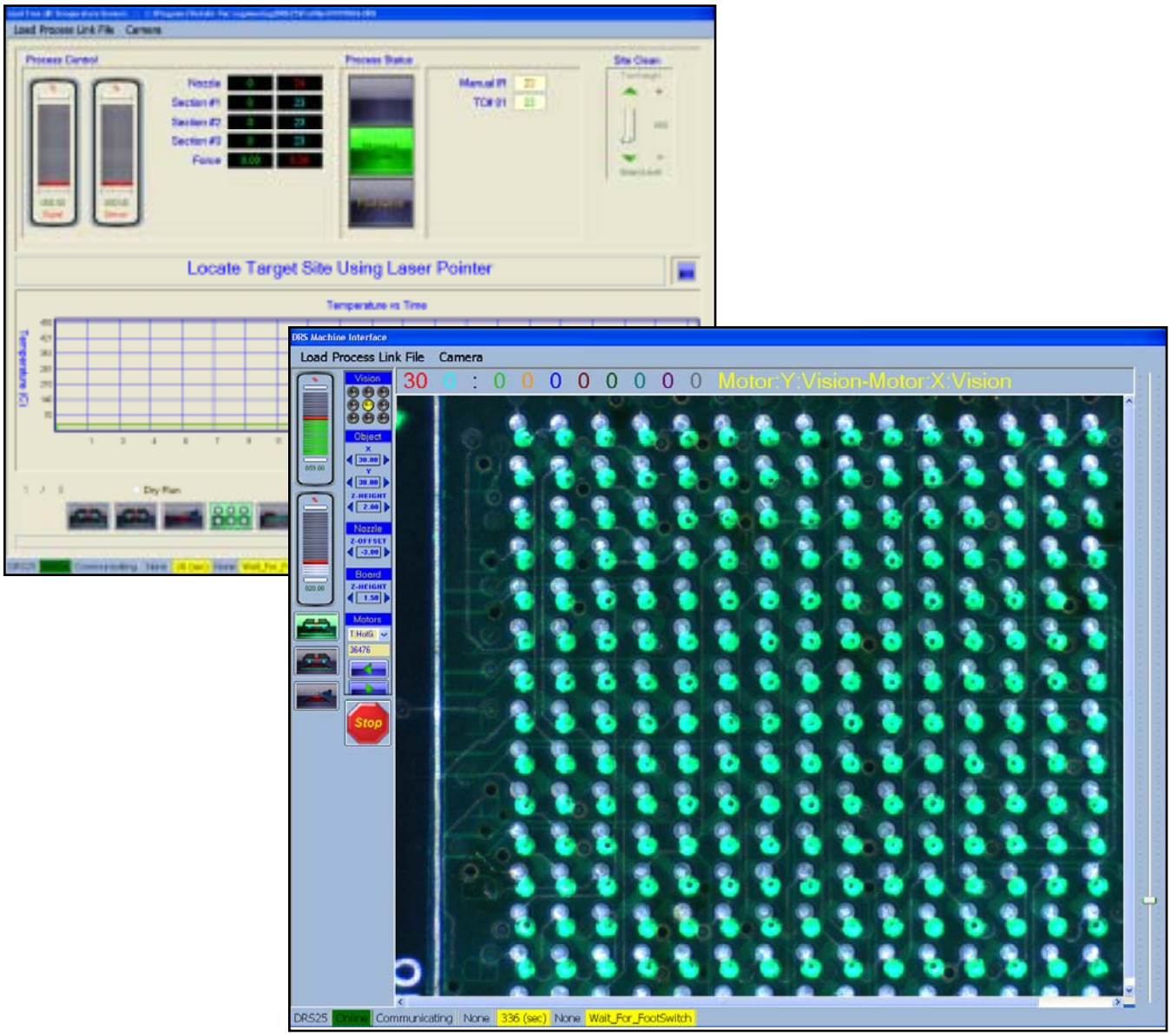


## 4.7 Camera Views

The camera screen is typically used for: component alignment or site inspection in conjunction with the vision system camera. Or, site cleaning and viewing reflow with the direct view camera. It is typically programmed in the inspection block, inspection vision system or inspection direct view. It can also be manually activated on the run screen.

### 4.7.1 Vision System- Component Alignment

The camera screen will normally be activated automatically during the component replacement process. It is programmed in the Inspection block, Inspection-Vision System. The message "Locate Target Site Using Laser Pointer" will be shown on the run screen. Then the camera screen will be activated. Settings of the view are set by the programmer. The operator has the ability to change settings for personal viewing preference.



### 4.7.2 Direct View Camera

The direct view camera is typically programmed and will be viewed automatically in the direct view mode. The direct view mode can be activated manually in the run screen and using pull down menu activated.

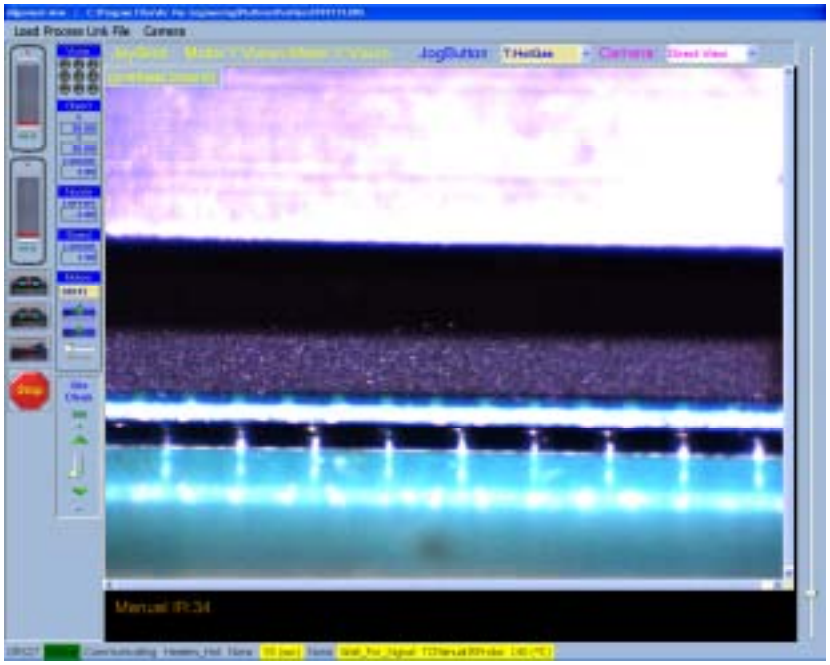


The DRS27 lights are turned on/off by the z-axis lights icon.

The camera lights are turned on/off by the camera light icon.

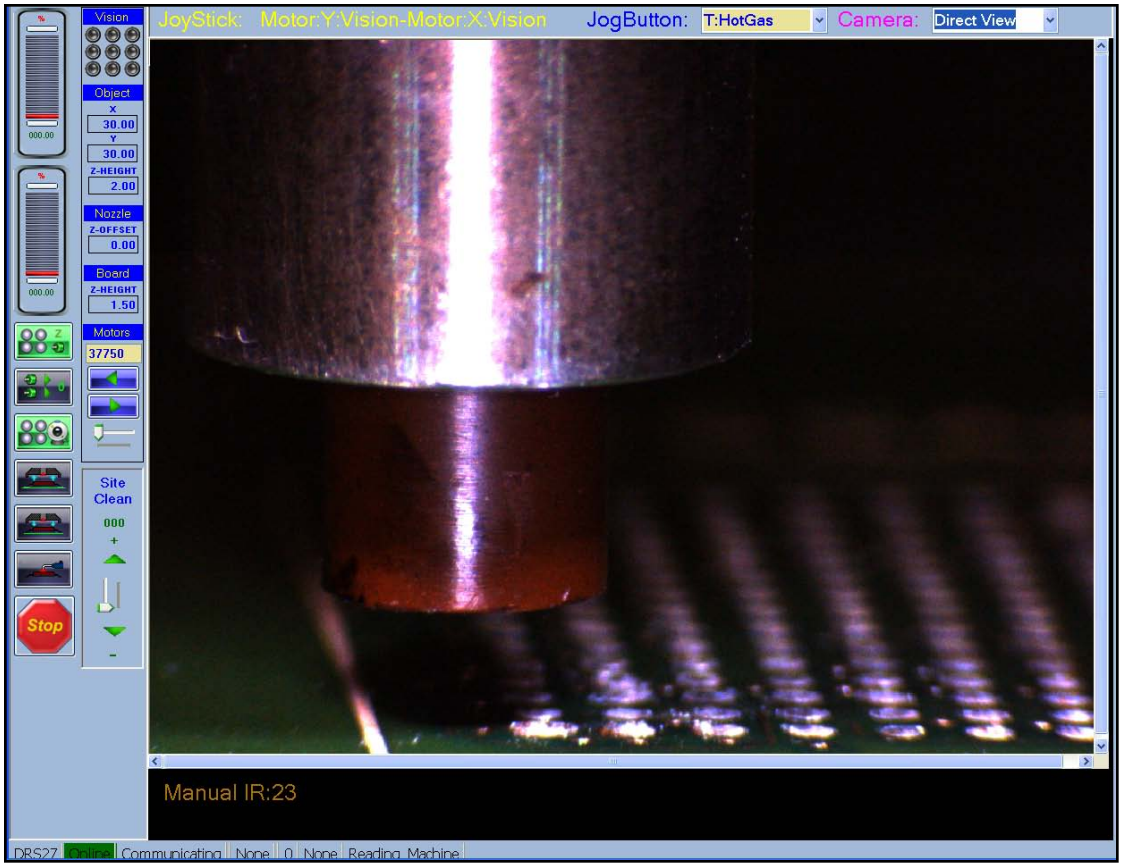
### 4.7.3 Direct View Camera – Reflow View

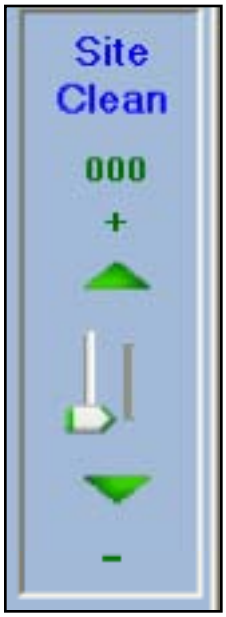
The direct view camera can be utilized to view solder reflow.



### 4.7.4 Site Cleaning

The direct view camera can provide close up view of the site cleaning process.



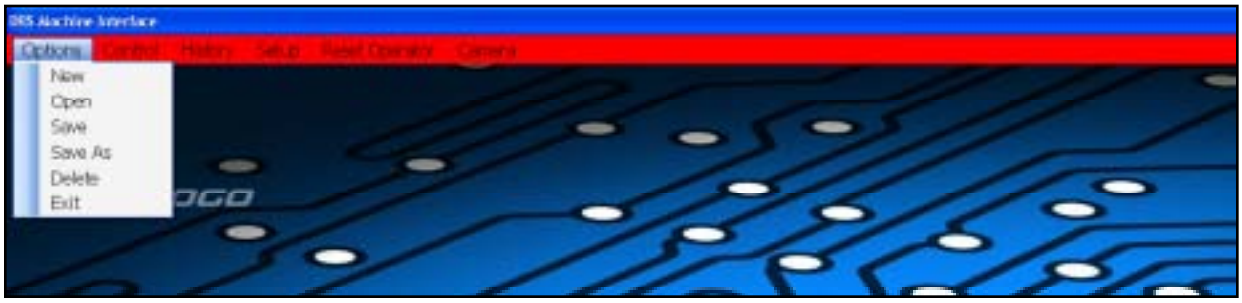

The z-height position can be adjusted using the site clean up/down arrows (+/-). The vacuum sensor of the site cleaning program will continue to automatically adjust based on the new settings.

## 4.8 Protected System Security Access:

To access the Protected System Menu, the user must click on the Air-Vac logo with the right mouse button. The menu background color will change to red. The menu options will be changed to allow access to machine calibration and critical properties / parameters.

The Protected System Security Menu consists of:

Options:




Control:

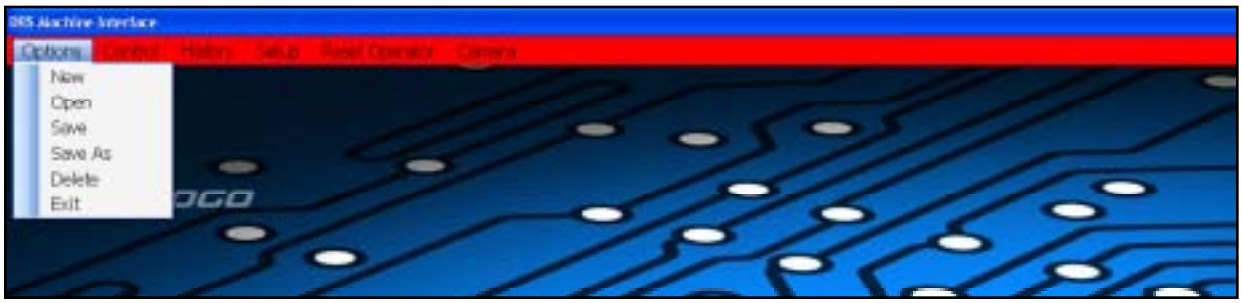

History


Setup


Reset Operator

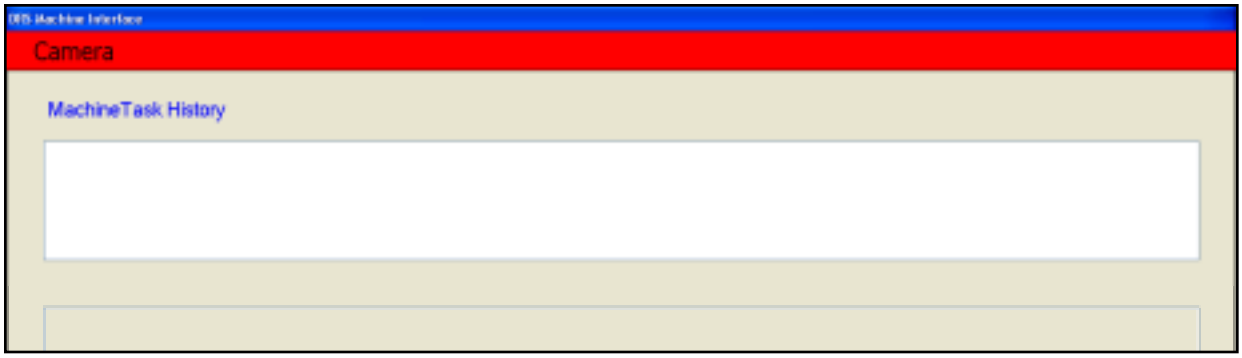
Camera


Options functions are the same as in the main menu.




Control functions are the same as in the main menu.

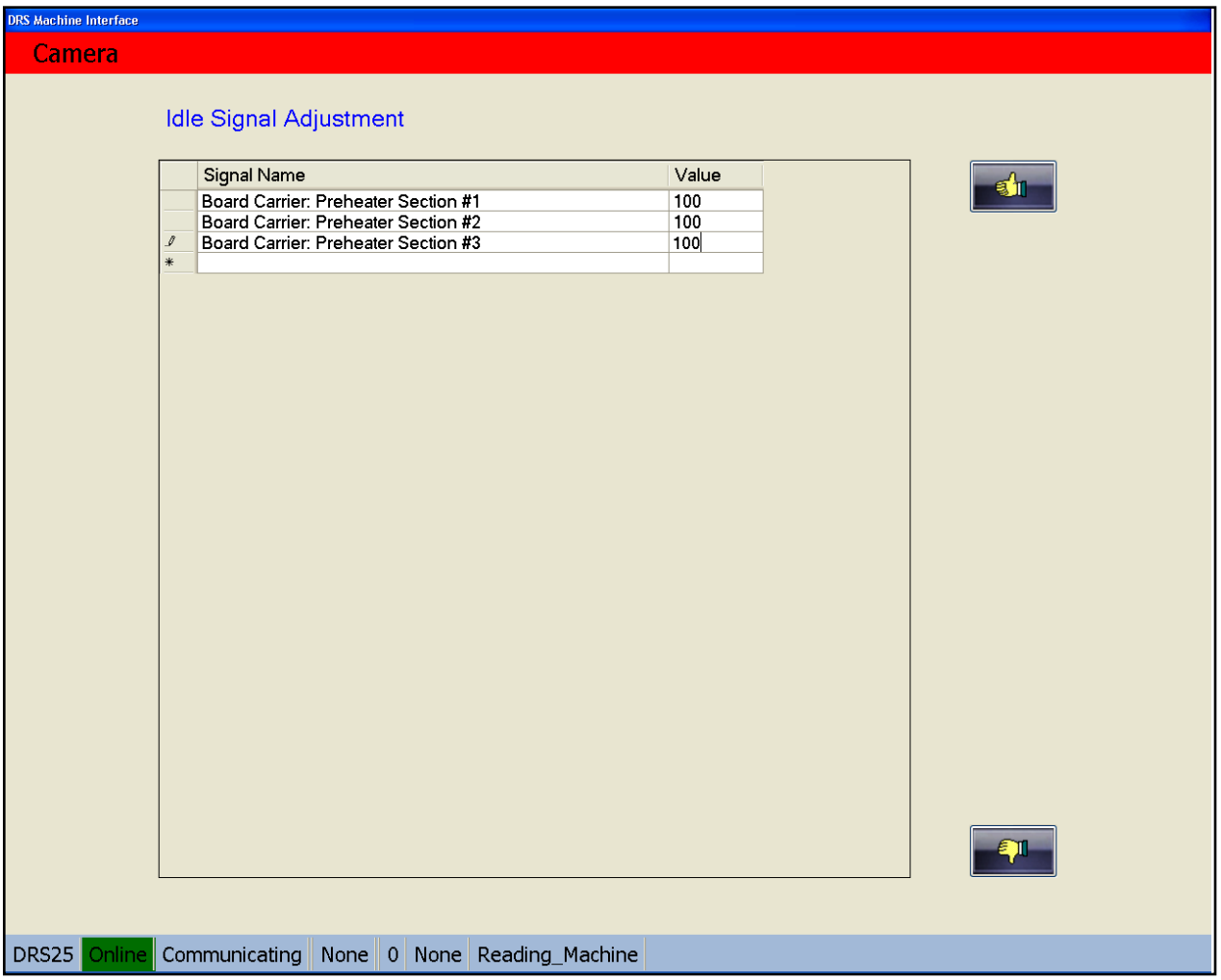

History function includes Machine Tasks

### 4.8.1 Preheater Idle


This menu option performs the same functionality as the standard operator idle option.

Selecting the **Preheater Idle** from the **Setup** menu will present the operator with the **Preheater Idle Control** screen. These settings are global and will control the preheater during all screens <u>except</u> the **Run** screen. Individual profiles will control the preheater based on process requirements.

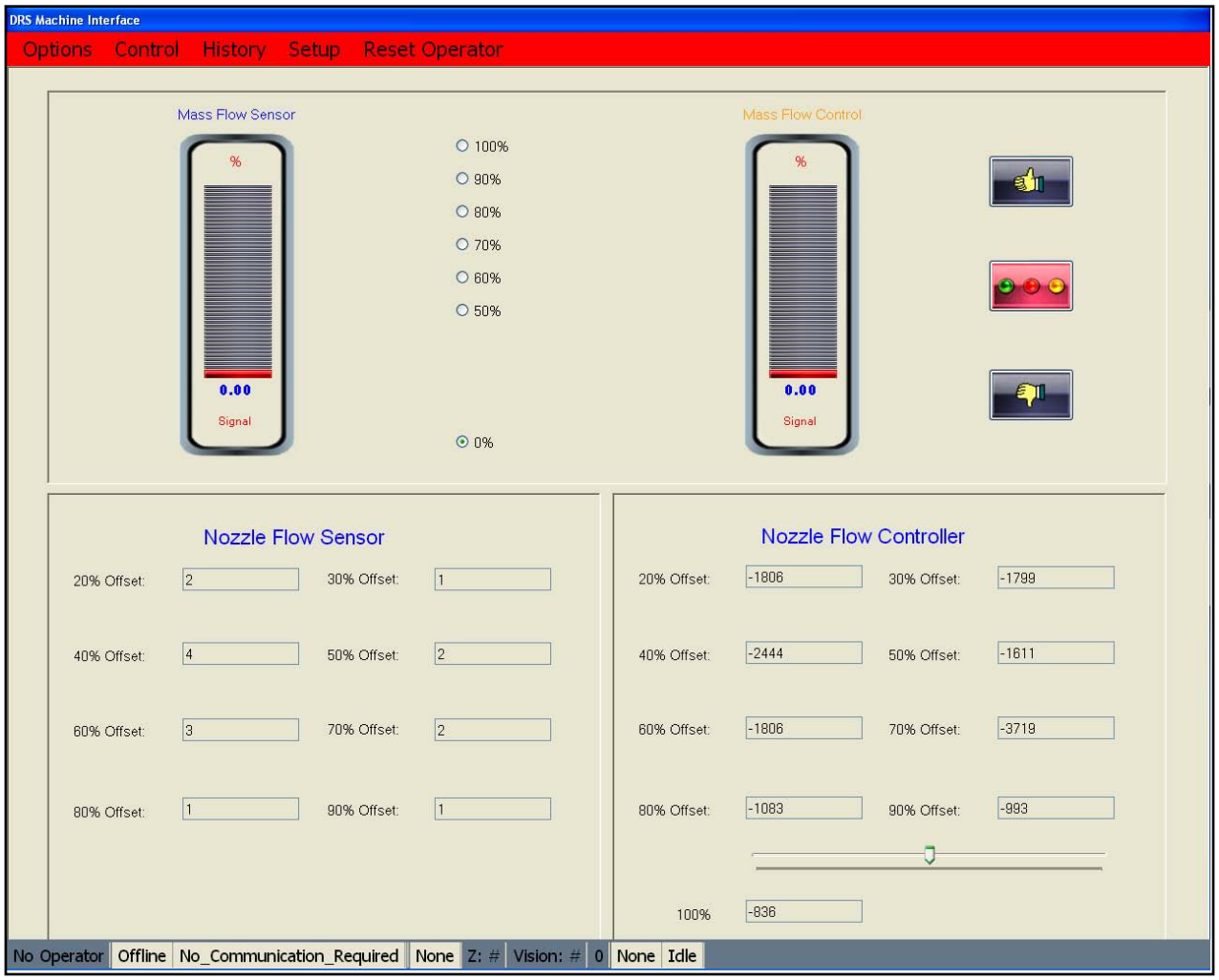


## Adjustments:


- Nozzle Flow:

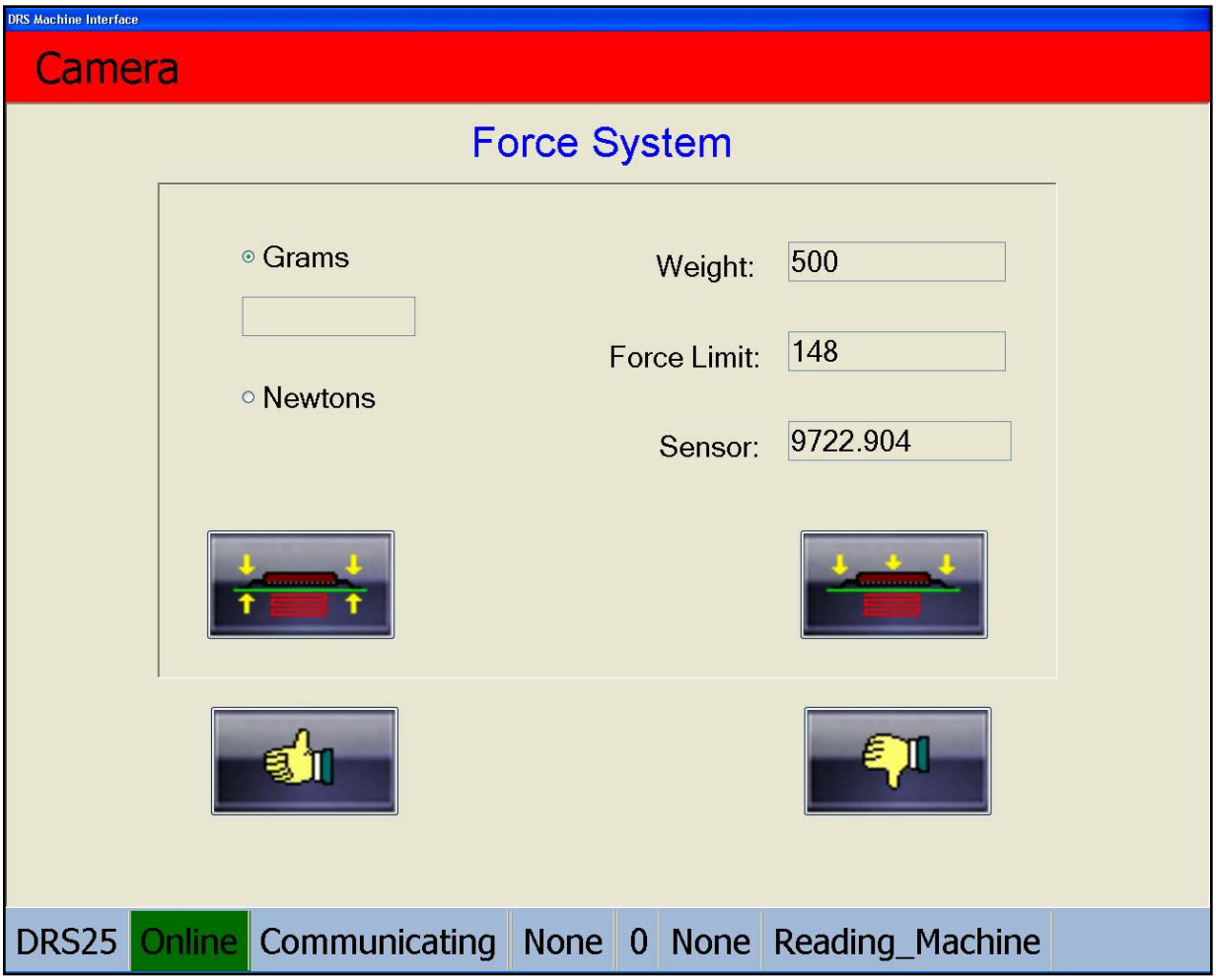
The Nozzle Air Flow is calibrated by adjusting the offset parameters. These offsets are set for each air-flow percentage reference, and calibrated to a certified flow meter. The Flow Sensor and Flow Controller have individual dial indicators and are adjusted individually starting at 100%.

Slide bars make adjustments easier and only the target flow rate that is currently being change; this reduces accidental adjustment to different flow rate parameters.



- Force Adjustment:

This screen is used to provide adjustment and calibration to the force system. This activity is performed at the factory and normally does required customer adjustments.



- Nozzle Heater

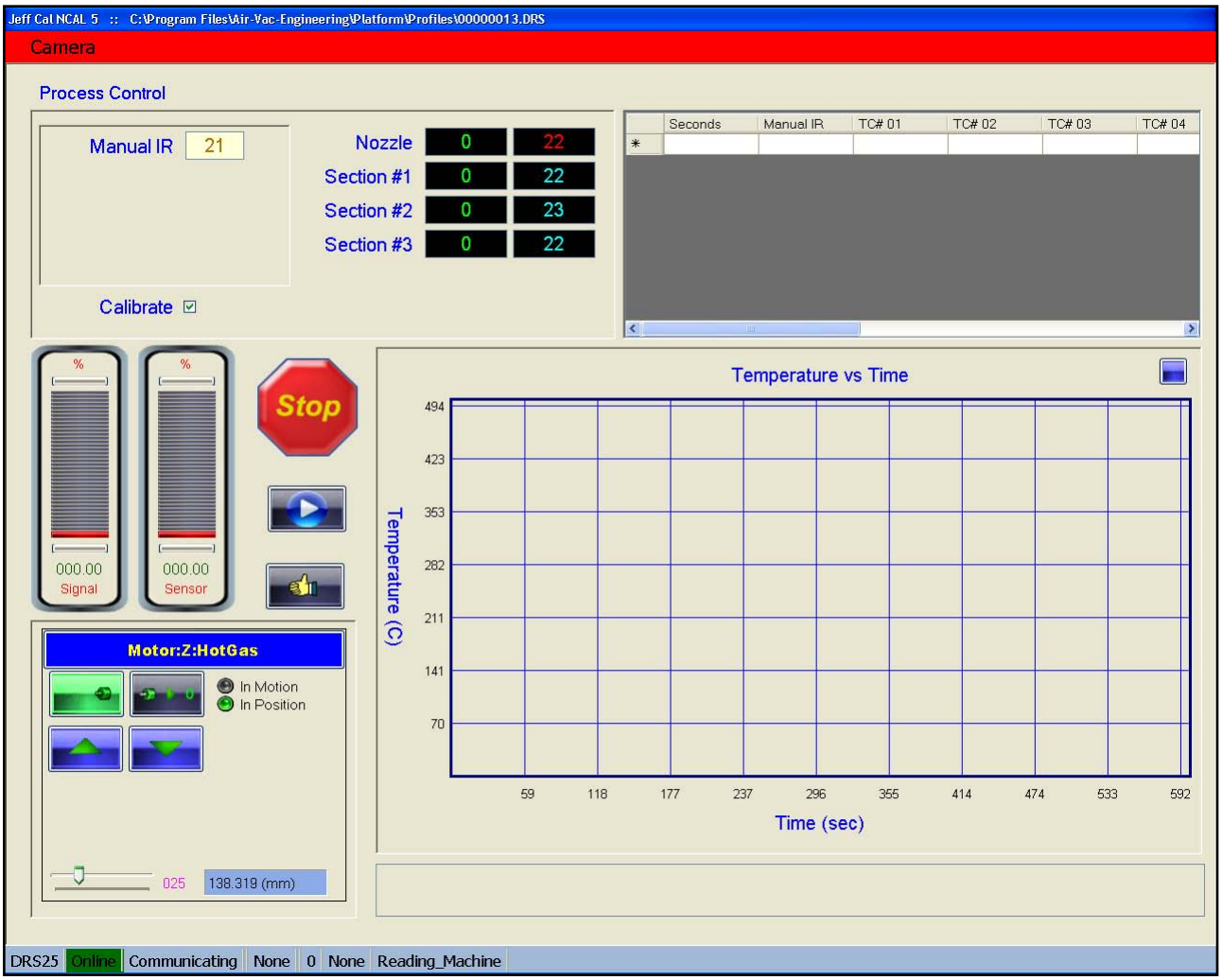
This screen is used to perform the automatic nozzle heater calibration.

Temperature offsets are calibrated based on flow rate (20-100%).

Adjustments to individual calibration points should not be made.

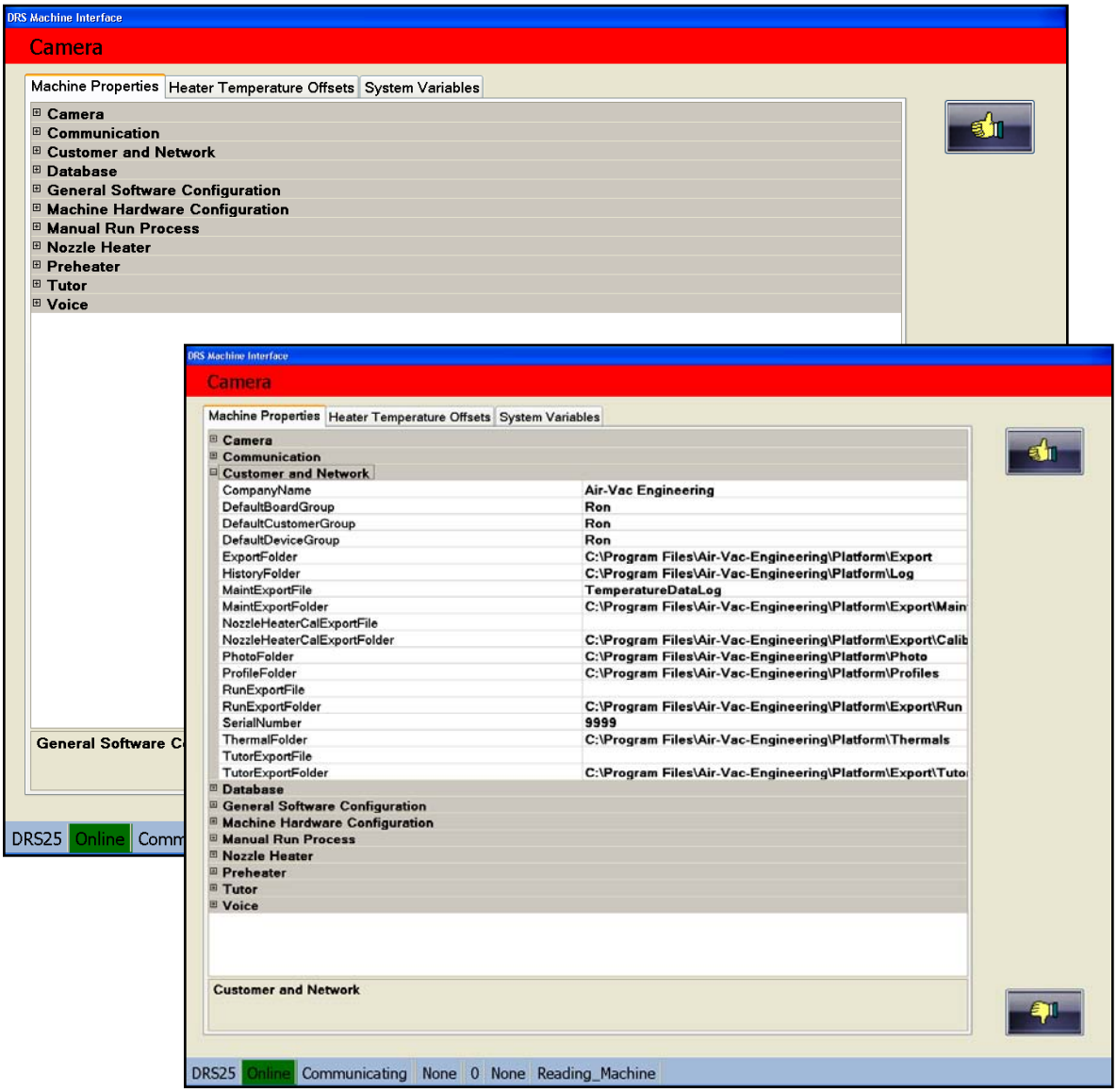
Adjustments are available to influence the automatic adjustment/decision logic (contact Air-Vac factory technicians).

To start the calibration sequence the operator need only plug the NCAL-5 nozzle into thermocouple channel #1 and click on the start button. The cycle will run for 25-35 minutes. All necessary offsets are automatically computed. Click the up-thumb button to save the results.



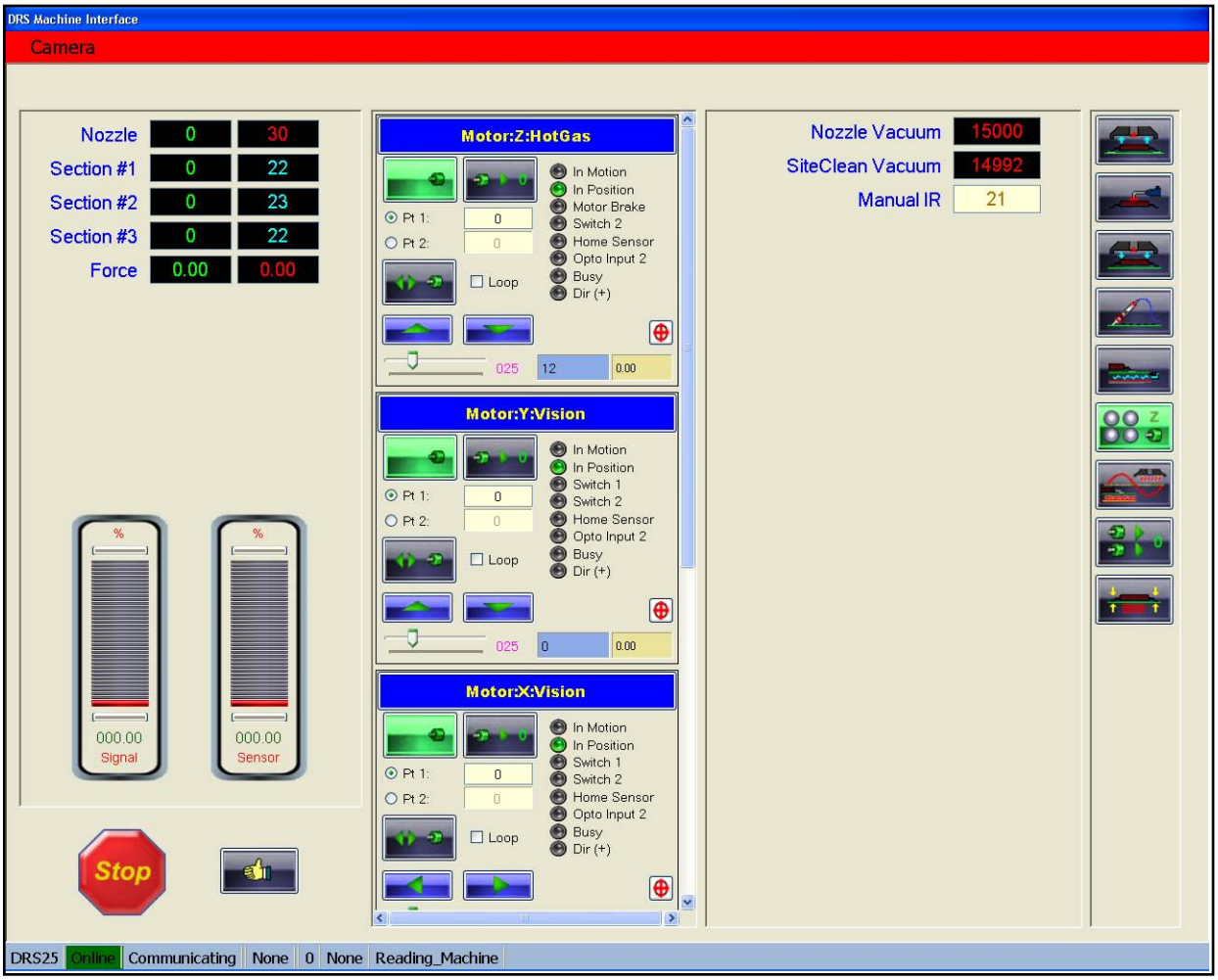
## Machine Properties:

- All machine properties (control / setup parameters) are connected to this screen.
- Machine properties associated with different peripherals to be quickly adjusted.
- Click on the plus sign (+) to expand a category.
- Use caution before making any critical machine control properties.



## Machine Maintenance:

This screen offers access to all machine the interface / control signals. This screen is normally used to test individual control signals diagnose a repeatable issue.



# 5: Process Development Guide/Engineering Training

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# 5 Process Development Guide/Engineering Training

## 5.0 Profile Tutor Software


Access to Profile Tutor requires high operator password level.

### 5.0.1 Overview

The DRS27 Process Development Guide is designed to allow novice users to create and run new processes. There are five (5) steps to creating and running a new process:

1. Physical Setup
2. Profile Tutor
3. Thermal Profile Analysis
4. Auto Profile Build
5. Program Execution

Each of the five steps is documented in detail in this Process Development Guide. Please contact Air-Vac with any questions (203-888-9900; request DRS27 Process Assistance).

### 5.0.2 Physical Setup

IR Sensor

The IR Sensor measures and monitors board temperature during the rework process. Its main function is to insure that the board is at the same starting temperature during each rework cycle. The IR Sensor is connected to its own internal TC port. If you did not purchase the optional IR Sensor, contact Air-Vac for further instructions. Position the IR Sensor on an open area of the board 2-3 inches away from the rework site.

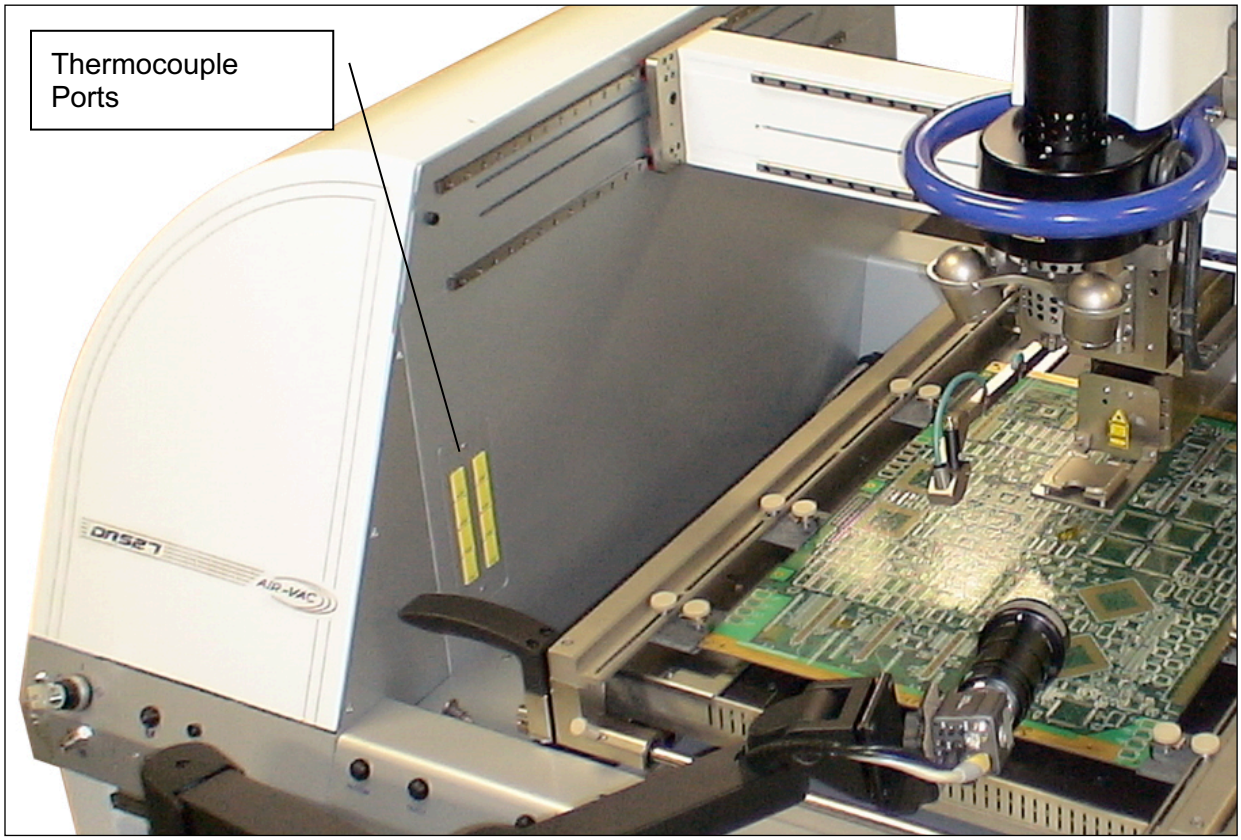
TC#1: Joints

Slide a TC underneath the BGA and plug into channel #1. If possible, slide two additional TC's underneath the BGA for additional data. For large components, 3 thermocouples will provide a good set of data to insure accurate profiling. Erroneous TC's can be removed while running the profile tutor. Air-Vac uses .003" gauge K-type TC's (1-888-TC-OMEGA, Part #5 SRTC-TT-K-40-36).

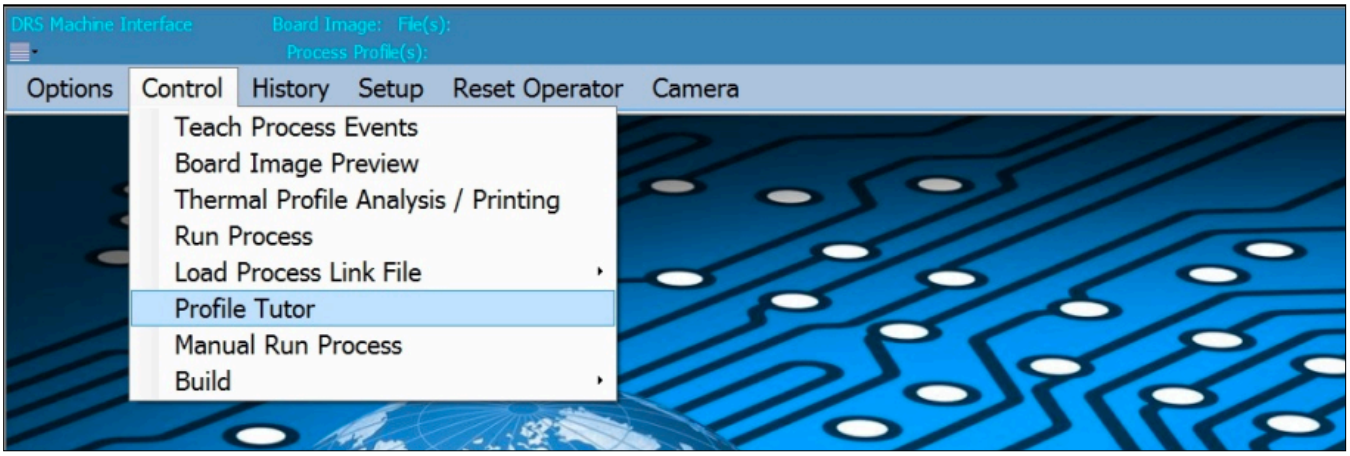
Apply Kapton tape to hold the TC's in place. If desired, x-ray will show the exact positioning of the TC head, however this is not critical. Studies have shown that TC's underneath the BGA that are not in direct contact with a solder joint are typically within –5 to 0 degrees of the joint temperature.

**The major advantage of this approach is that it is non-destructive yet still highly accurate.**

If the standoff height or ball density does not allow a TC to be slid underneath it, a scrap board should be drilled from the bottom, TC's installed into the joints are then epoxied in place.

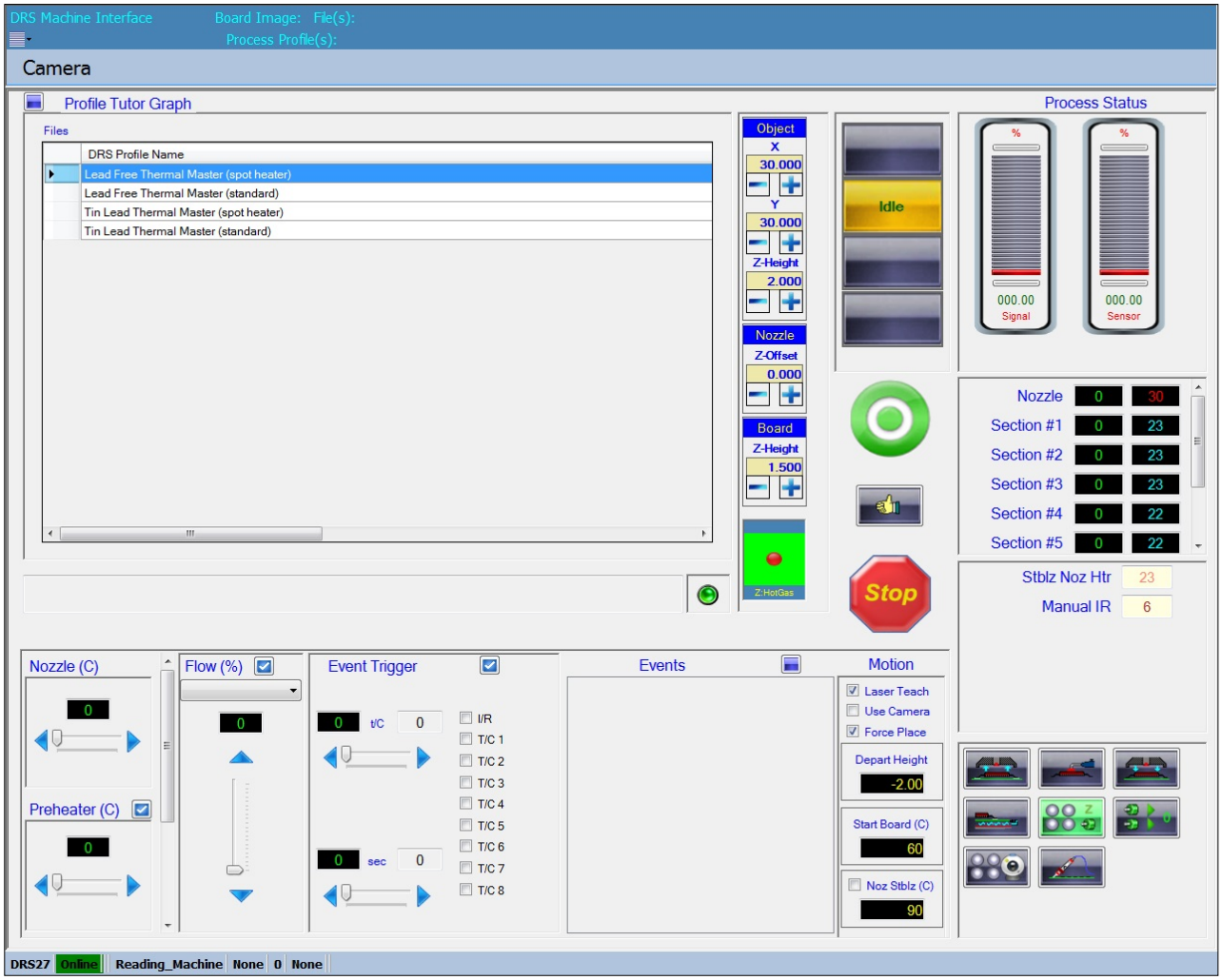

Thermocouple
Ports
DRS27
AIR-VAC

### 5.0.3 Creating a Thermal Profile

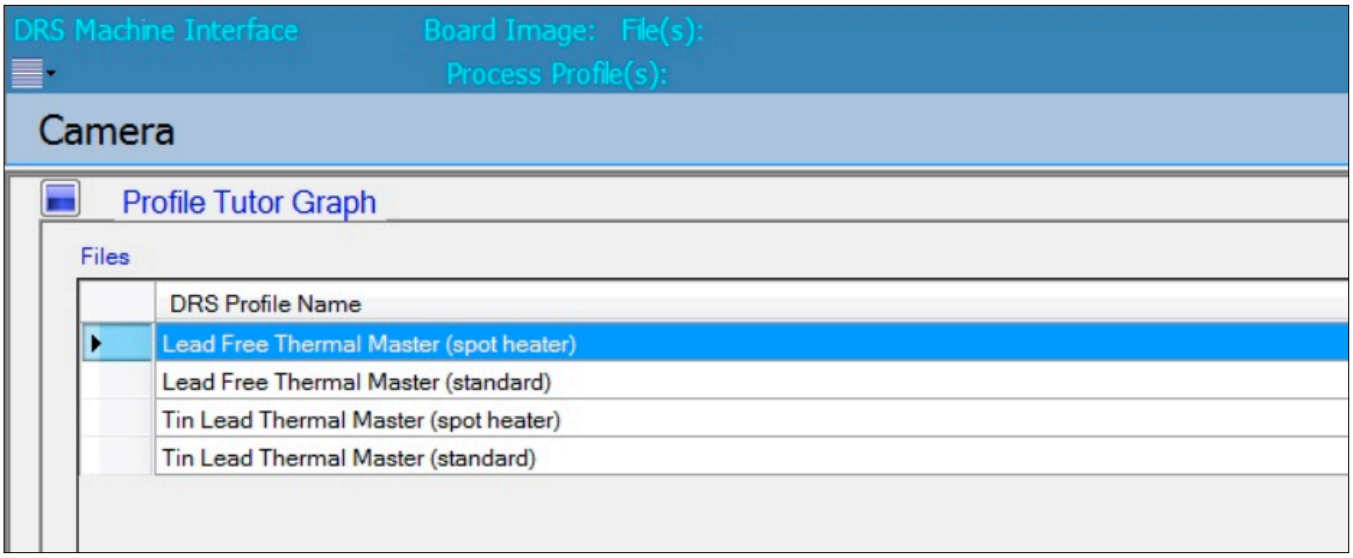



- From the toolbar, select **Control** then **Profile Tutor**.

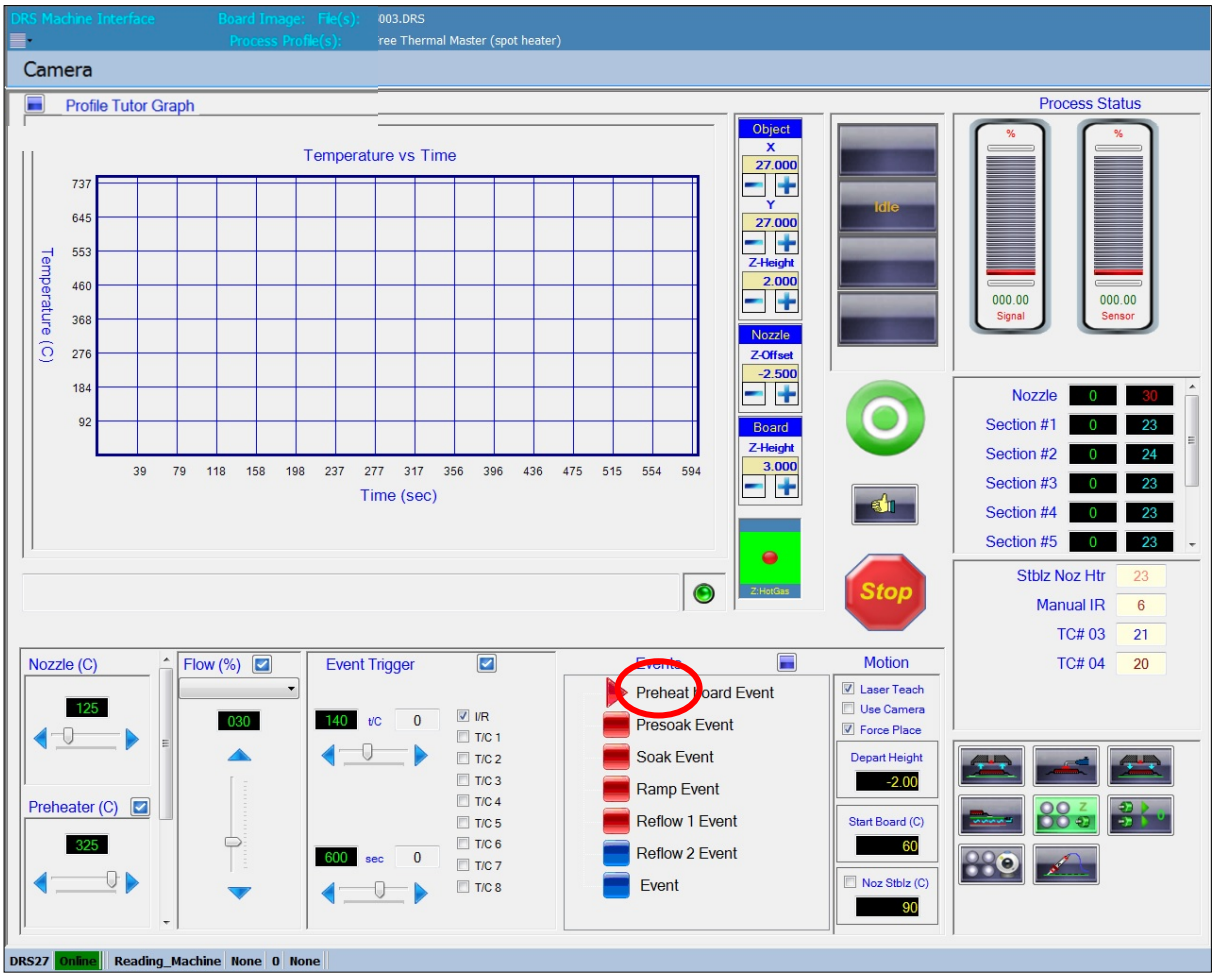
**Profile Tutor screen shown.**



1. Select (double click) the appropriate **Thermal Profile Master** that most closely matches the new application.




The selected Master will load and the Template steps will appear under the Events column (below).



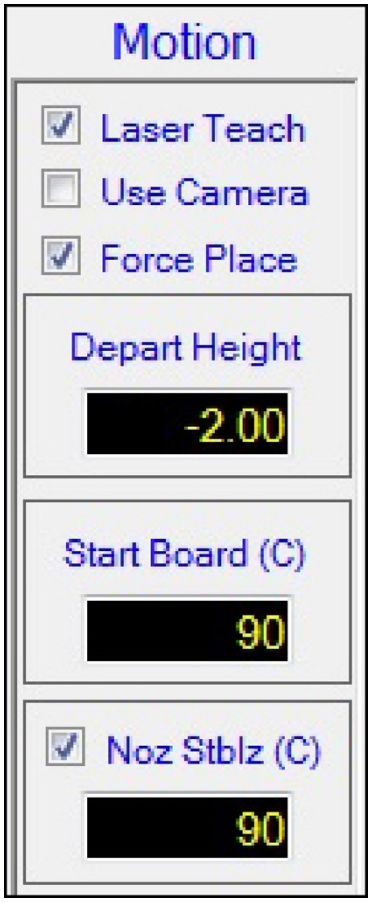

- Measure the **Object** (component) width (X), length (Y) and thickness (Z) in mm and input into corresponding boxes.
- Measure the **Nozzle Z-Offset**, the total length of the nozzle (in mm) and subtract from 66. Enter the difference.
  - (Nozzle length) – 66 = Nozzle Z-Offset

**NOTE: All EZ style nozzles are 63.5 mm long. (63.5-66= -2.5) For all EZ style nozzles enter –2.5mm**

- Enter **Board Z-Height** (thickness) in mm.

**IMPORTANT!**

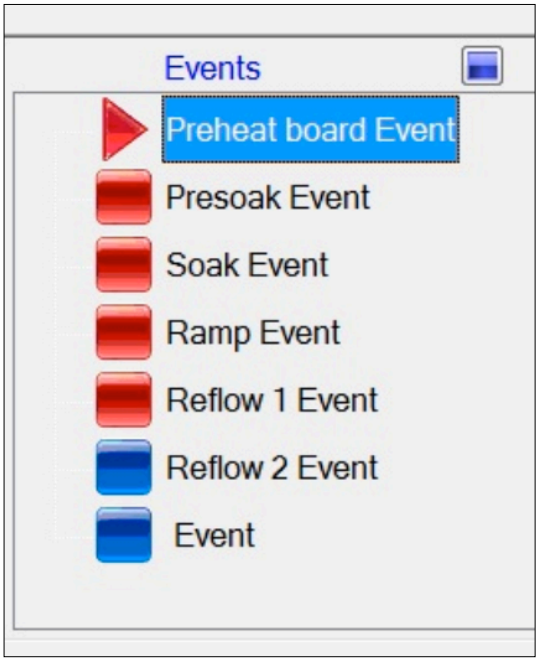
**Entering the correct object (component), nozzle and board parameters is critical for proper z-axis positioning. Incorrect data can result in the nozzle contacting the part in a high speed mode.**



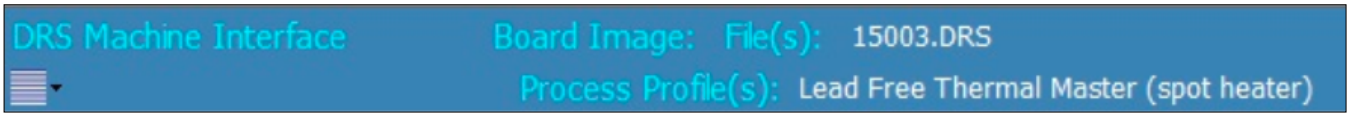

**Motion**

- **Laser Teach:** (always put a check in this box) Extends vision system to laser pointer position to teach component center position.
- **Use Camera:** (Optional - Direct View Camera option only) Takes user at cycle start directly to camera screen during Tutor process.
  - **NOTE:** If **Use Camera** is not selected here, user still has the option of manually selecting Direct View Camera screen from top tool bar at any time during process.
  - **NOTE:** See Addendum at back of this section for use and explanation of Direct View Camera screen.
- **Force Place:** (always put a check in this box) Allows nozzle to approach then force touch top of component.
- **Depart Height:** Distance of nozzle from component top after Force Place during heating/cooling events. Use –2.0mm
- **Start Board:** Additional development runs are typically necessary after the first iteration. This is the topside board temperature the machine will cool to at restart.
  - Typically 60˚C for tin/lead assemblies
  - Typically 90˚C for lead-free assemblies
- **Nozzle Stabilization:** (always put a check in this box) Will heat/cool nozzle head temperature prior to every start/restart for improved profile repeatability.
  - Use 90˚C

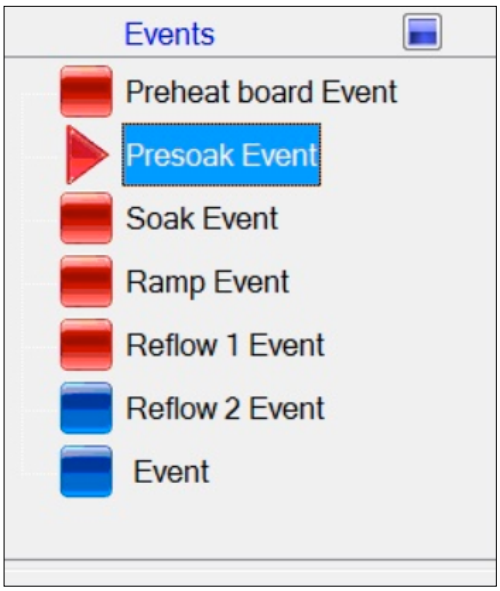
The events are shown.



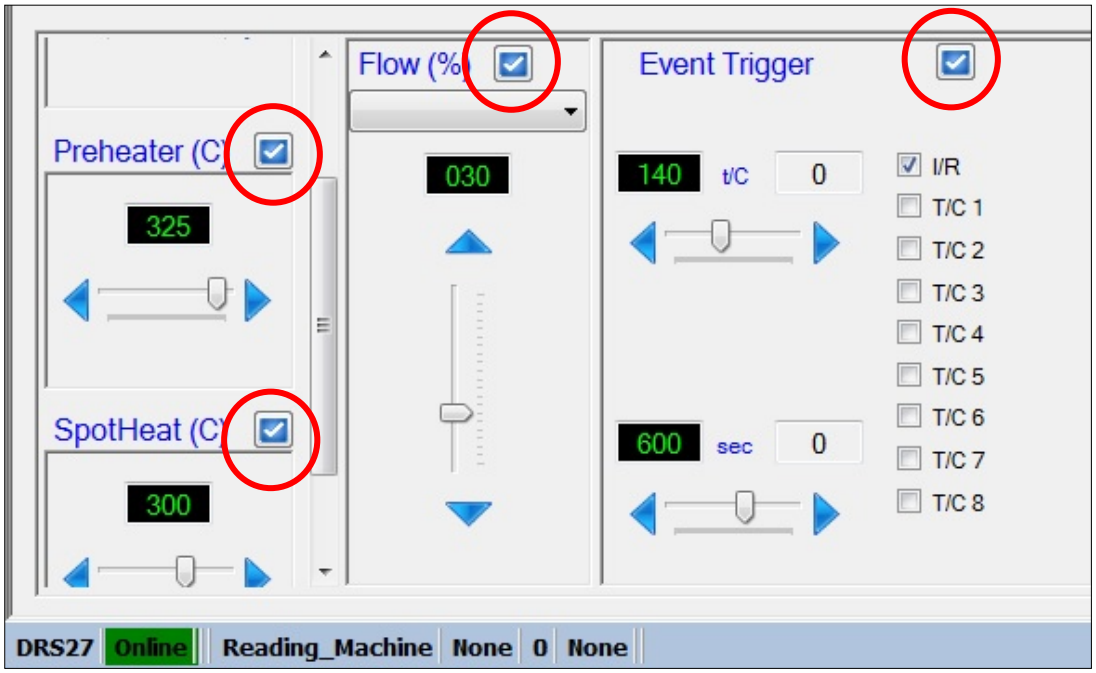

The master profile name will be displayed at the top of the page.




All master profiles typically have seven (7) stages (Events): Preheat, Presoak, Soak, Ramp, Reflow 1, Reflow 2, and Off.



The Update All buttom offers the ability to quickly update all events to the set value in that single event. Can be used for Preheater Temperature, Spot Heater Temperature, Nozzle Flow Rate, and Event Trigger TC's.



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

1. **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.
2. **PRESOAK:** Presoak is the period between preheat and soak.
3. **SOAK:** Flux is activated during the soak stage. Typically, significant voiding will occur without proper soak.
4. **RAMP:** Quickly takes the solder joints from the end of soak to the beginning of reflow.
5. **REFLOW 1:** Time over liquidus until the heaters are shut off.
6. **REFLOW 2:** Time until the joints fall back below liquidus.
7. **EVENT:** Turns off the heaters.

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

| | Tin/Lead | Lead-Free |
|---|---|---|
| **PREHEAT** | | |
| - Topside Board Temp (°C) | 90-120<br>avg=100 | 130-150<br>avg=140 |
| **PRESOAK** | | |
| - Joint Temp (°C) | 101-139 | 141-169 |
| - Time (seconds) | 20-45 | 20-45 |
| **SOAK (joint)** | | |
| - Joint Temp (°C) | 140-165 | 170-200 |
| - Time (seconds) | 45-75 | 45-75 |
| **RAMP (joint)** | | |
| - Joint Temp (°C) | 165-182 | 201-216 |
| - Time (seconds) | 15-30 | 20-35 |
| **REFLOW 1 (joint)** | | |
| - Joint Temp (°C) | 183-215 | 217-245 |
| - Time (seconds) | 30-50 | 35-55 |
| **REFLOW 2 (joint)** | | |
| - Joint Temp (°C) | 215-183 | 245-217 |
| - Time (seconds) | 15-25 | 10-20 |
| **EVENT** | Heaters Off | |
| Typical solder liquidus temp (°C) | 183 | 217 |
| Typical max joint temp (°C) | 210 | 245 |
| Typical max package temp (°C) | 250 | 260 |

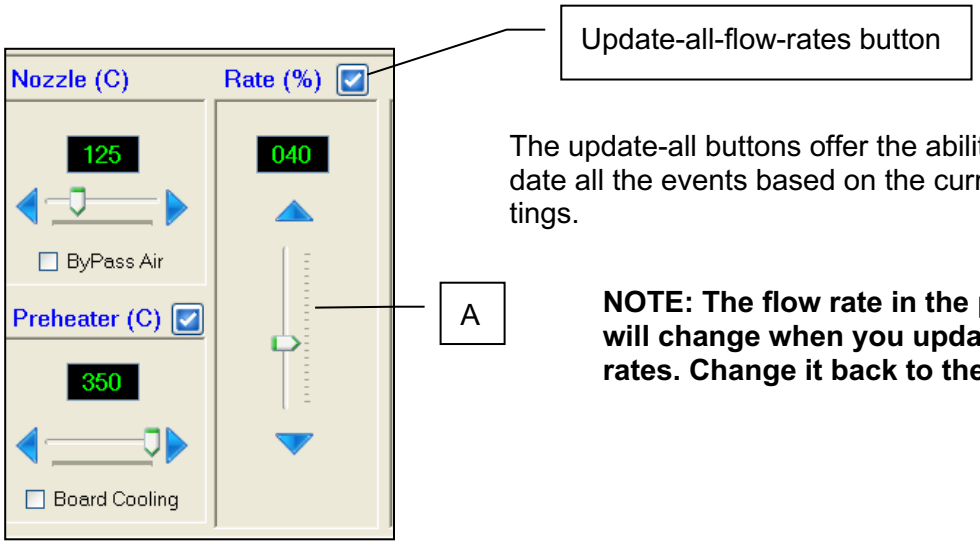
## Parameter Adjustments

1. Prior to starting the cycle, the nozzle **Flow Rate (A)** needs to be adjusted for the new application.

The default nozzle heater flow rate in the template is 30% (100% = 2.75 scfm) in the Preheat event and 50% in all other events. Change the nozzle flow rate based on the nozzle you are using as shown below.

| Nozzle Size (mm) | Nozzle Heater Flow (%) |
|---|---|
| Less than 10mm | 30% |
| 10-15 mm | 35-40% |
| 16-26 mm | 45-50% |
| 27-31 mm | 55-60% |
| 32-35 mm | 65% |
| 36-40 mm | 70-75% |
| 40+ mm | 80%+ |
| NMX Nozzles | 40-60% |

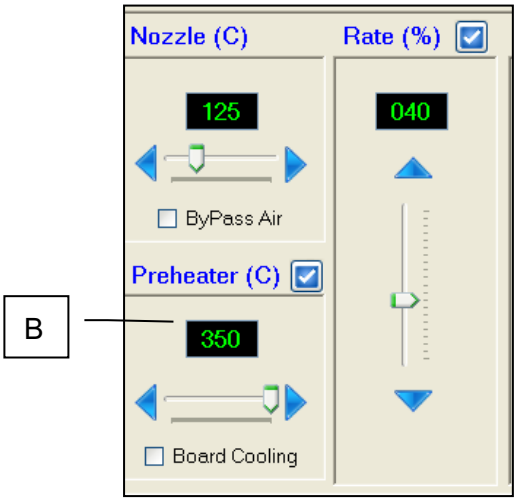
Be sure to change the flow in all events except Preheat (click on each event radio button to access the event flow rate).




The update-all buttons offer the ability to quickly update all the events based on the current event settings.

**NOTE: The flow rate in the preheat event will change when you update all flow rates. Change it back to the original 30%.**

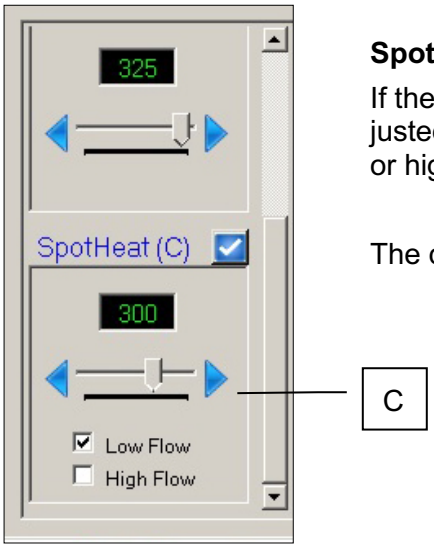
- If you are reworking a high thermal mass board, (3.0mm and higher thickness) increase the nozzle temperature by 25 degrees in each event except Preheat and Reflow 2.




**Preheater:**

Preheater temperature **(B)** is typically set to 300˚C (tin lead) or 325˚C (lead-free) for the preheat event, then reduced to for subsequent events to a level that maintains board top side temperature.

**NOTE:** Preheater can be raised to a maximum of 350˚C during preheat for high thermal mass assemblies.

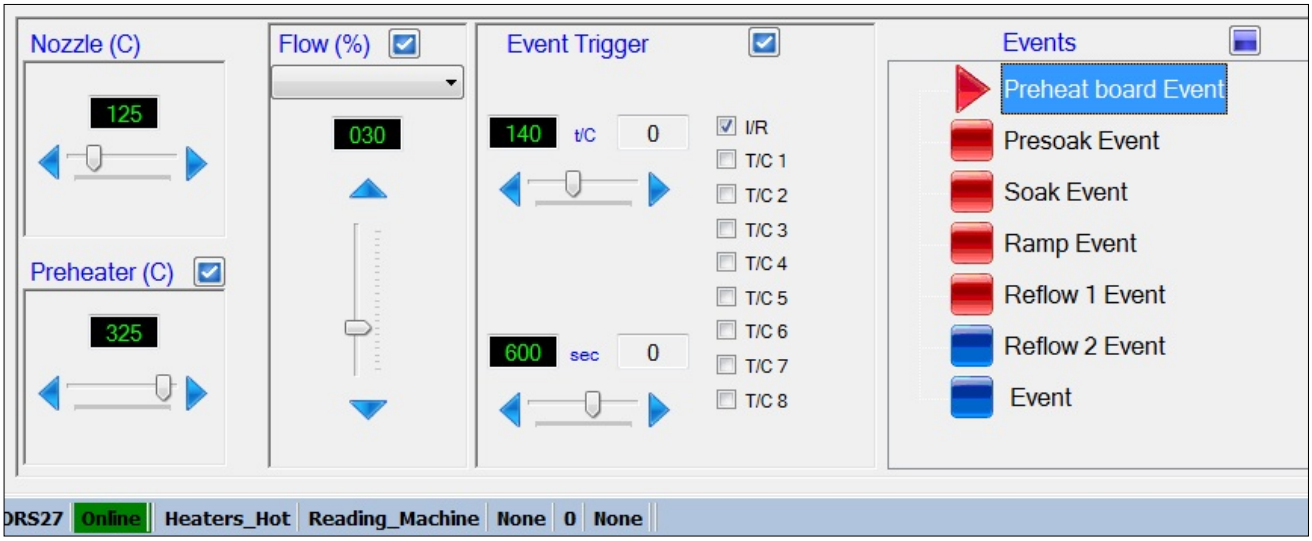



**Spot Heater:**

If the Spot Heater option is installed on the system, this section can be adjusted **(C)** to set the spot heater temperature for each event and if low flow or high flow should be enabled.

The default setting is 325˚C, low flow.

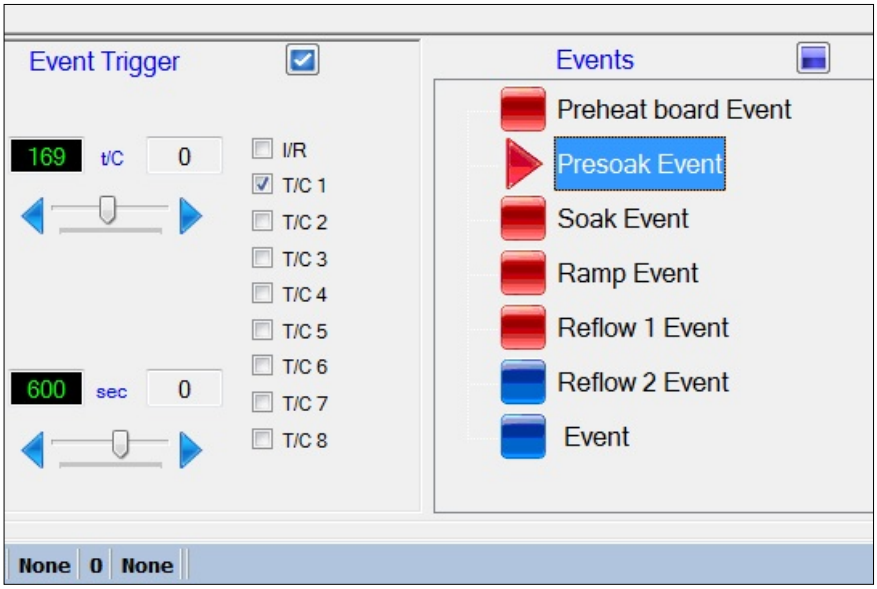
**Preheat Flow Rate:**




Low temperature air flow from the nozzle may impede preheating the board due to ambient air moving across the surface. The programmer has the option to:

1. Keep the air flow of the upper heater low, for example, 30% to reduce the air current cooling effect. This method will allow the system to have to stable, repeatable initial conditions prior to the remaining heating events.
2. Turn off the upper heater, no air flow or temperature, during the preheat event. This event may allow the board to preheat quicker.

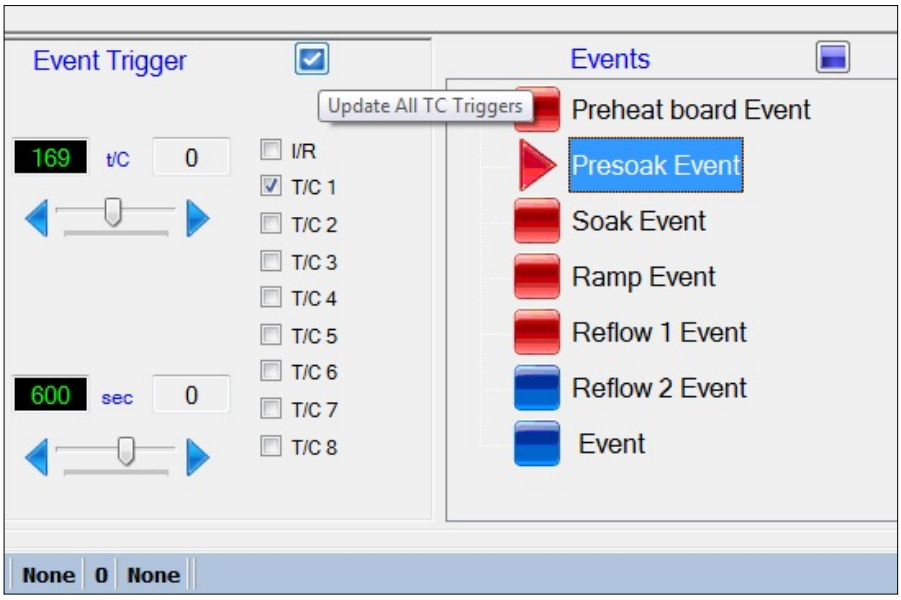
## Event Trigger




Click on **PreSoak Event** Stage in the **Events** list and check mark the channel(s) being used to control joint temperatures during process.

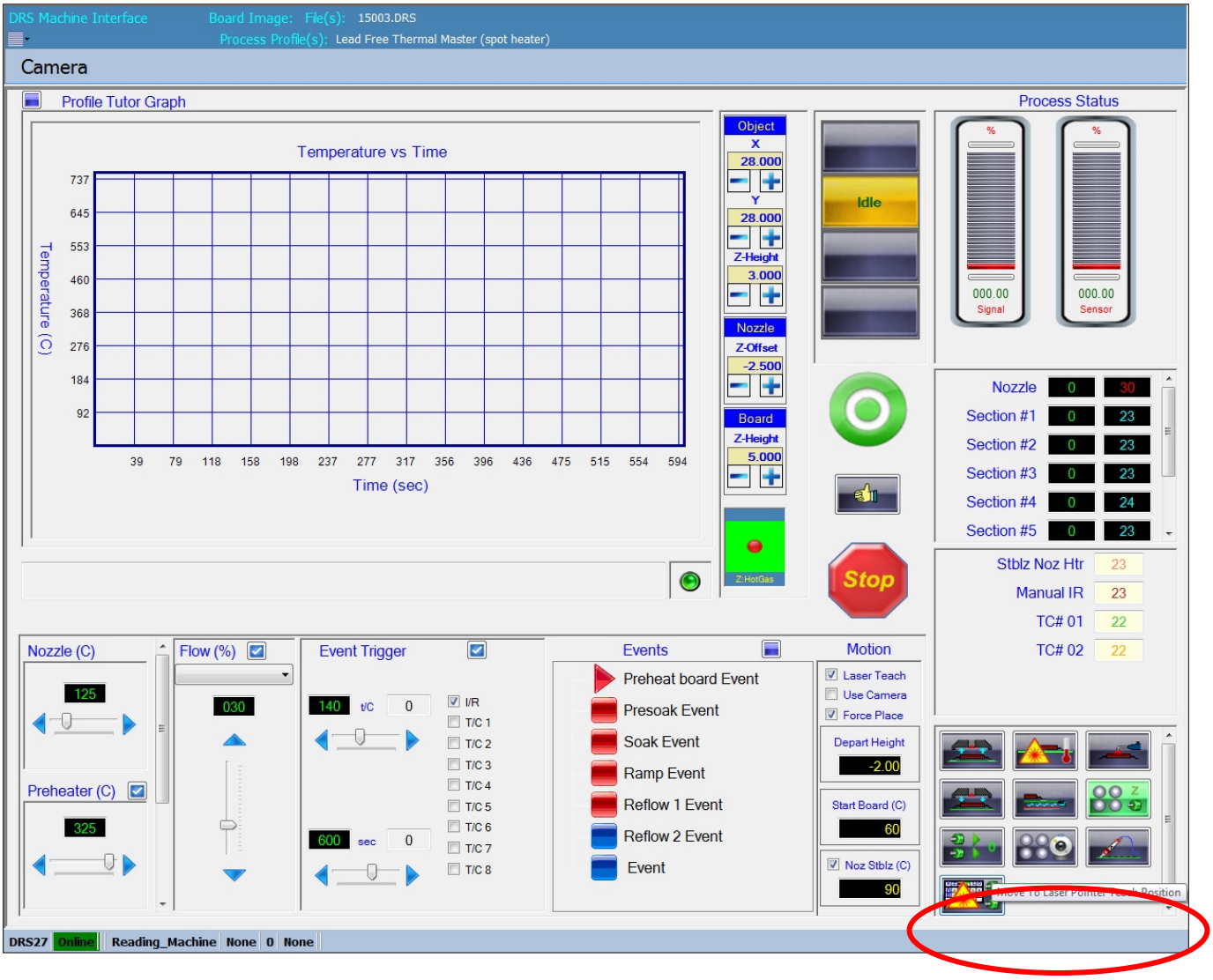
If only one TC is monitoring joint temperature, the T/C 1 box should be checked as shown above. If three TC's are monitoring joint temperature, T/C 1, 2, and 3 boxes all should be checked.

Click on the **Update All TC Triggers** box.

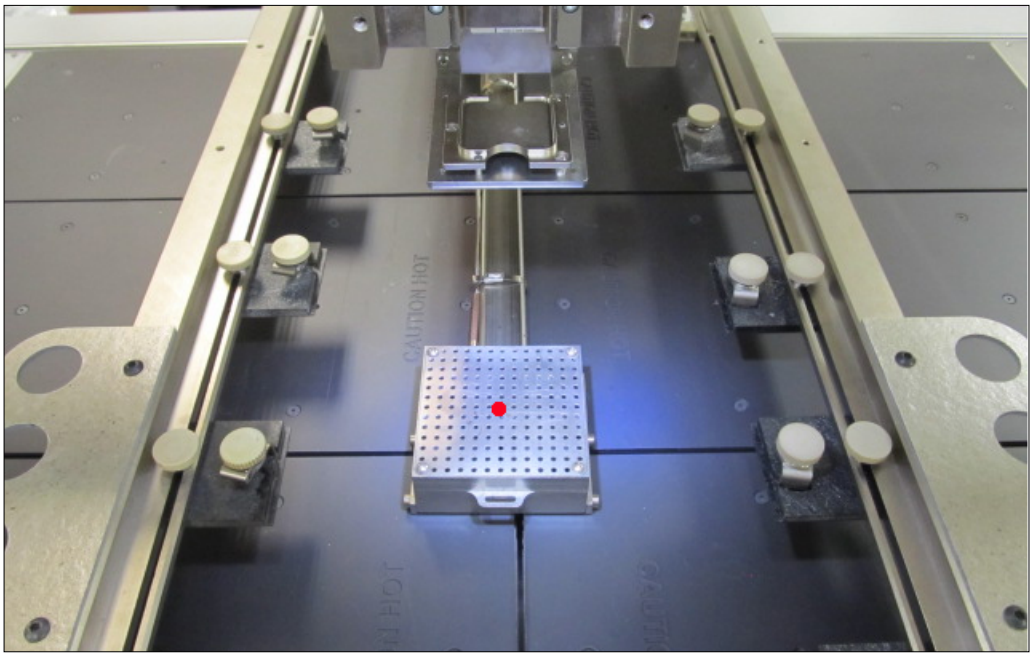


## Initializing Process Development Run

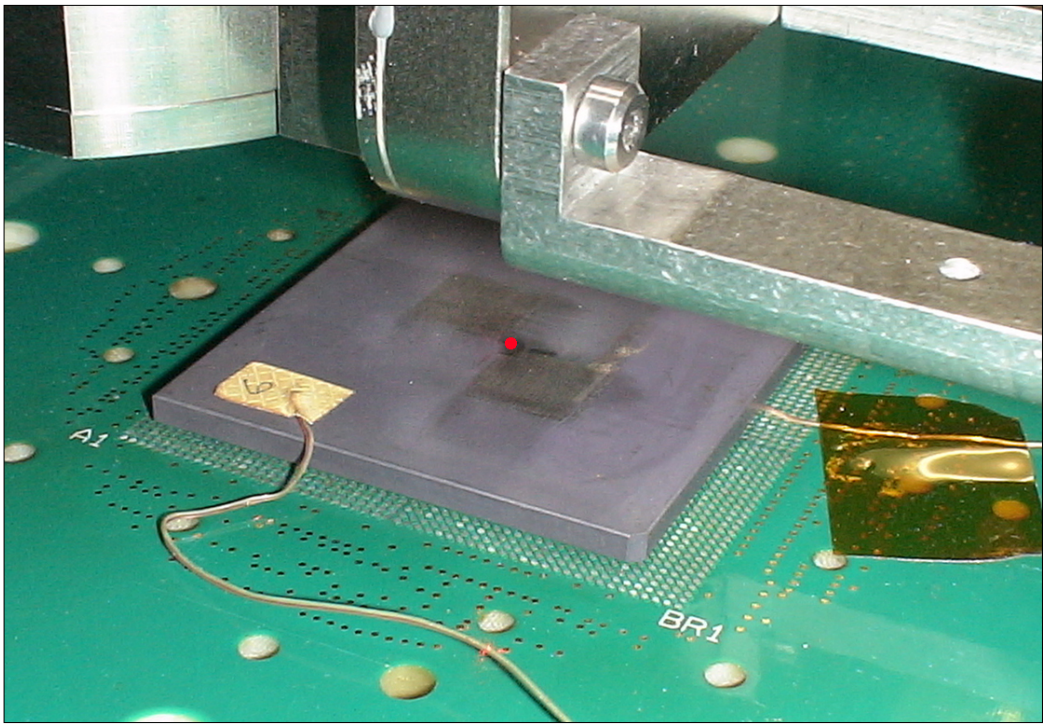
- Install the EZ Nozzle that matches the component size or is slightly larger than the component. **NOTE: If the EZ Nozzle is smaller than the component, heating uniformity will be poor.**
- Click on the **Move To Laser Pointer Teach Position** icon.



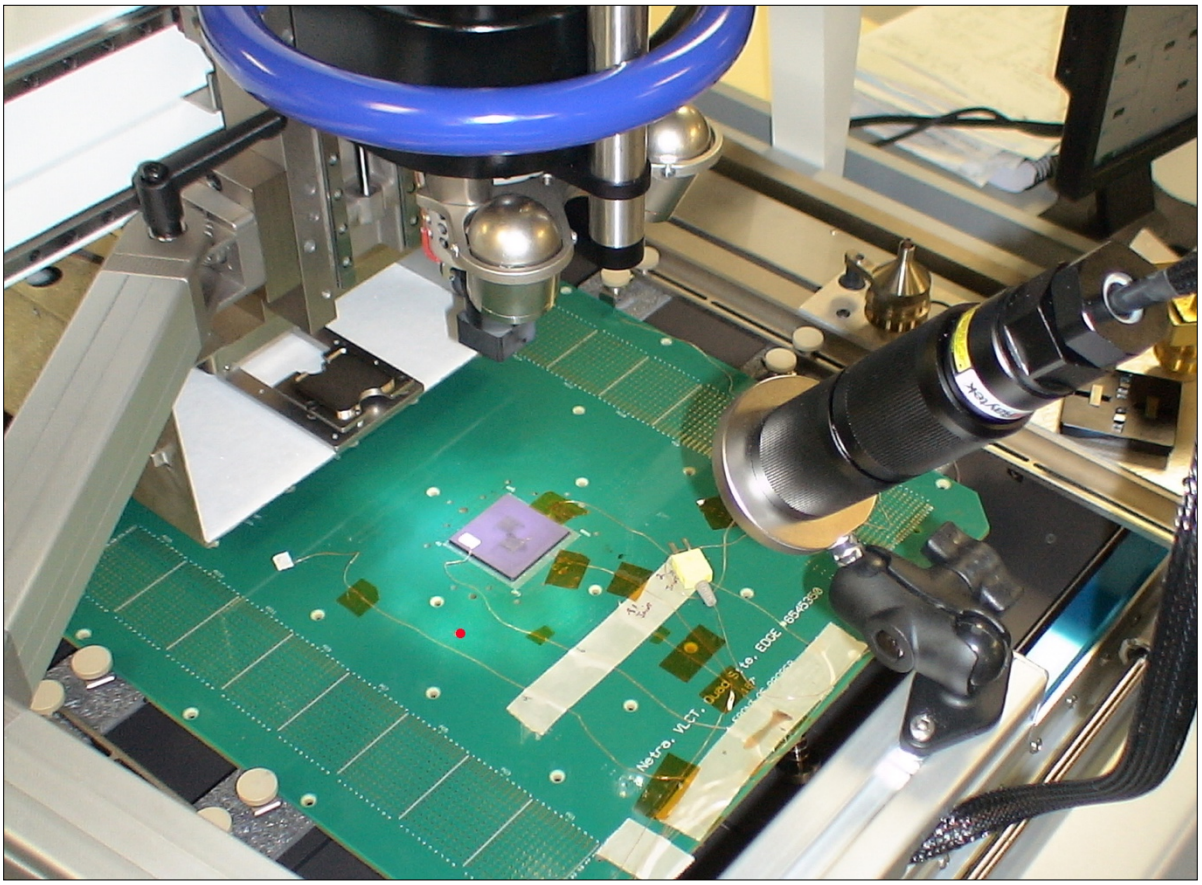
- The vision housing will move outward and the laser pointer will activate.
- Position the bottom spot heater near the center of the bottom heater plate.
- Move the z-head using the blue ring so the red laser dot is roughly centered on the spot heater.



- Install the board so the laser pointer is also centered on the component.



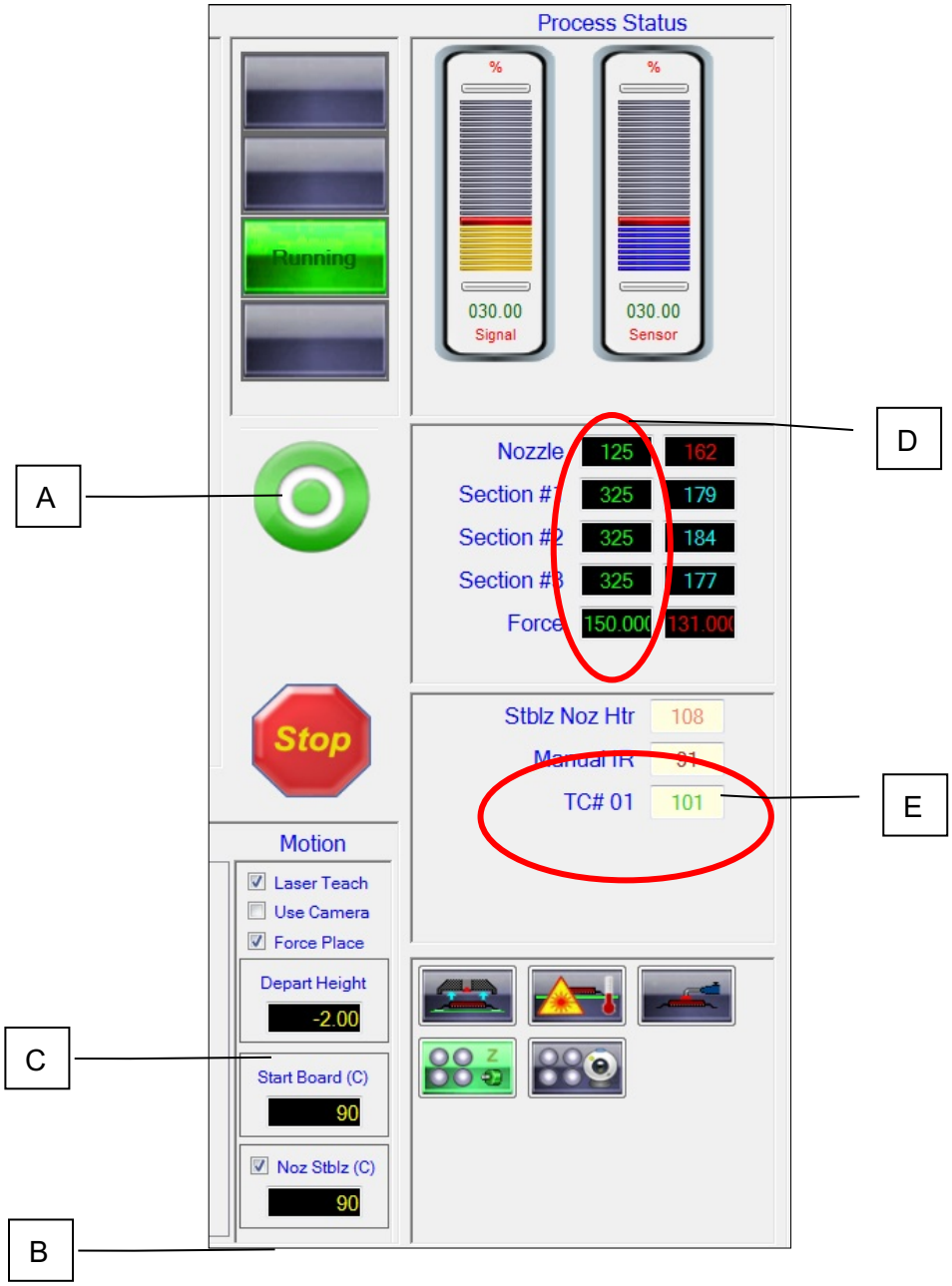
- Lock the carrier arms and tighten the hold down clamps.
- Position board supports if necessary.
- Install the joint thermocouple(s) and plug in to channel 1 (2,3).
- Click on the icon. Use the Laser Pointer to position the IR sensor 2-3 inches away from the component.



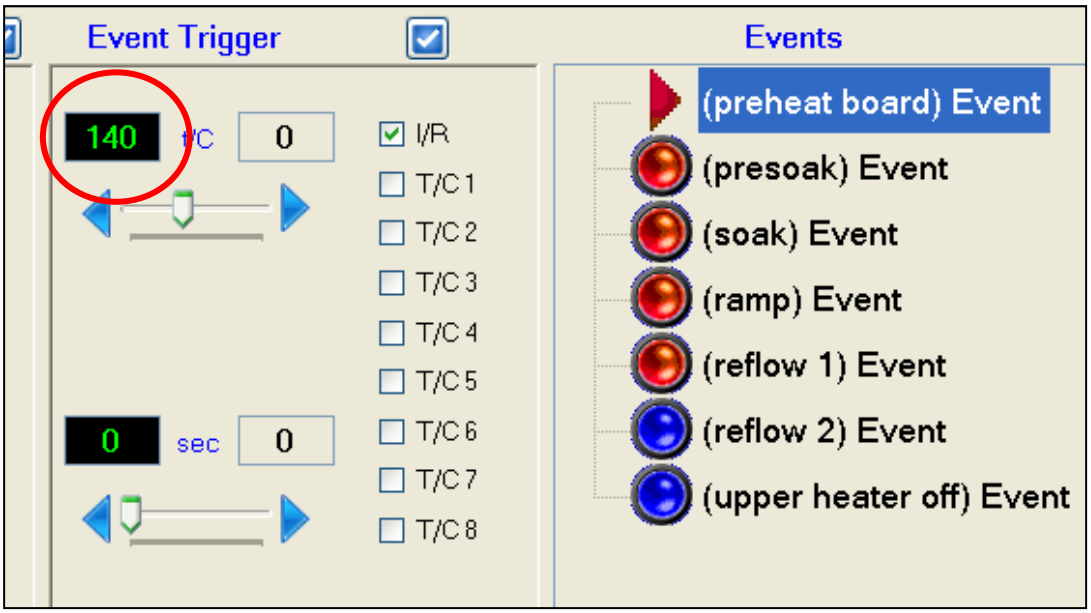
- Click on the Start icon **(A).**
- The nozzle stabilization routine will run until the head TC reaches its target temperature of 90˚C **(B).**

  **NOTE: The head stabilization routine is critical for thermal repeatability.**
- The vision system will extend and the laser pointer teach position red dot will activate. The laser should already be centered on the component.
- The vision system will retract when you click on the yellow footswitch message.
- The nozzle will then move downward and touch the component under force control and will retract the programmed height **(C).**

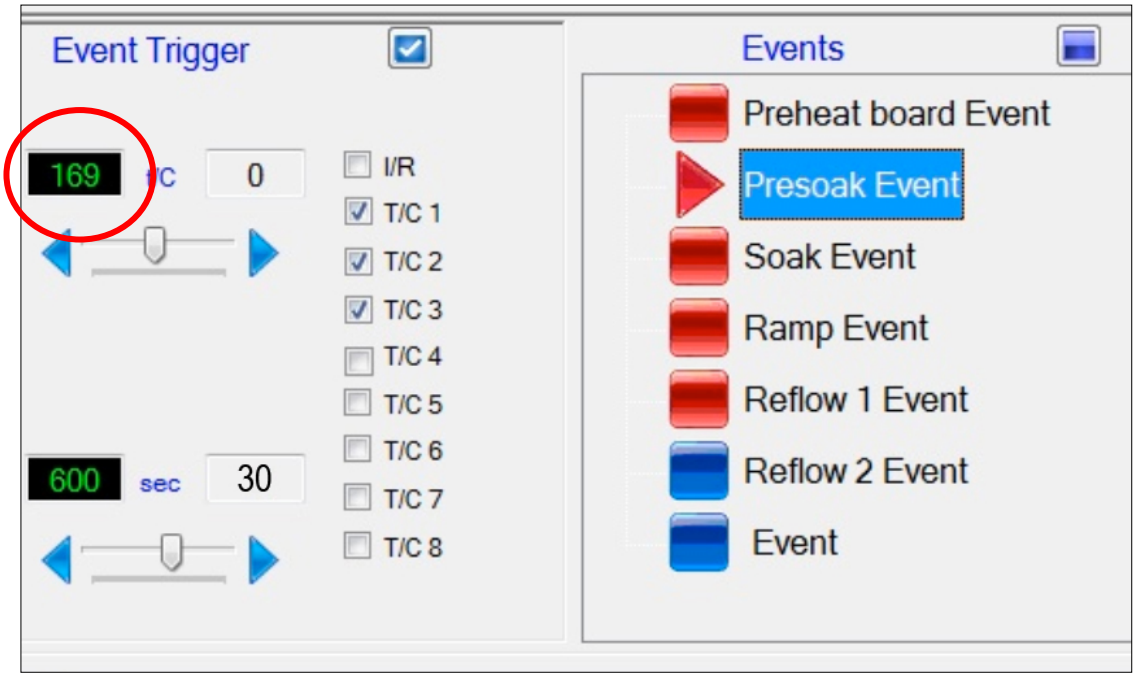
  **NOTE: If the nozzle is not centered over the component, use the x/y wheels to correct this.**
- The thermal profile will begin execution and the graph will plot temperatures for the heaters **(D)** and thermocouples **(E).**



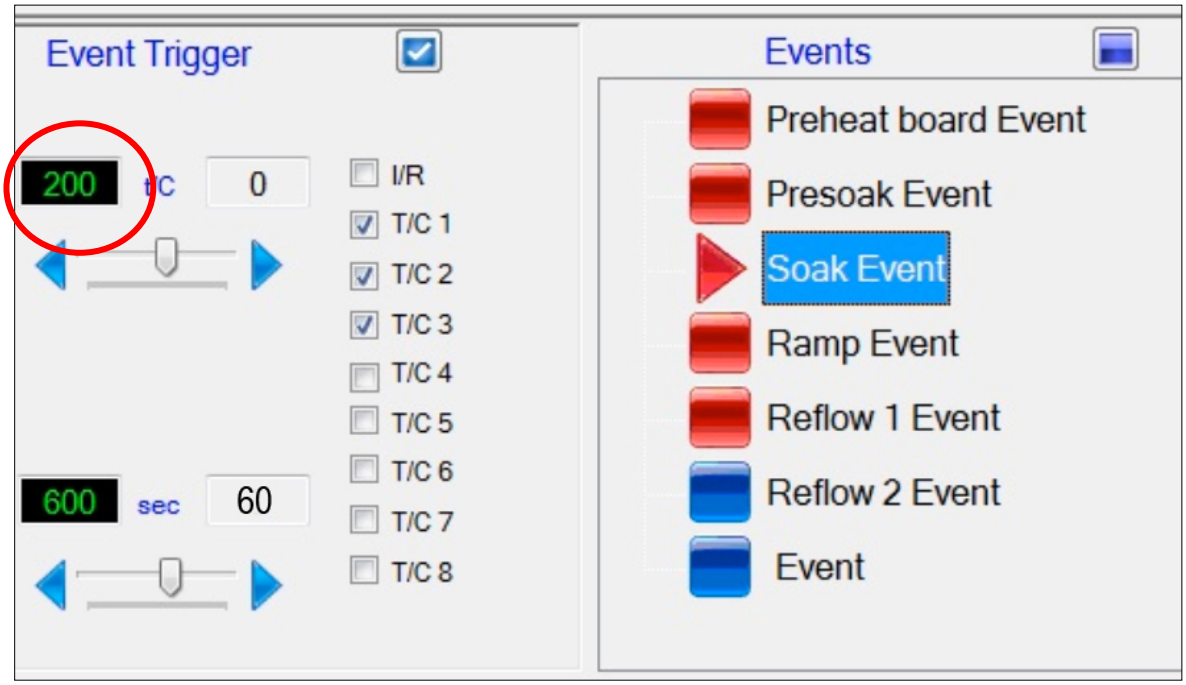
The **Preheat Event** will continue until the IR Probe reaches 140°C (Lead-Free profile) or 100°C: (Tin Lead profile). Time is not used as this is a temperature based event using the IR probe.




The **Presoak Event** will continue until T/C#1 (or multiple checked TC's if used) reaches 169°C (Lead-Free profile) or 139°C (Tin Lead profile). Time in Presoak stage is automatically recorded and saved. If one thermocouple is providing an erroneous reading it may eliminated from the event by clearing the box.

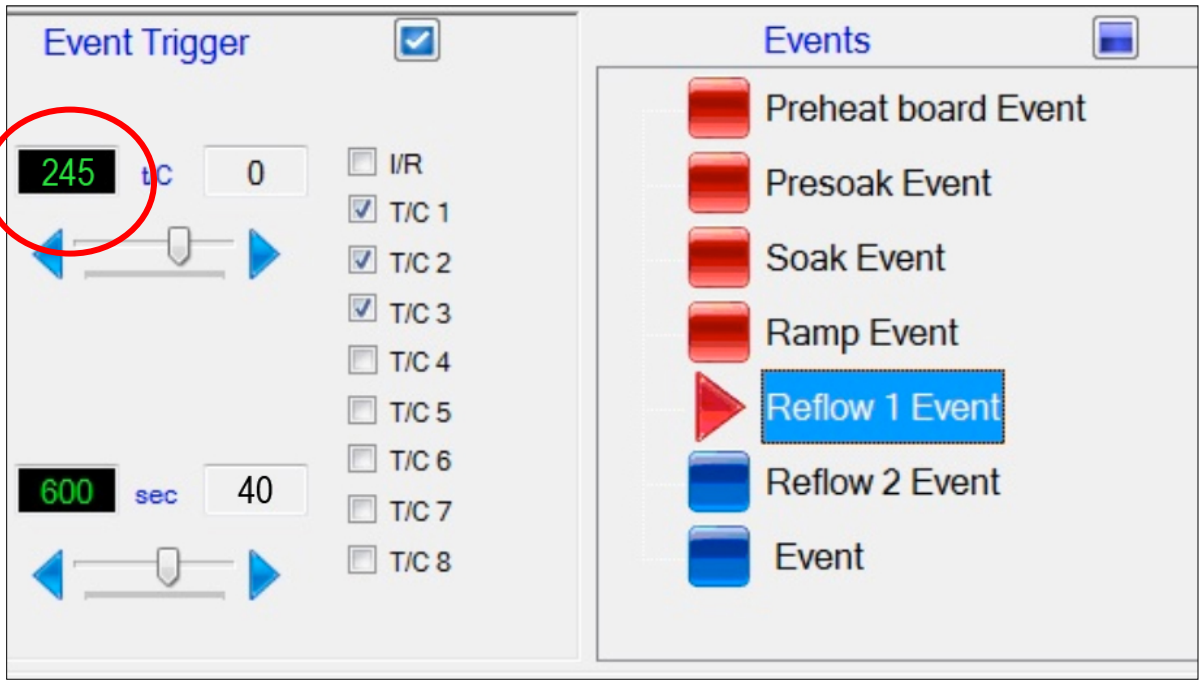


The **Soak Event** will continue until T/C#1 reaches 200°C (Lead-Free profile) or 165°C (Tin Lead profile). Time in Soak stage is automatically recorded and saved.

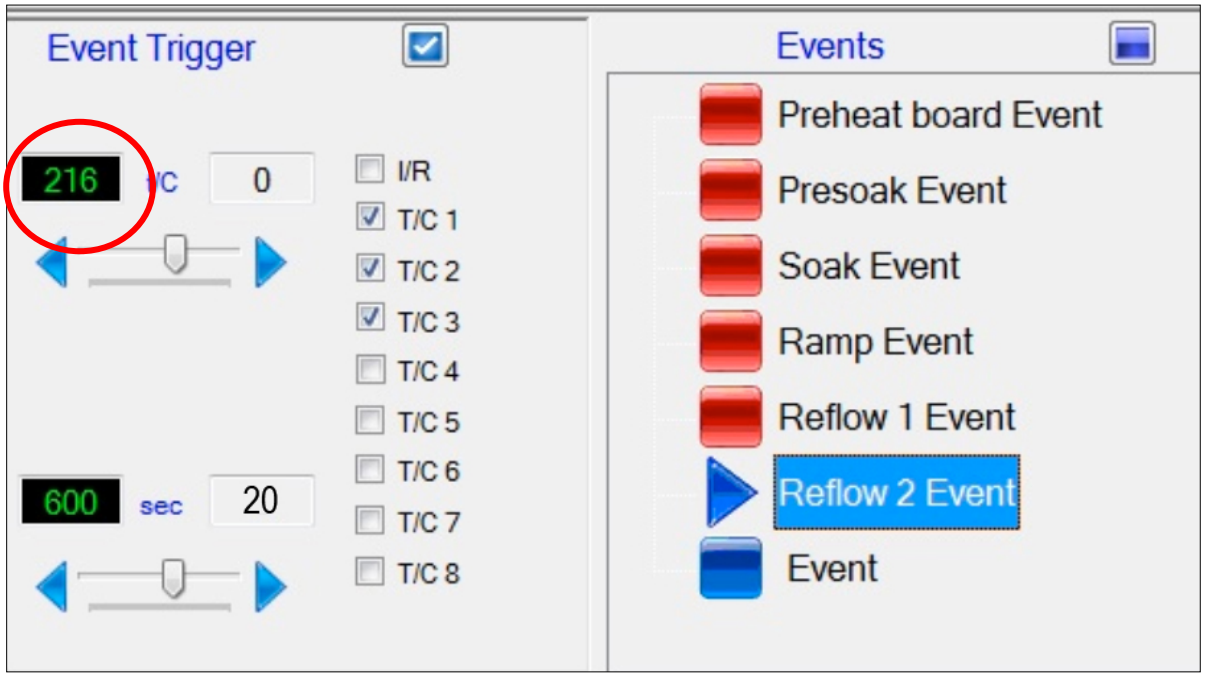



The **Ramp Event** will continue until T/C#1 reaches 216°C (Lead-Free profile) or 182°C (Tin Lead profile). Time in Ramp stage is automatically recorded and saved.

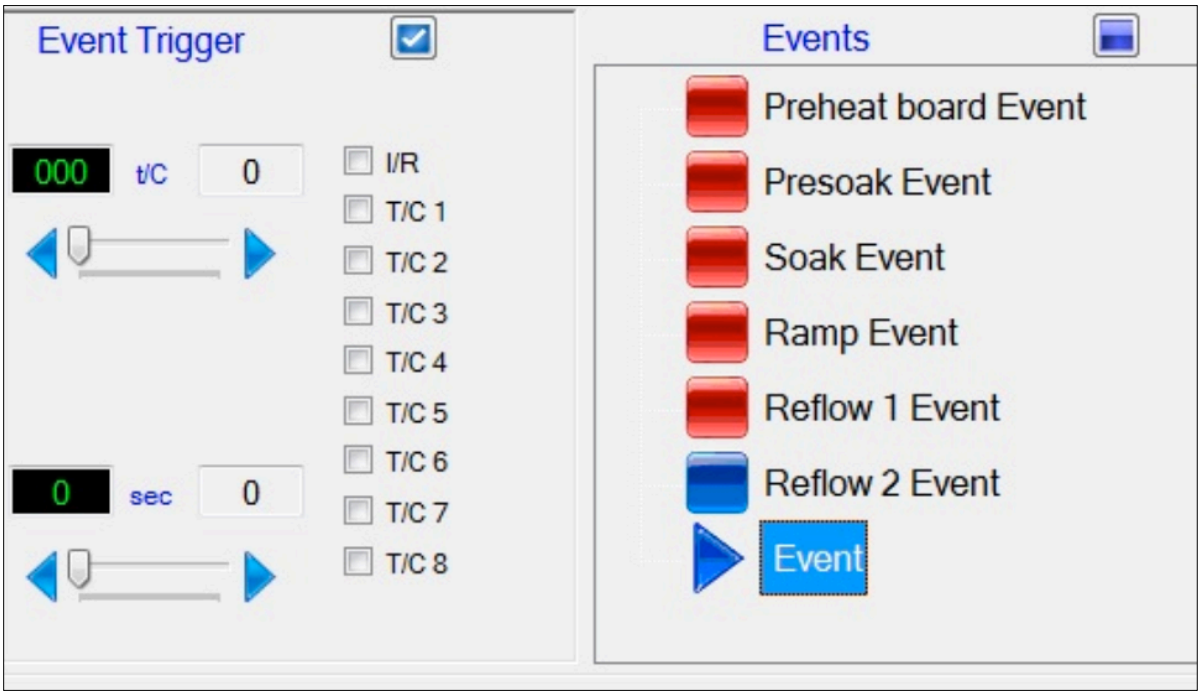
The **Reflow 1 Event** will continue until T/C#1 reaches 245°C (Lead-Free profile) or 215°C (Tin Lead profile). Time in Reflow 1 stage is automatically recorded and saved.




The **Reflow 2 Event** will continue until T/C#1 drops down below 217°C (Lead-Free profile) or (183°C: Tin Lead profile). Time in Reflow 2 stage is automatically recorded and saved. **NOTE: Total time over reflow is the sum of Reflow 1 and Reflow 2.**

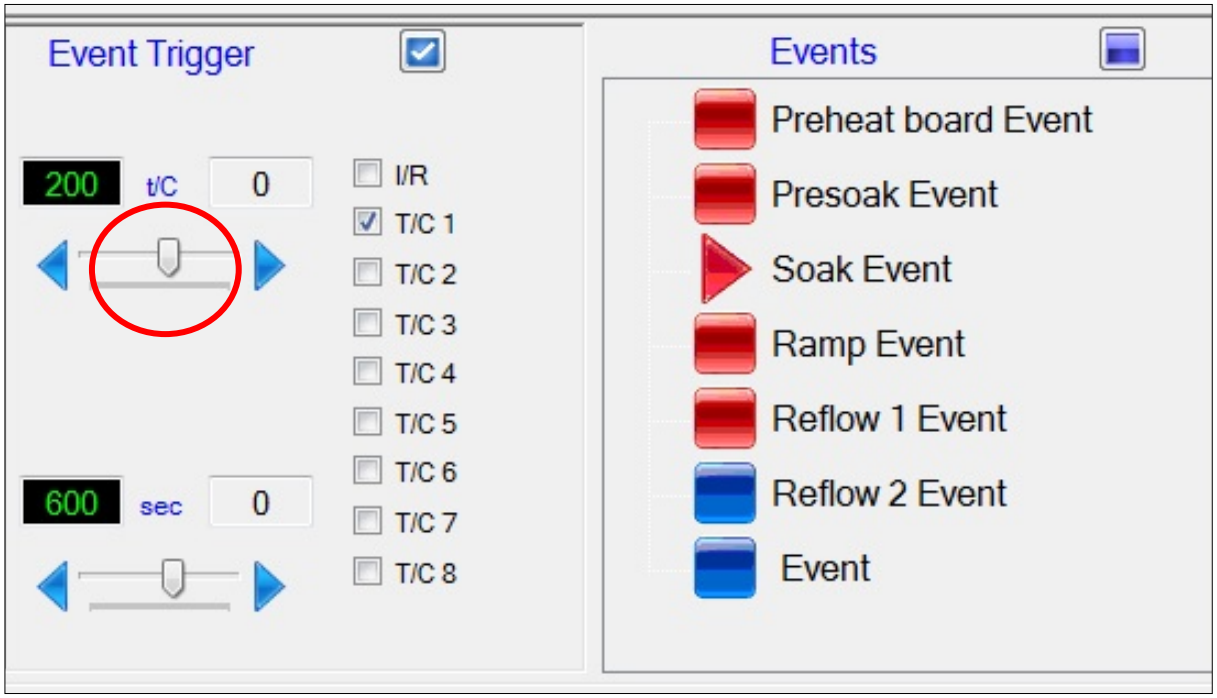


The **Upper Heater Off Event** – 0 seconds

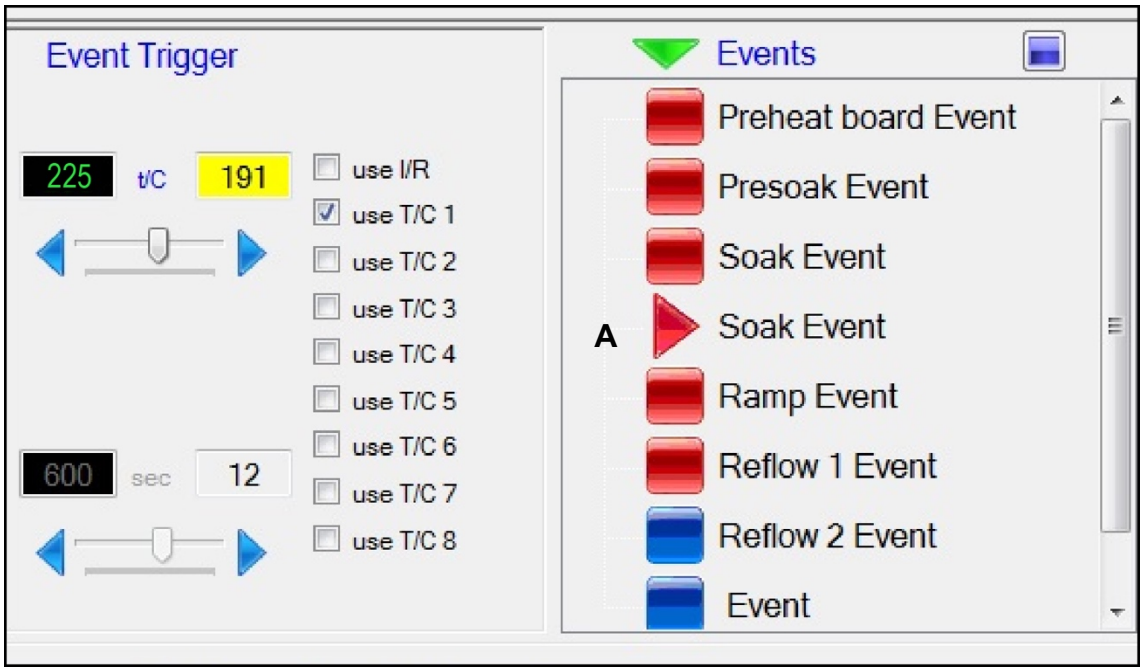



**IMPORTANT!**

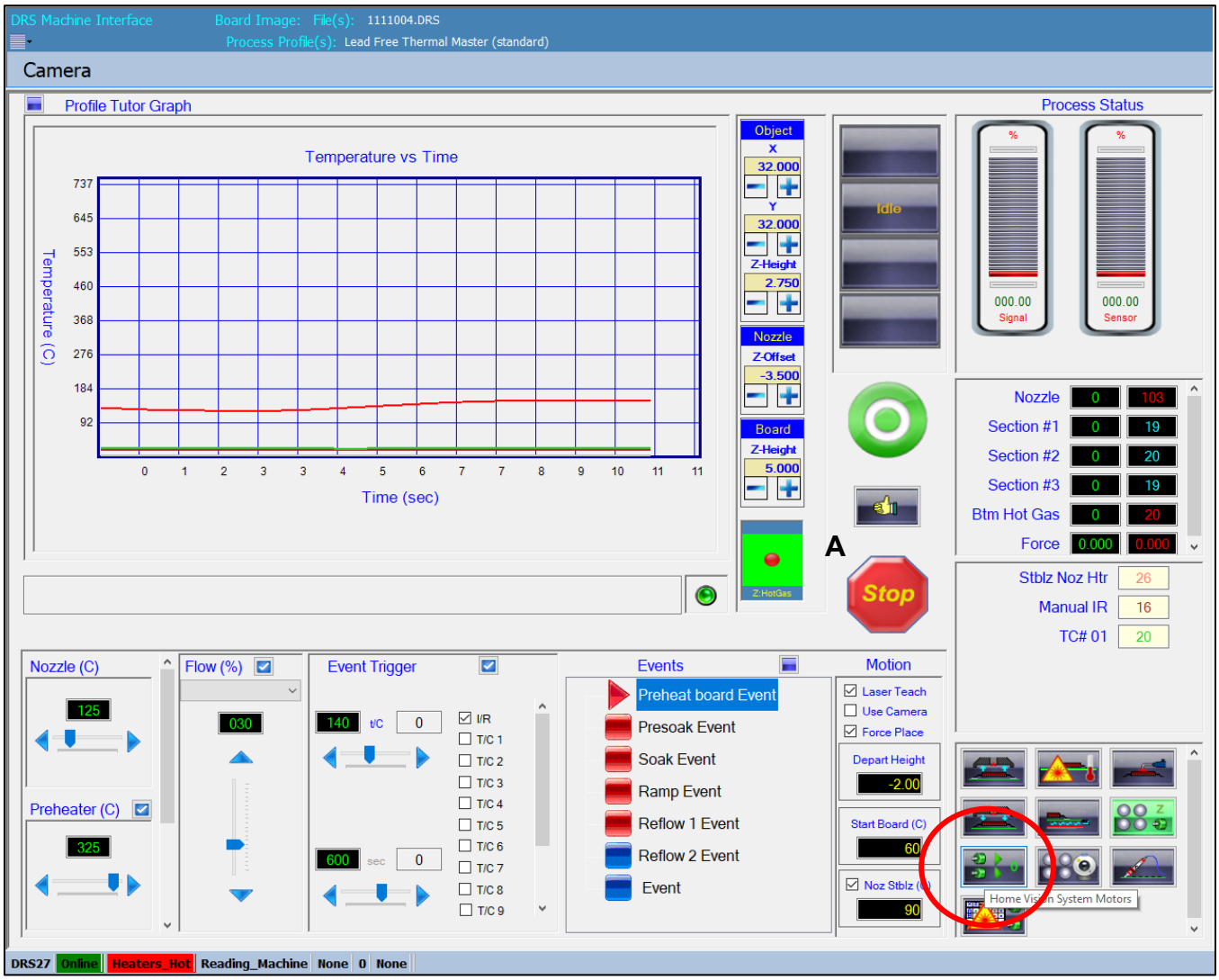
**If the Event Trigger temperature is not being reached in a reasonable amount of time (30 seconds in Presoak and Ramp, 60 seconds in Soak and Reflow1) click on the Nozzle Temperature tab and drag it to the right so that the temperature increases by 25 degrees.**



A new **Event (A)** will be inserted automatically and the nozzle temperature will increase to the new set-point.



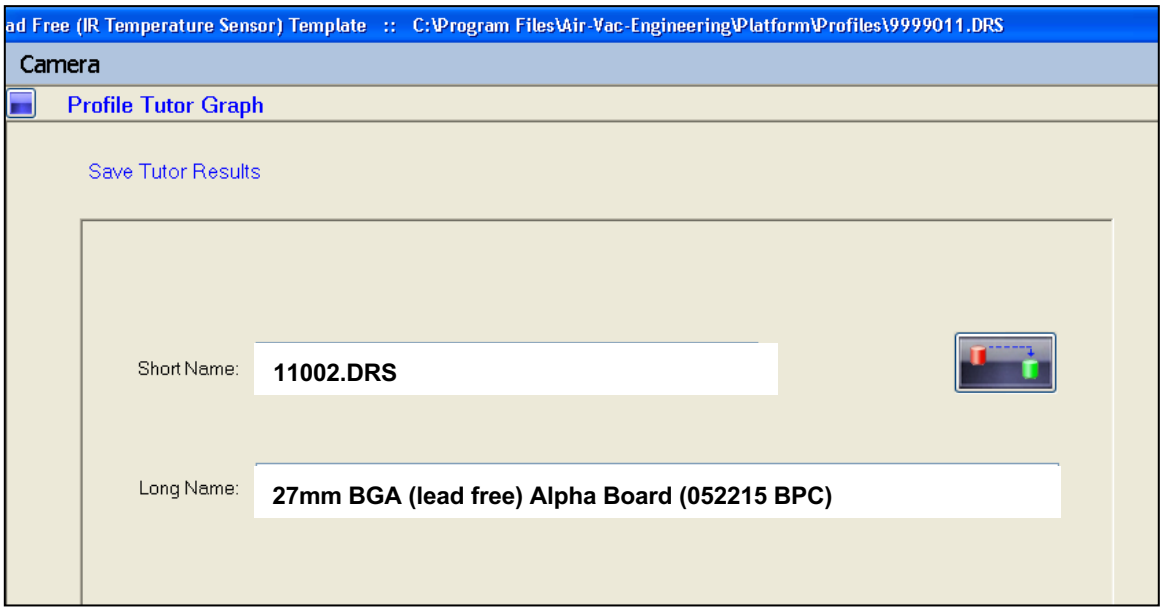
If you **stop (A)** the Thermal Profile, you must click on the green **Home Vision System icon (B)**, before you restart the process.




B

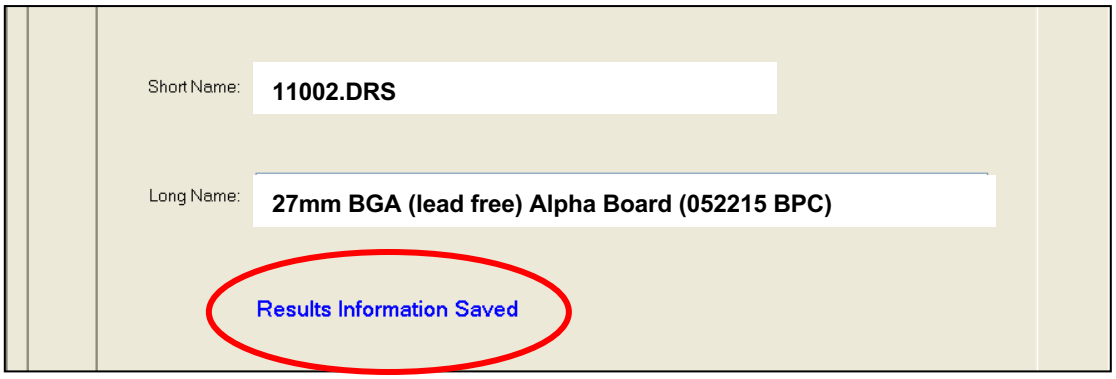
**Automatic prompt to Name and Save new thermal profile.**

- Input in Long Name box a name for this thermal profile. Common naming protocals include assembly name, component type and size, tin lead (TL) or lead-free (LF), nozzle used, and creation date/creator initials.
- Click on red/green icon to save.

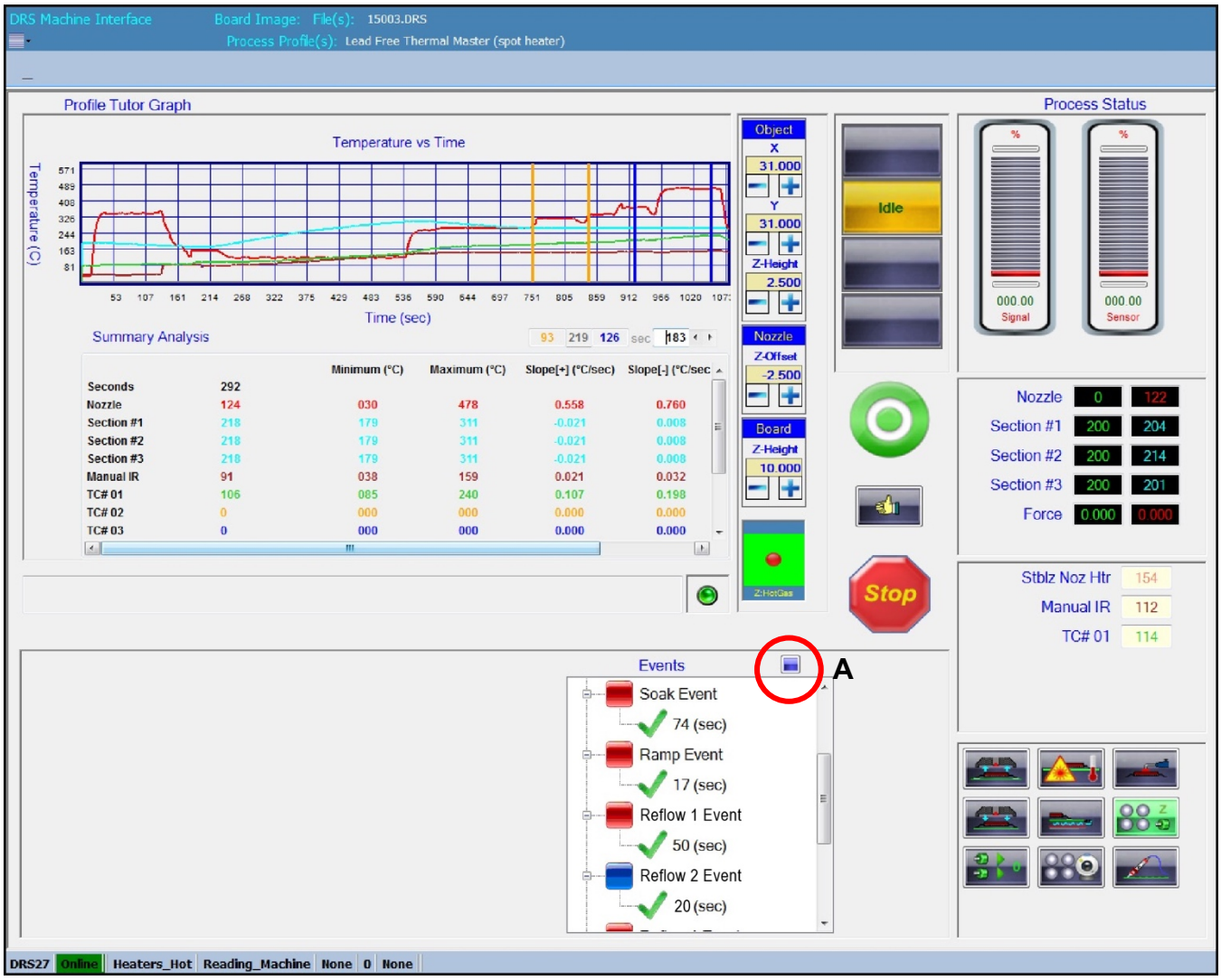



**Confirmation of save.**

WARNING: If you exit Tutor without saving the graph, the process information will be lost.



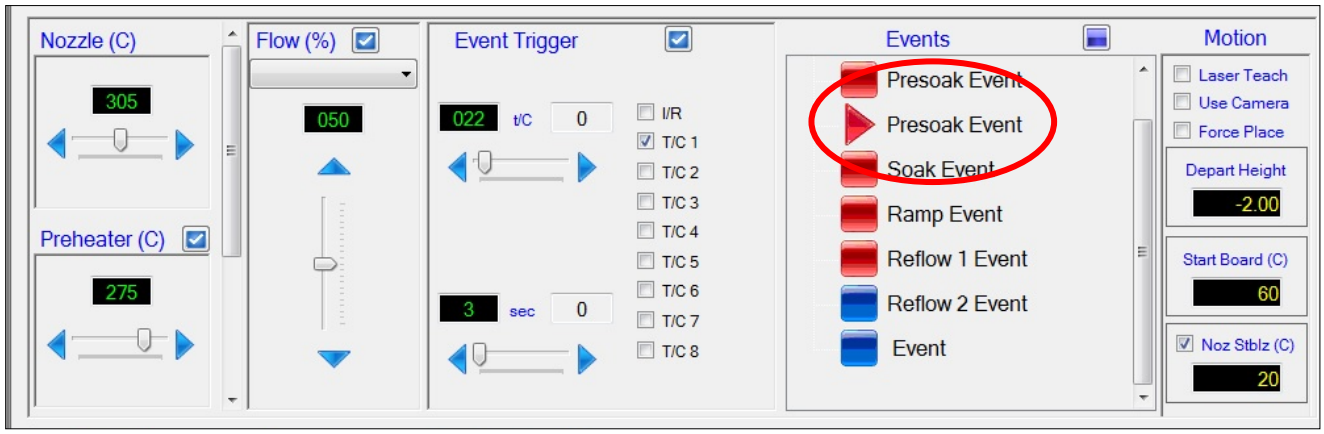
### 5.0.4 Tutor Screen: Thermal Analysis




- This screen can be activated by clicking on the Analysis-toggle button **(A)**.
- Compare the actual time in the Soak Event to the Target Soak time of 45-75 seconds.
- Compare the actual time in the Reflow 1 and 2 events to the Target Reflow time of 45-75 seconds.
- If the actual Soak and Reflow times fall within the targeted time ranges, you have created a good thermal profile. Proceed to the Profile Build section.
- If the Soak and/or Reflow stage(s) are less than the minimum target of 45 seconds, the profile is too "hot" and has run too fast.
- If the Soak and/or Reflow stage(s) are greater than the maximum target of 75 seconds, the profile is too "cold" and has run too slow.

  **NOTE: High thermal mass components on high thermal mass assemblies have a 45-75 second soak range, however, the reflow stage may be as long as 120 seconds due to the longer time required to return to minimum liquidus temperature.**
- If the first iteration is too hot or too cold, a second iteration is required.

### 5.0.5 Running a Second Thermal Cycle

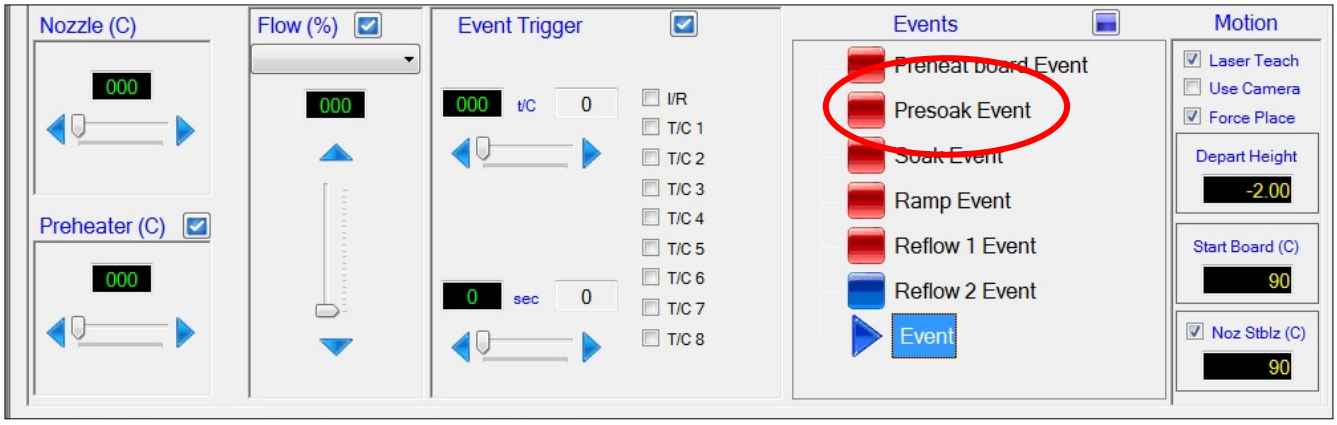



Profile events that have been added during the first run as a result of an on-the-fly adjustment should be deleted prior to starting additional tutor cycles.

**NOTE: The Event Trigger temperature must be reset.**

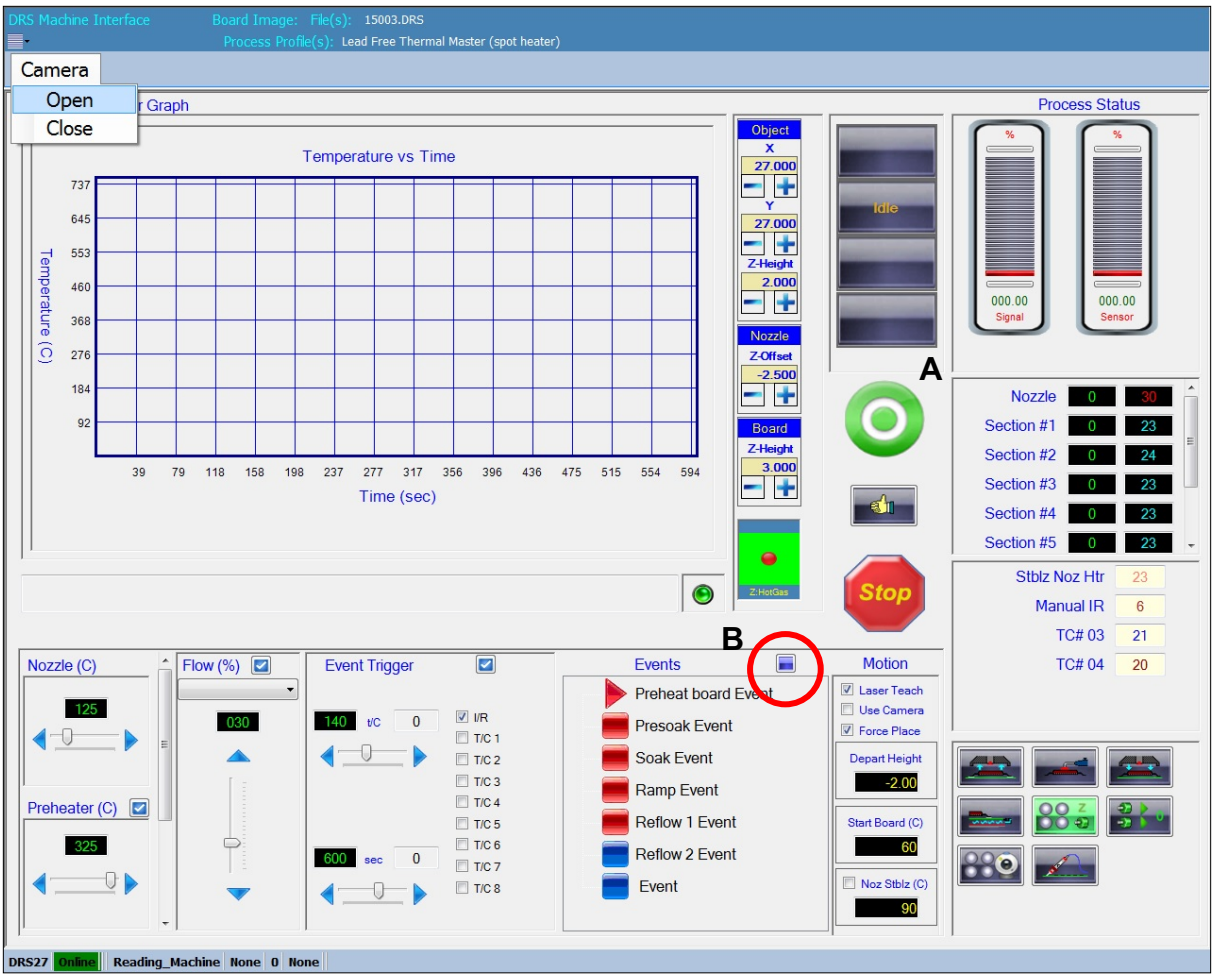
Procedure for deleting an added event:

1. Highlight the target event (left single click).
2. Right double click on the arrow event, will provide a delete message.
3. Click the ok button to accept/complete the delete activity.



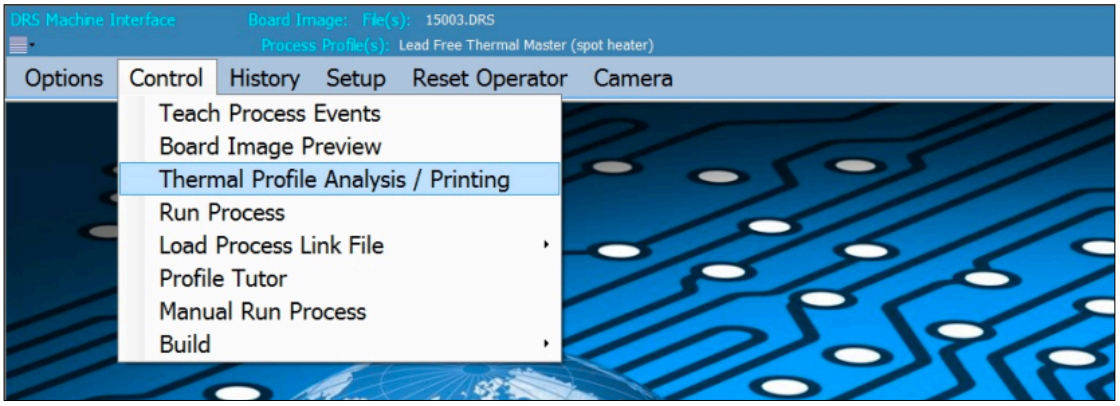
### Before Running a Second Cycle

- Decrease the Nozzle temperature by 25 degrees in the Presoak/Soak/Ramp/Reflow 1 stages if the Soak and/or Reflow 1 stages are less than 45 seconds. Decreasing the Nozzle temperature will slow the profile down and increase the time in each event.
- Increase the Nozzle temperature by 25 degrees in the Presoak/Soak/Ramp/Reflow 1 stages if the Soak and/or Reflow 1 stages are longer than 75 seconds. Increasing the Nozzle temperature will speed up the profile and reduce the time in each event.



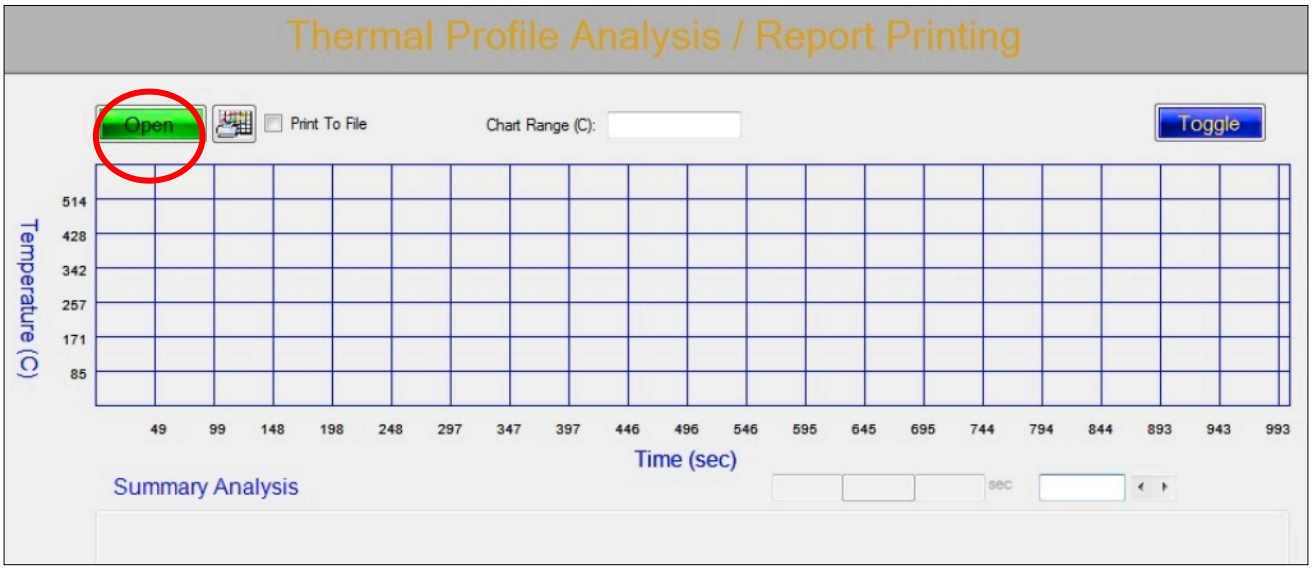

- Click on the **Start icon (A)**. Machine will automatically cool board and heater head to restart temperature then re-run process.
- Name and save the second run (recommended: same name as first run with "Rev 1" added).
- After the process is complete, click on the analysis icon **(B)** to again review the data. Continue to run iterations until acceptable soak and total reflow times are achieved.

### 5.0.6 Thermal Profile Record Keeping



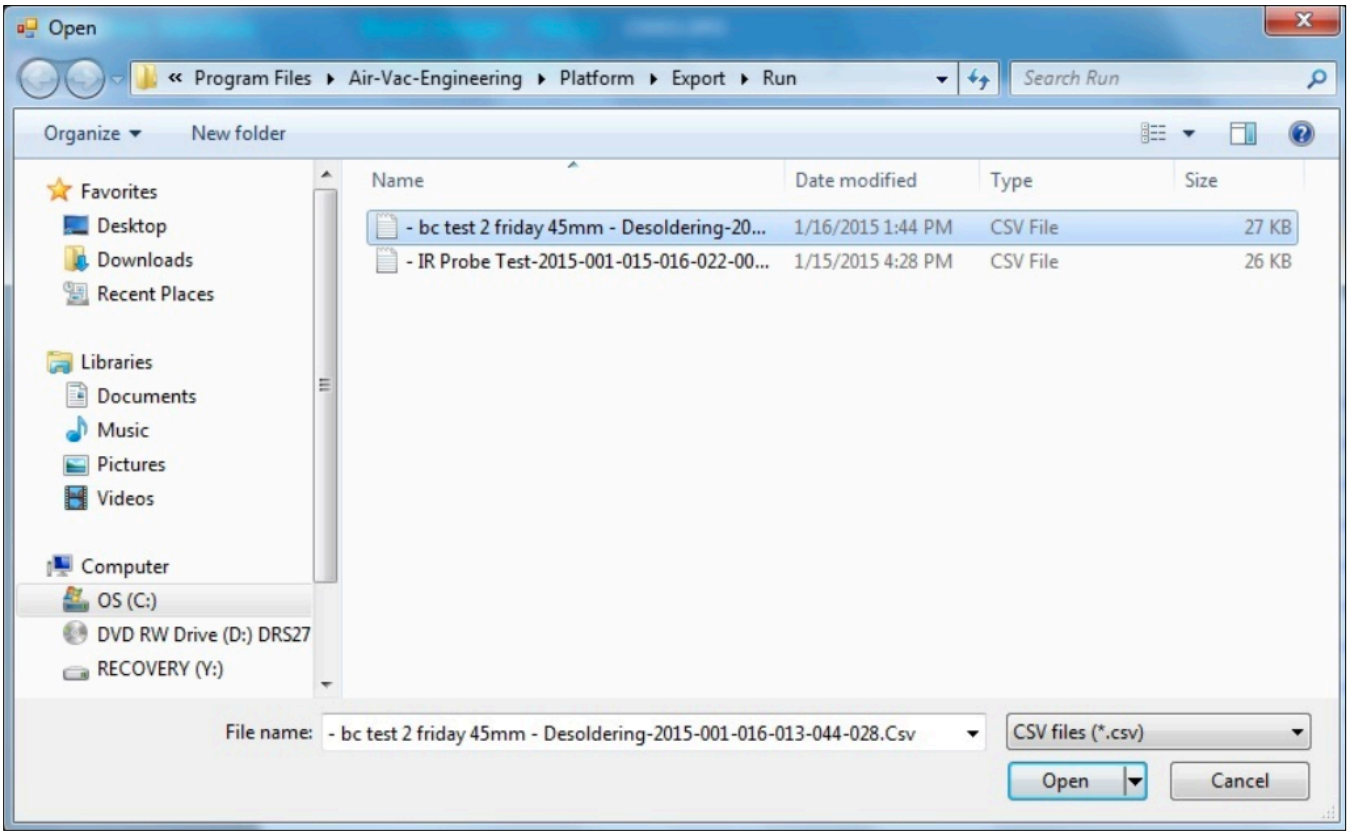

After a new thermal profile is created, the thermal profile is saved. The Thermal Profile Analysis tool is used for documentation and reference to analyze the profile.

- Click on the green icon.

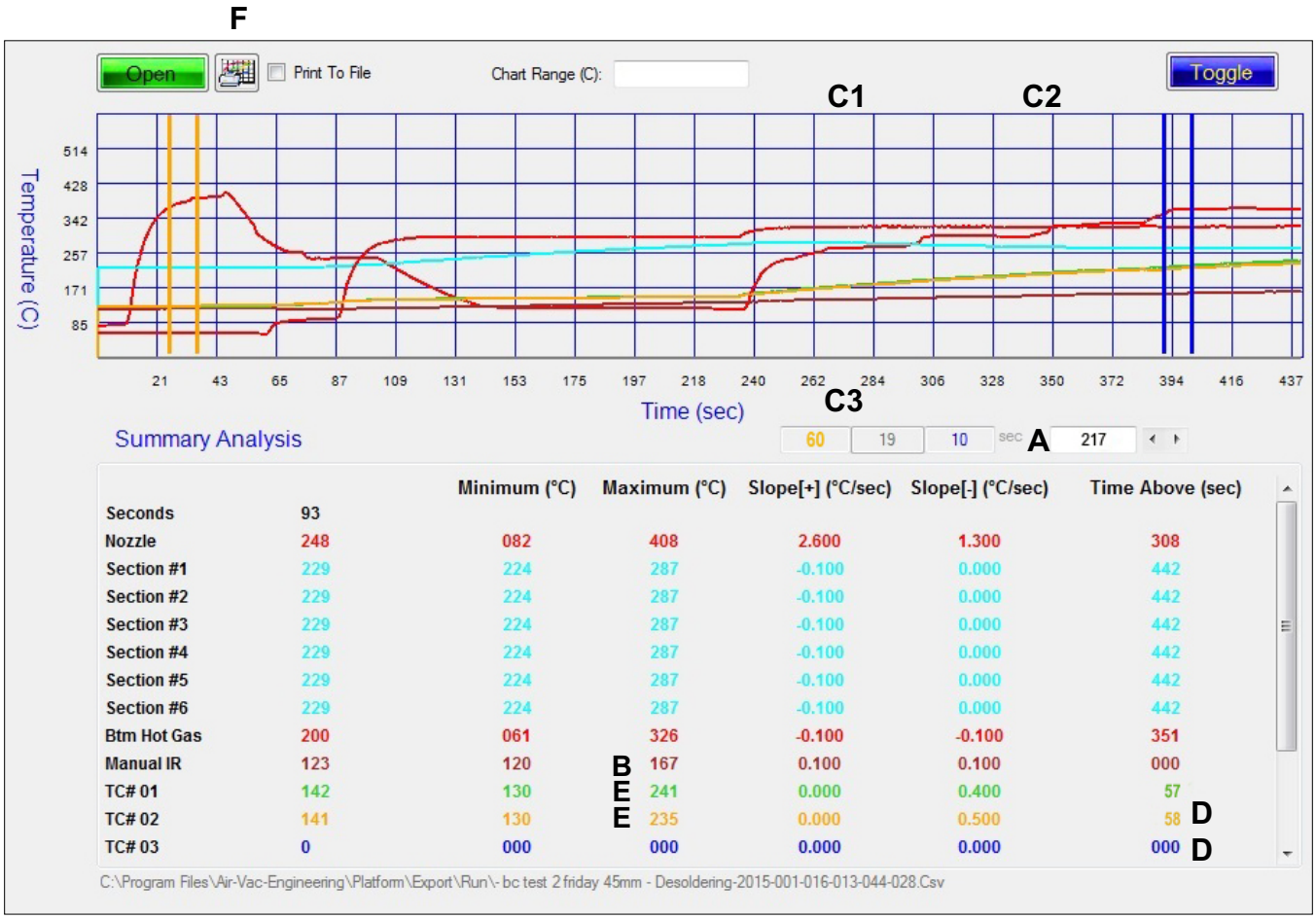


Insure that you are looking in the Tutor folder.

- Path to data is **C: Program Files>Air-Vac Engineering>Platform>Export>Tutor**
- Double click on the thermal profile that you just created to open it.



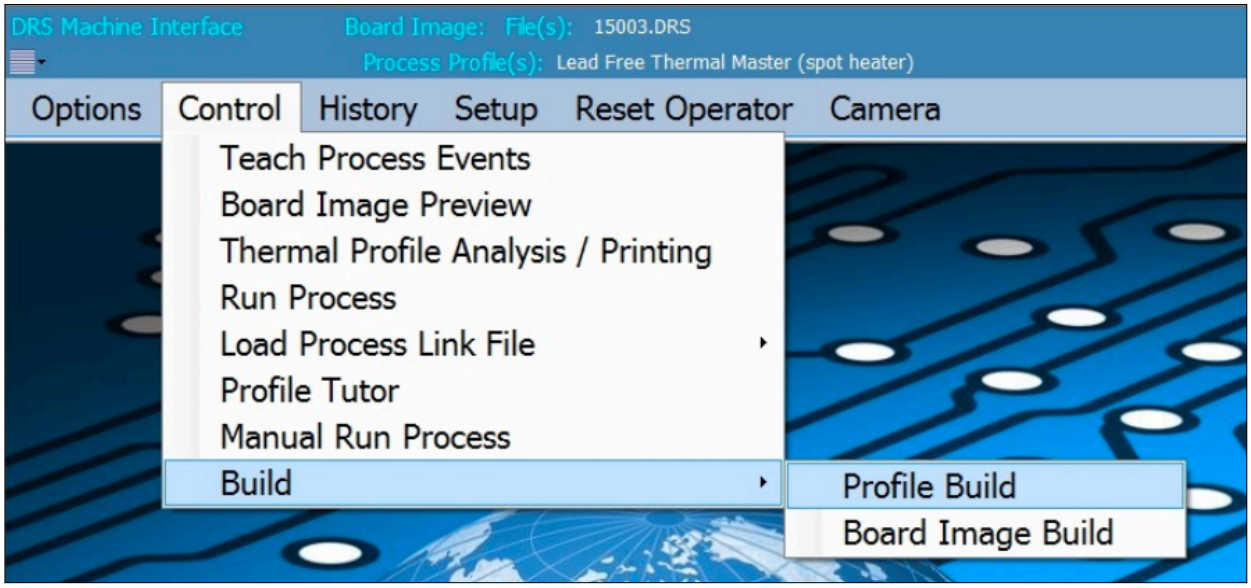
- Change "Time Above" box **(A)** to 217 (Lead-Free), 183 (Tin Lead).
- Preheat – Verify that max top side board temperature **(B)** did not exceed 190C (ok 167C).
- Soak – Position first yellow bar **(C1)** where T/C#1 is 170C, second yellow bar **(C2)** where T/C#1 is at 200C. Soak stage **(C3)** should be 45-75 seconds (ok 60 seconds).
- Reflow – Joints **(D)** should have time above 217C of 45-75 seconds (ok 57 and 58 seconds). Confirm max joint temperature **(E)** was approximately 240C (ok 241, 235).
- Maximum package temperature should not exceed 260 (ok 248C).
- The thermal profile can be printed **(F)** for permanent record keeping.



### 5.0.7 Profile Build

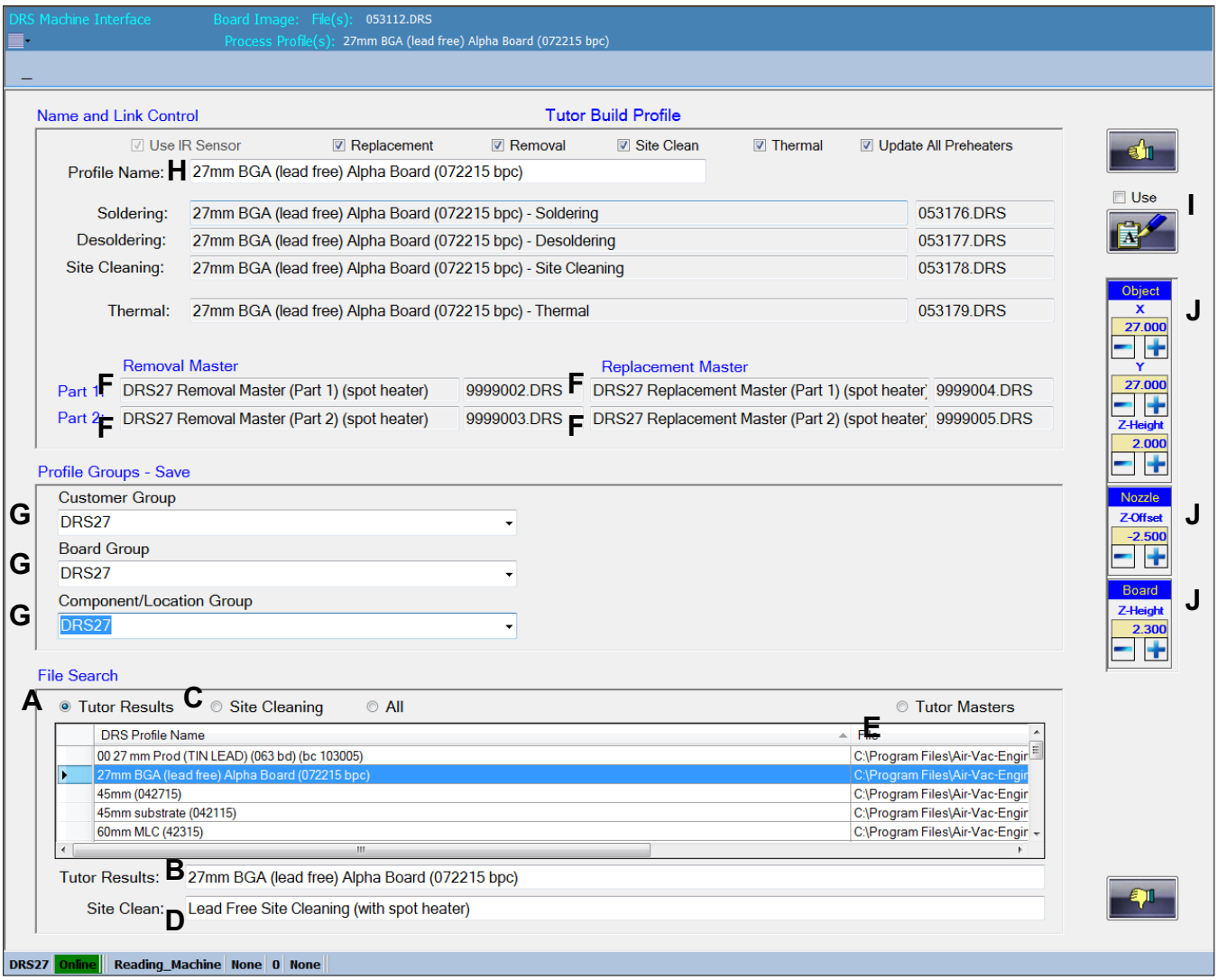
Now that a good thermal profile has been created and saved for the new application, the Automatic Profile Build function is used to integrate the new thermal profile into a complete rework process that enables the user to remove, site clean and replace the new component.

- Select Control/Build/Profile Build.



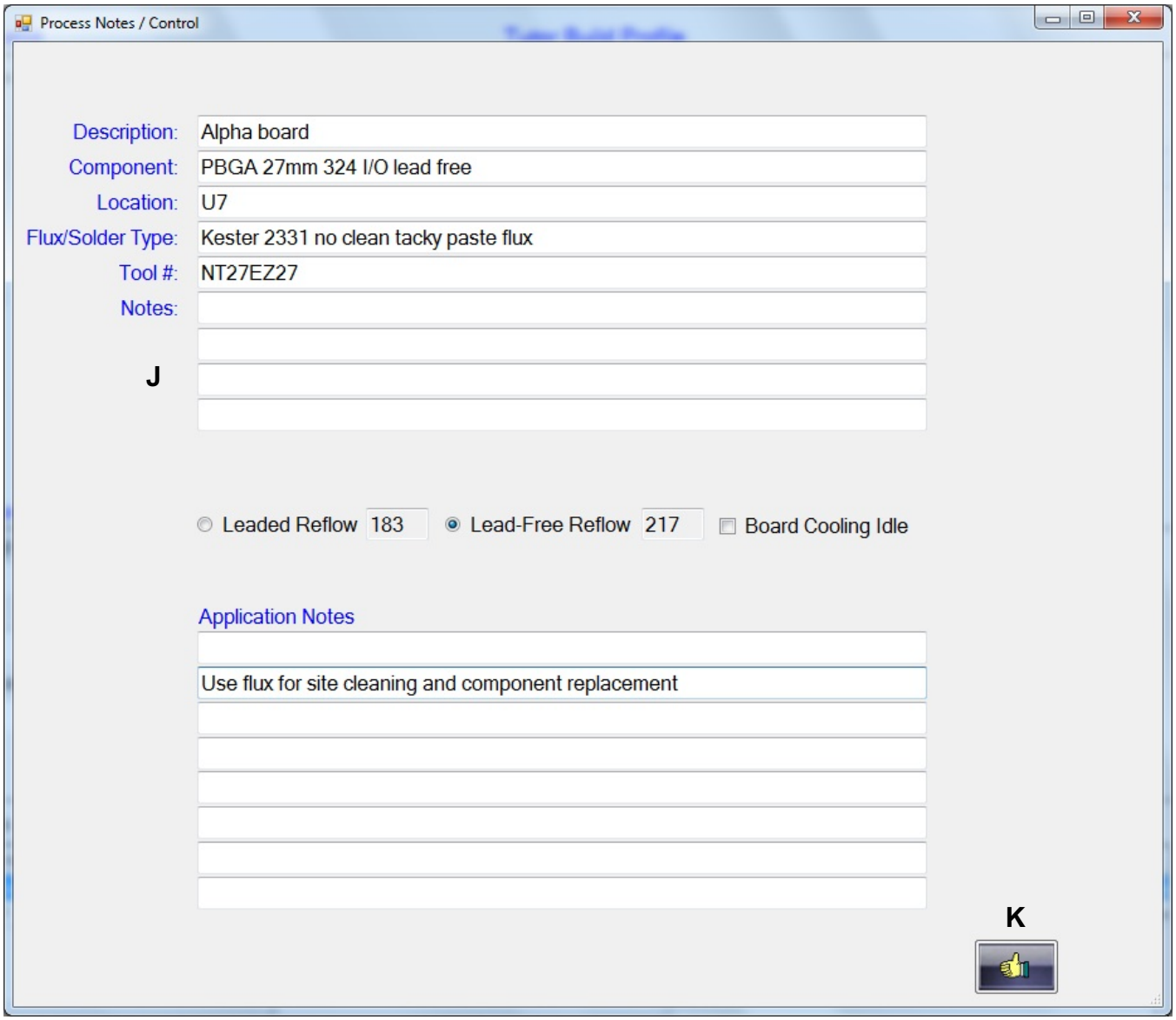
- Under Tutor Results **(A)** (radio button filled), select (double click) the thermal profile that you created **(A)**, saved and analyzed.
- The thermal profile will be shown in the "Tutor Results" box **(B)**.
- Click on the site cleaning radio button **(C)**. Select the appropriate site clean profile. It will be displayed in the site clean box **(D)**.
- Click on the Tutor Masters radio button **(E)** and select the appropriate Master Templates which will be displayed in the four boxes **(F).**
- Select/create the profile groups **(G)** where you want the profile to be saved to.
- Name the new profile **(H)**.

**NOTE: A good way to create the profile name is to copy the tutor results name and paste it in the Profile Name box.**

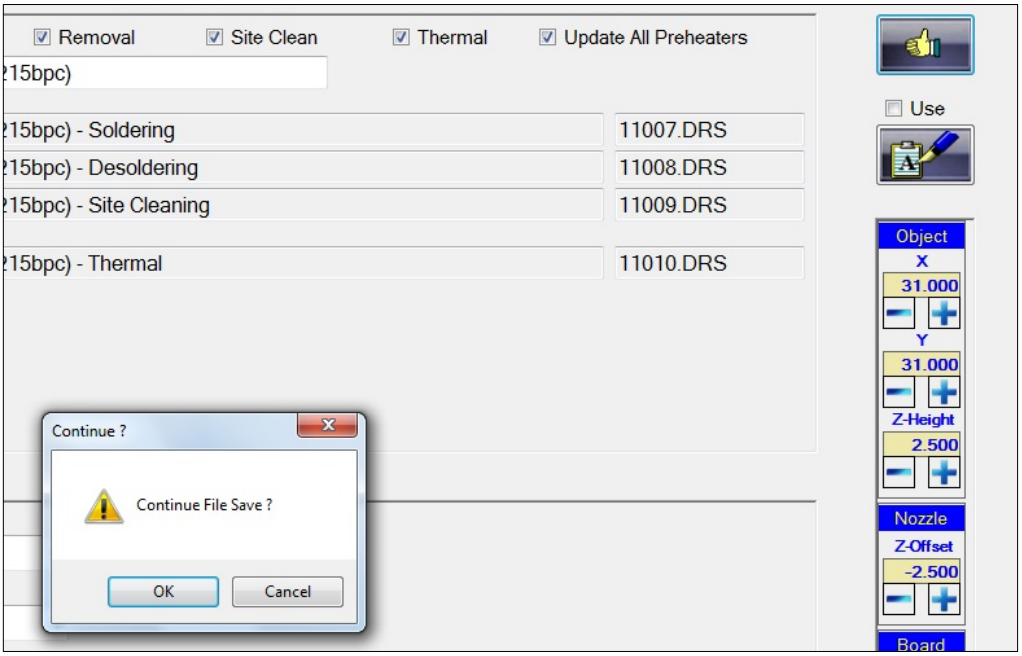



- Check the "Use" box **(I).**
- The Object/Nozzle/Board dimensions **(J)** should automatically update from the saved Tutor result. If they are not correct, update them.
  **Note: Incorrect Object/Nozzle/Board values may cause the nozzle to hit the component at high speed causing damage.**

- Enter set-up notes for the application **(J).**
- Select the Thumbs Up/Exit icon **(K)** to save.



- Select the thumbs up icon **(L)** to save.
- Click "OK" **(M)** to continue file save.



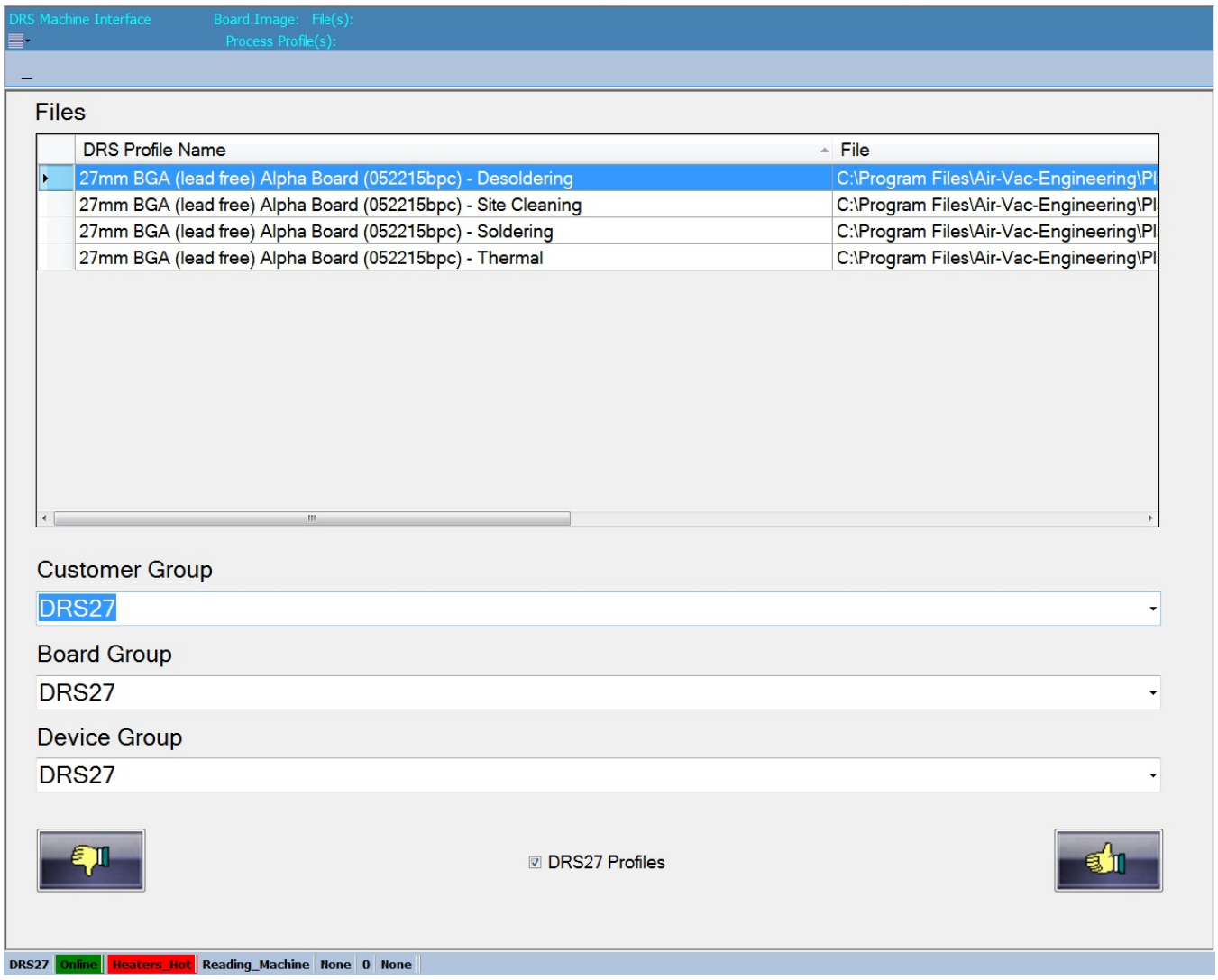

**L**

**M**

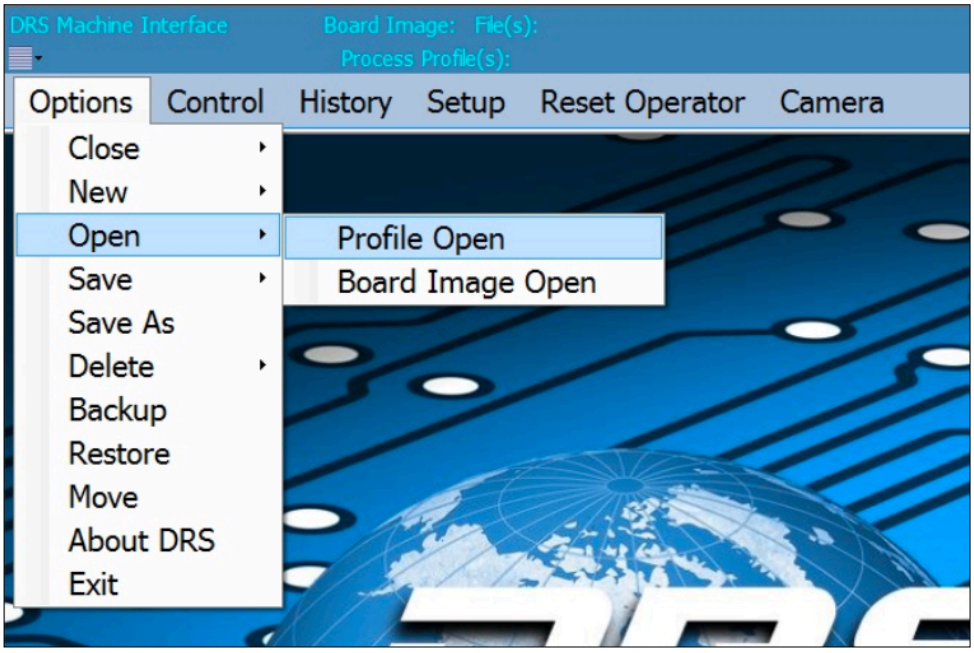
- Select Options/Open/Profile Open from the main menu.


Four (4) new profiles will be displayed in the directory you specified in Profile Build:

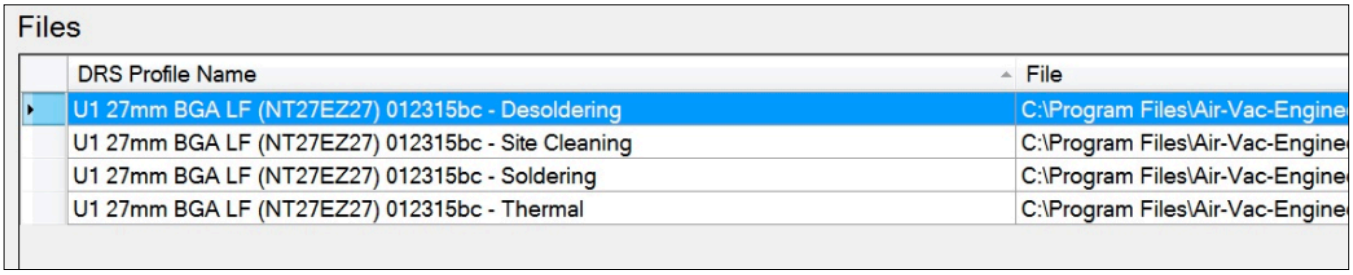
- Desoldering: Automatic component removal using the thermal profile you developed, excluding cooling.
- Site Cleaning: Removal of residual site solder after component removal.
- Soldering: Component replacement using the thermal profile you developed, including cooling.
- Thermal: The thermal profile you created, but with time-based events.


DRS Machine Interface
Board Image: File(s):
Process Profile(s):
Files
DRS Profile Name
File
27mm BGA (lead free) Alpha Board (052215bpc) - Desoldering
C:\Program Files\Air-Vac-Engineering\Pl
27mm BGA (lead free) Alpha Board (052215bpc) - Site Cleaning
C:\Program Files\Air-Vac-Engineering\Pl
27mm BGA (lead free) Alpha Board (052215bpc) - Soldering
C:\Program Files\Air-Vac-Engineering\Pl
27mm BGA (lead free) Alpha Board (052215bpc) - Thermal
C:\Program Files\Air-Vac-Engineering\Pl
Customer Group
DRS27
Board Group
DRS27
Device Group
DRS27
DRS27 Profiles
DRS27
Online
Heaters_Hot
Reading_Machine
None
0
None

### 5.0.8 Program Execution



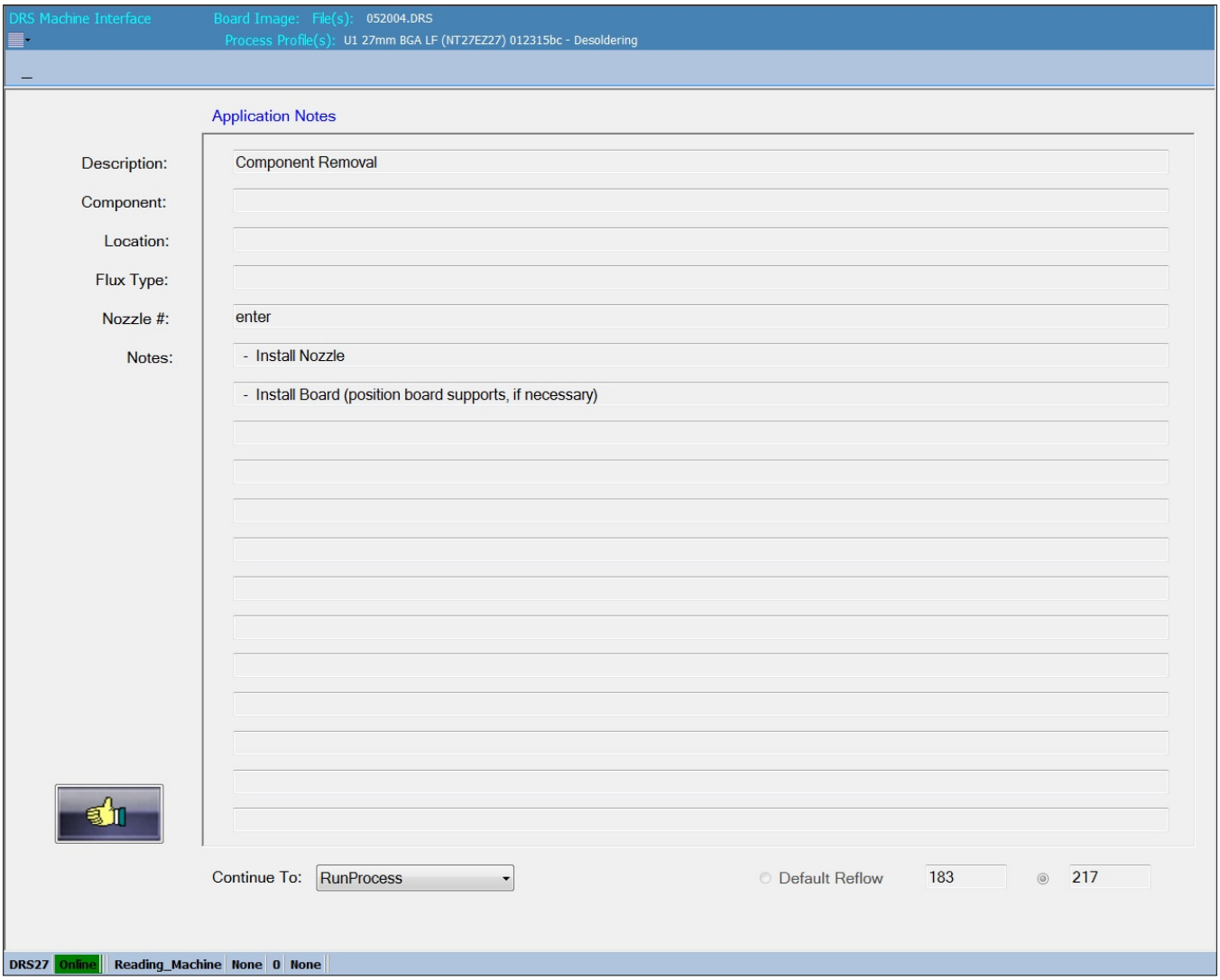

Four new profiles should now be available. "Desoldering", "Site Cleaning", "Soldering", and "Thermal" are automatically appended to the file name you created.



- Double click on the Desoldering profile to open it.

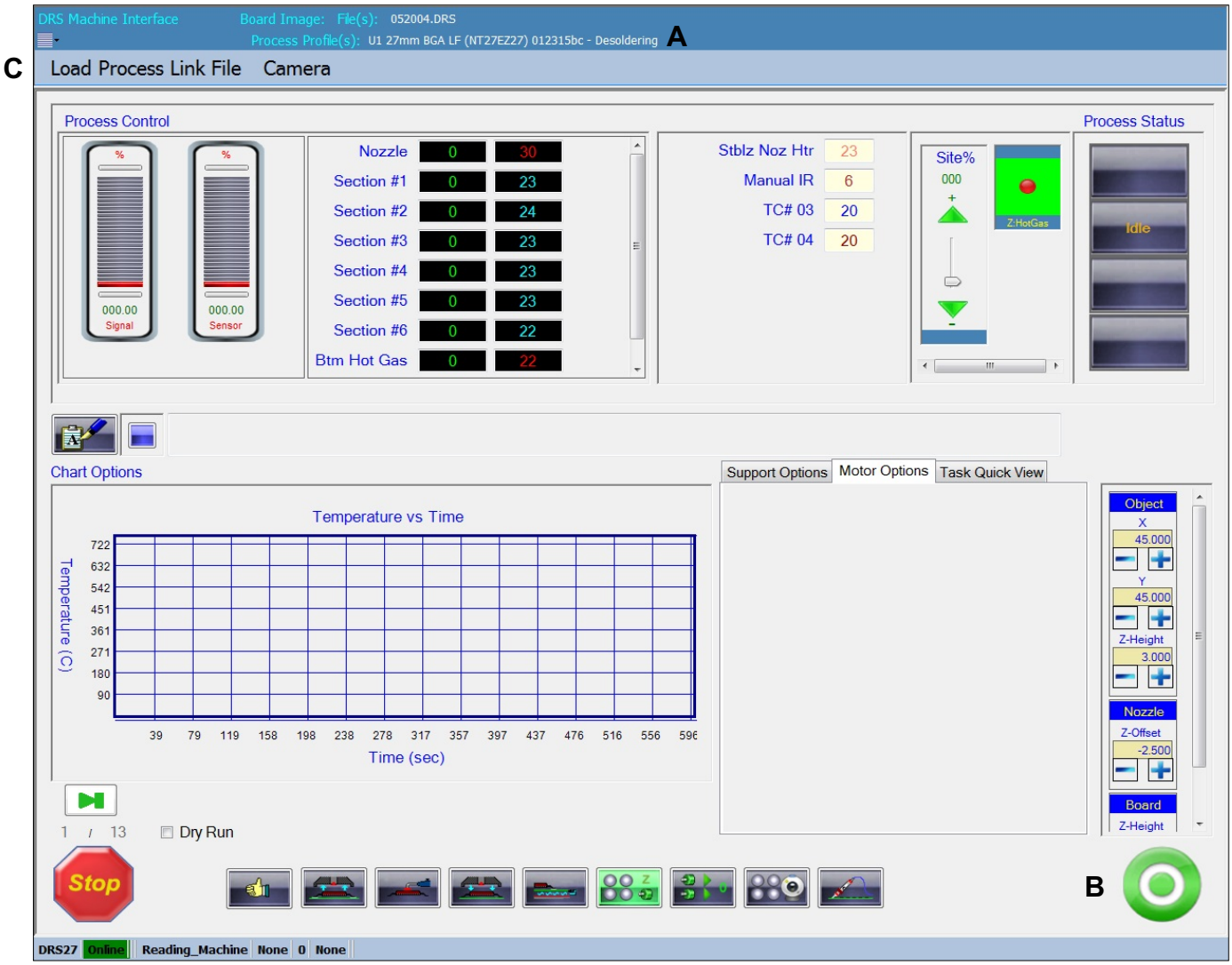
The process notes page is then displayed for the operator.

- Click Thumbs Up to continue to the Run screen after reviewing the setup notes.



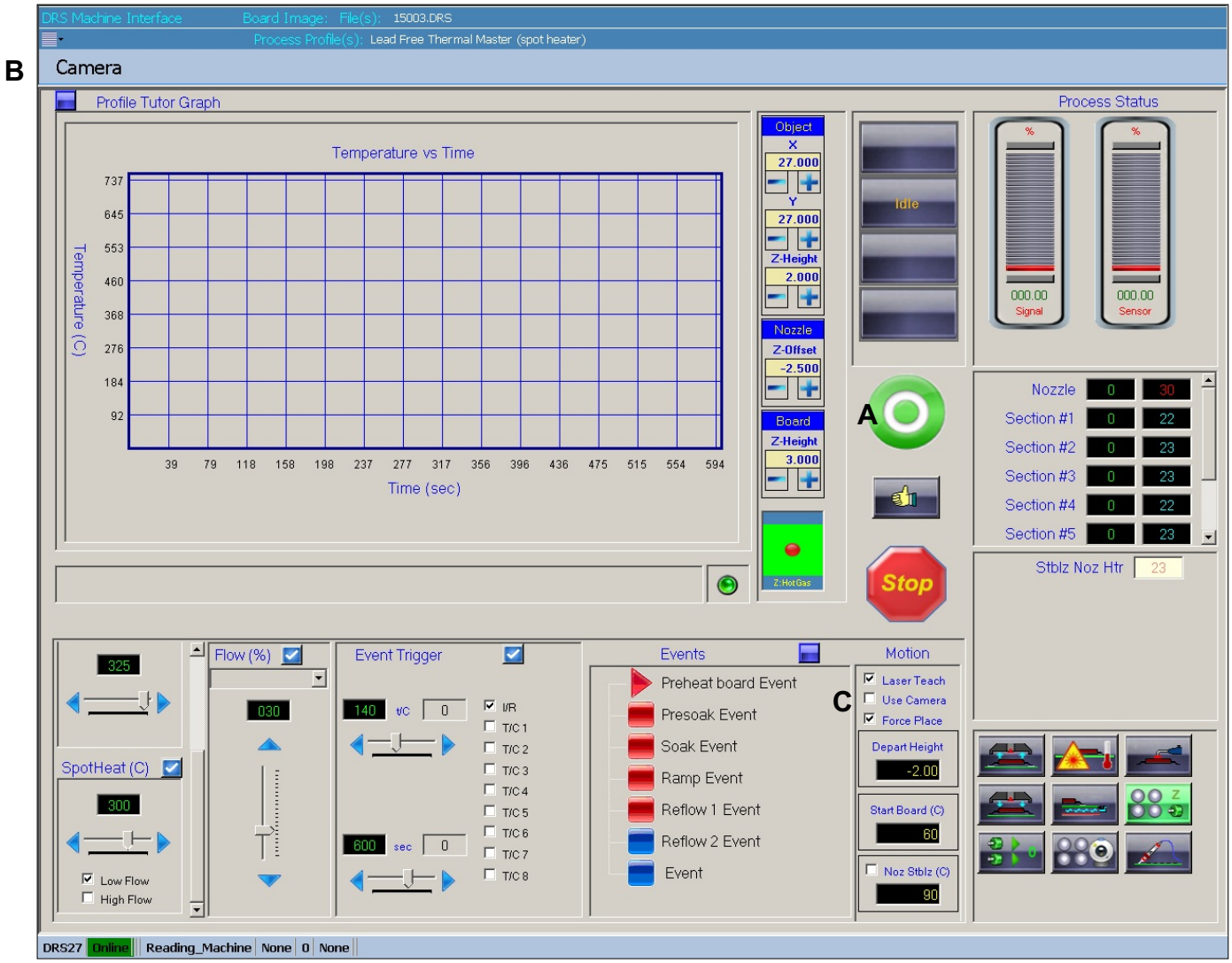
The profile name **(A)** will be displayed at the top of the page.

- Select Cycle Start **(B)** to start the profile. Follow all prompts.
- After the component is removed, select "Load Process Link File" **(C)** for site cleaning. Execute and reiterate for soldering.

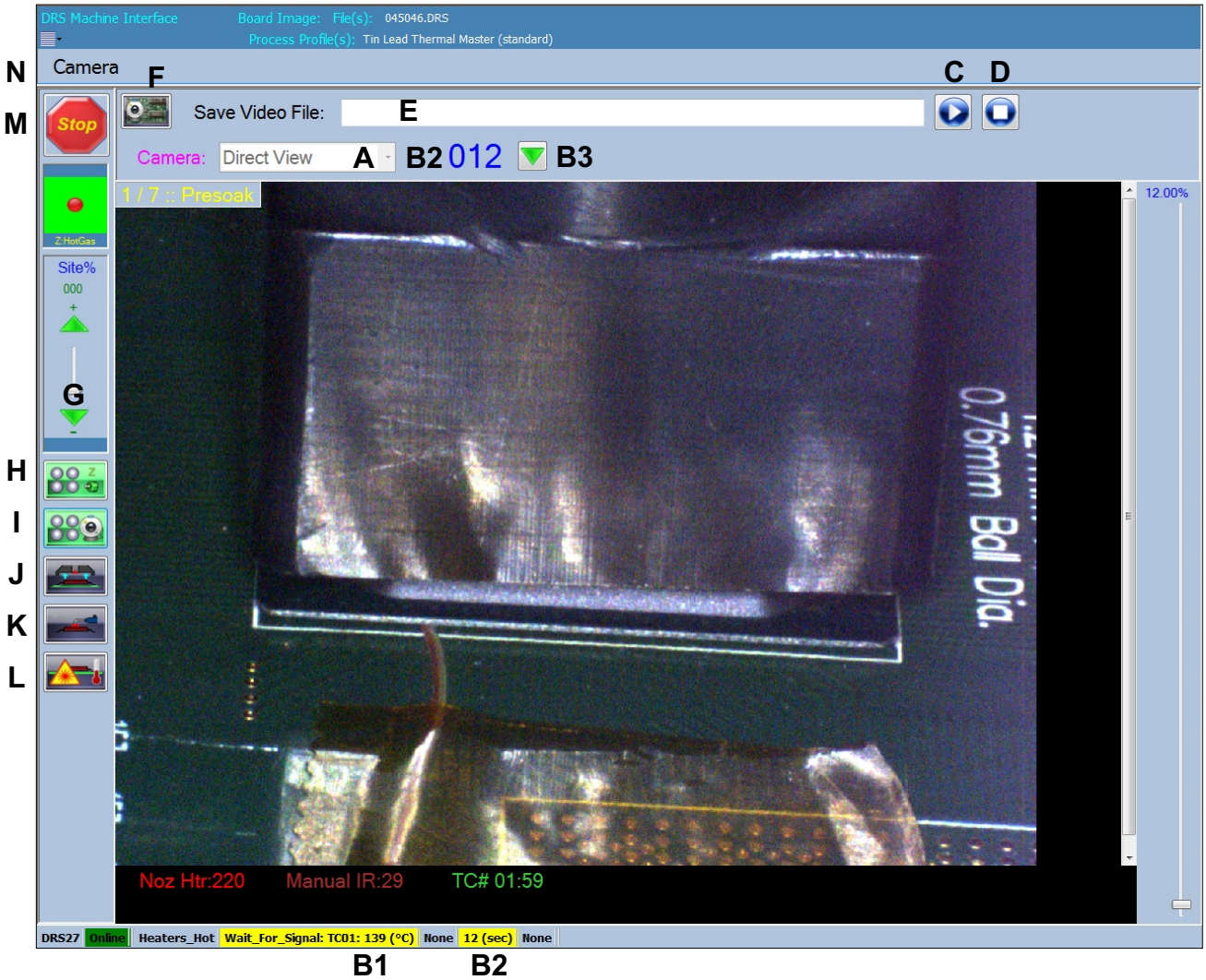


### 5.0.9 Direct View Camera Software Screen & Live View

Access the Tutor Camera screen after starting a Tutor Run **(A)**, by clicking on the **Camera** option **(B)** in the top left corner of the main Tutor screen, then choose **Open.**




If the **Use Camera** checkbox **(C)** was checked during setup, prior to starting a Tutor Run, the system will automatically go directly to the Camera screen after starting Tutor **(A)**.




**A** – Direct View Camera is automatically selected.

**B1** – The Target temperature is displayed.

**B2** – The Time is displayed and recorded.

**B3** – Clicking Down Arrow advances to next event and records time.

**C, D, E, F** – Capture Live Video Files. Start the live video recording by clicking **C**, stop by clicking **D**. Assign a name for file in **E**, then click **F** to choose a location to store file.

**G** – Adjusts height of Site Clean tool above site. **NOTE:** This feature is not active in Tutor, only active during the site cleaning process.

**H** – Takes the Z-Axis to the home position.

**I** – Turns the Direct View Camera light ring on and off.

**J** – Turns the Nozzle vacuum on and off.

**K** – Turns the Pickup Probe vacuum on and off.

**L** – Turns the Laser Pointer (aiming IR Sensor) on and off.

**M** – Stops the process.

**N** – Click **N** then choose Close to go back to the main Tutor screen.

# 6: Templates: Removal, Site Clean, Replacement

**6 Templates ..... 3**
6.0 OVERVIEW ..... 3
6.1 REMOVAL TEMPLATE ..... 3
6.2 SITE CLEAN TEMPLATE ..... 15
6.3 REPLACEMENT TEMPLATE (SOLDERING) ..... 25

# 6 Templates

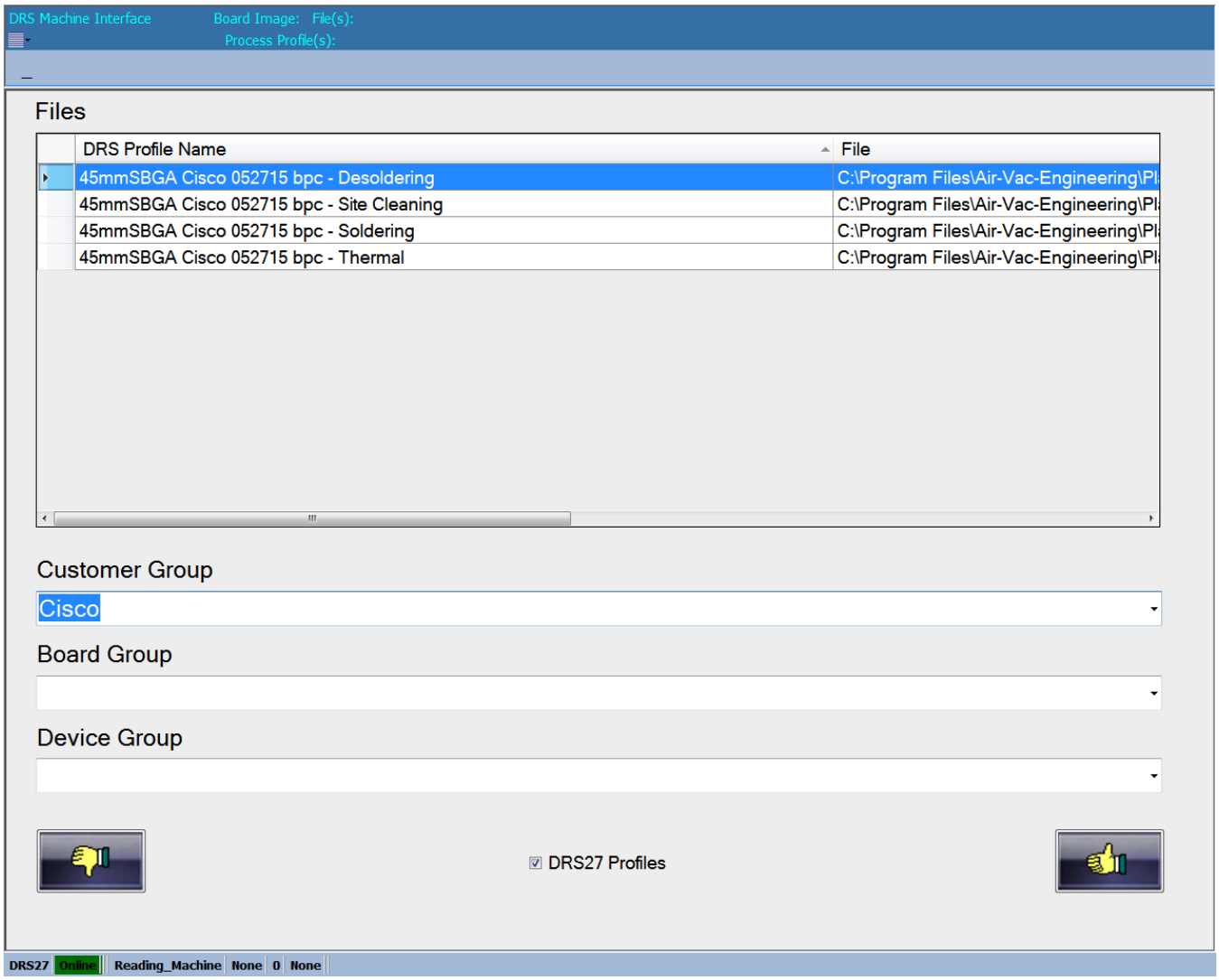
## 6.0 Overview

After a user develops a new thermal profile in Profile Tutor, the Build function is used to create complete desoldering, site cleaning, and soldering profiles.

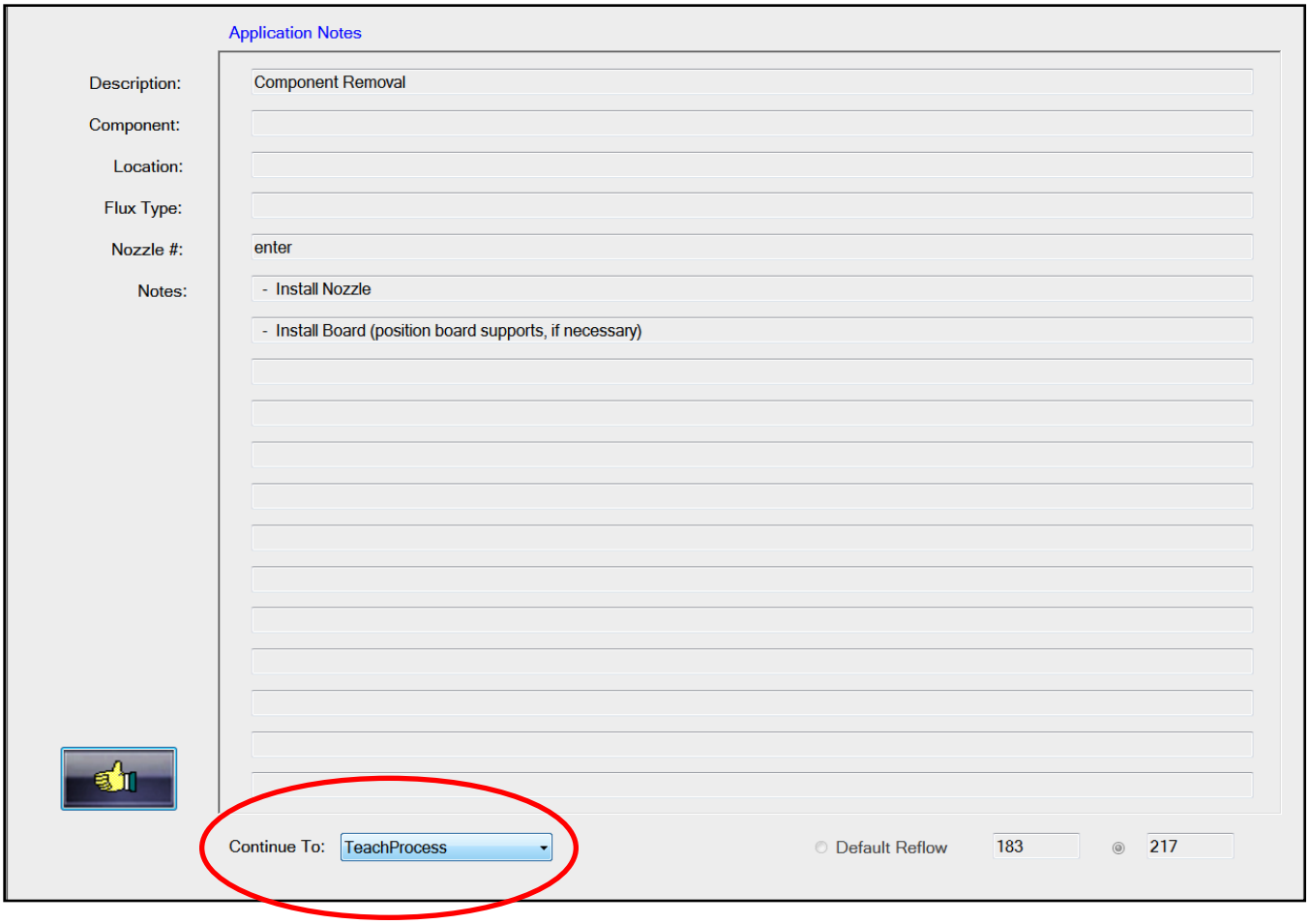
The events in these templates are explained and documented in this section.

## 6.1 Removal Template

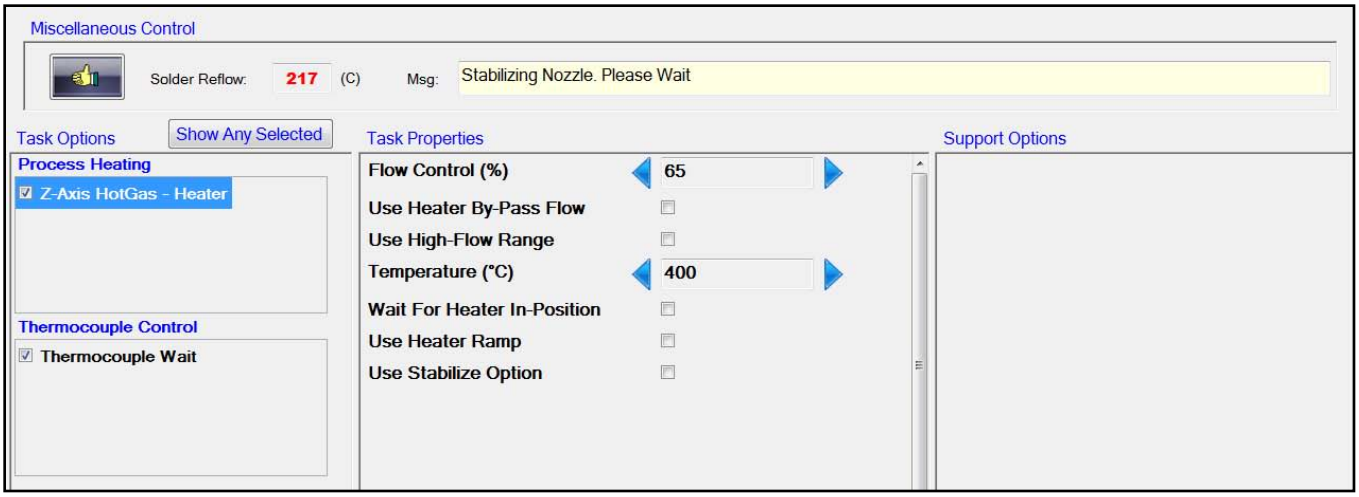
- Select Options/Open/Profile Open
- Select the Customer/Board/Device Group where the new profile was saved.
- Highlight the desoldering profile and click on the thumbs up icon to proceed.



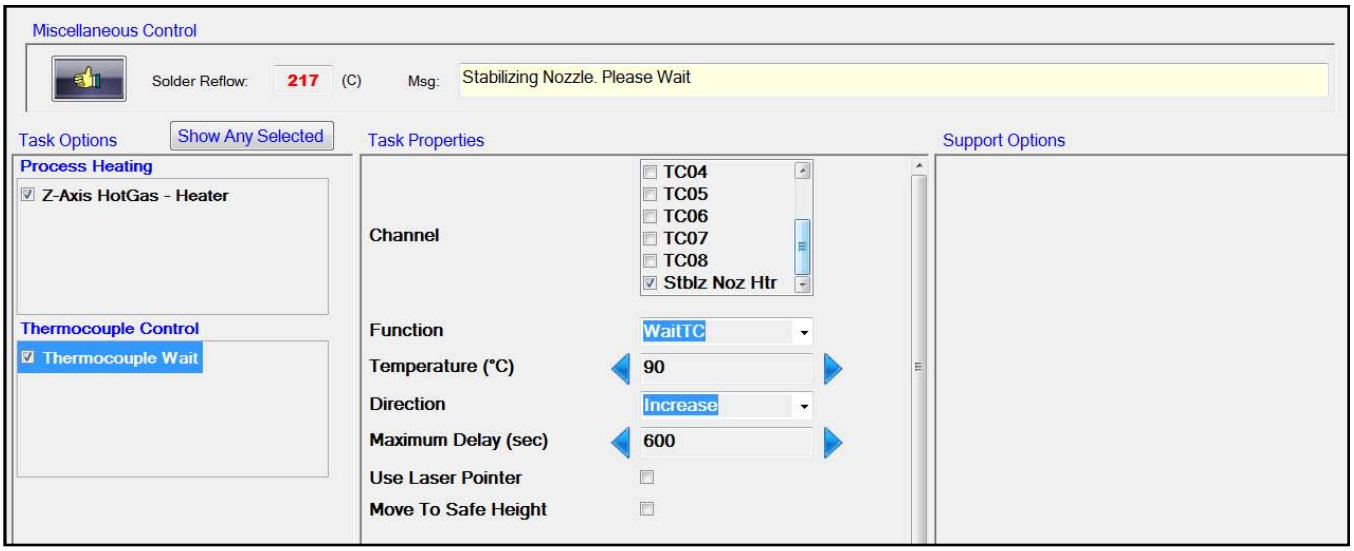
- Select **TeachProcess** in the **Continue To** pull down box.



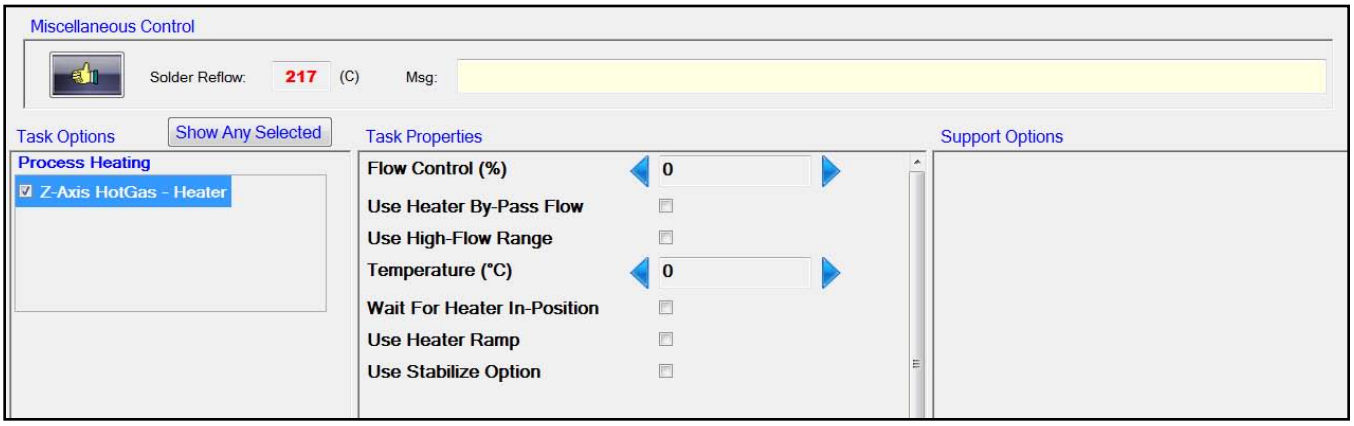

- The nozzle heater is turned on to stabilize the hot gas head.



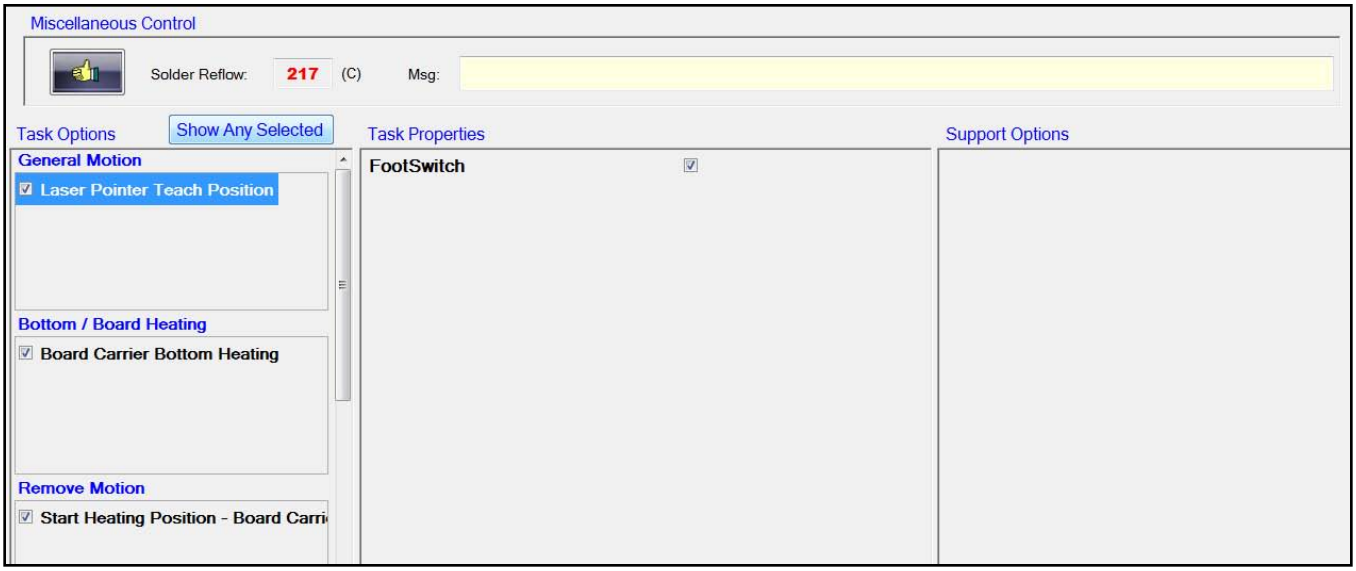
- This event will continue until the hot gas head thermocouple reaches 90˚C.



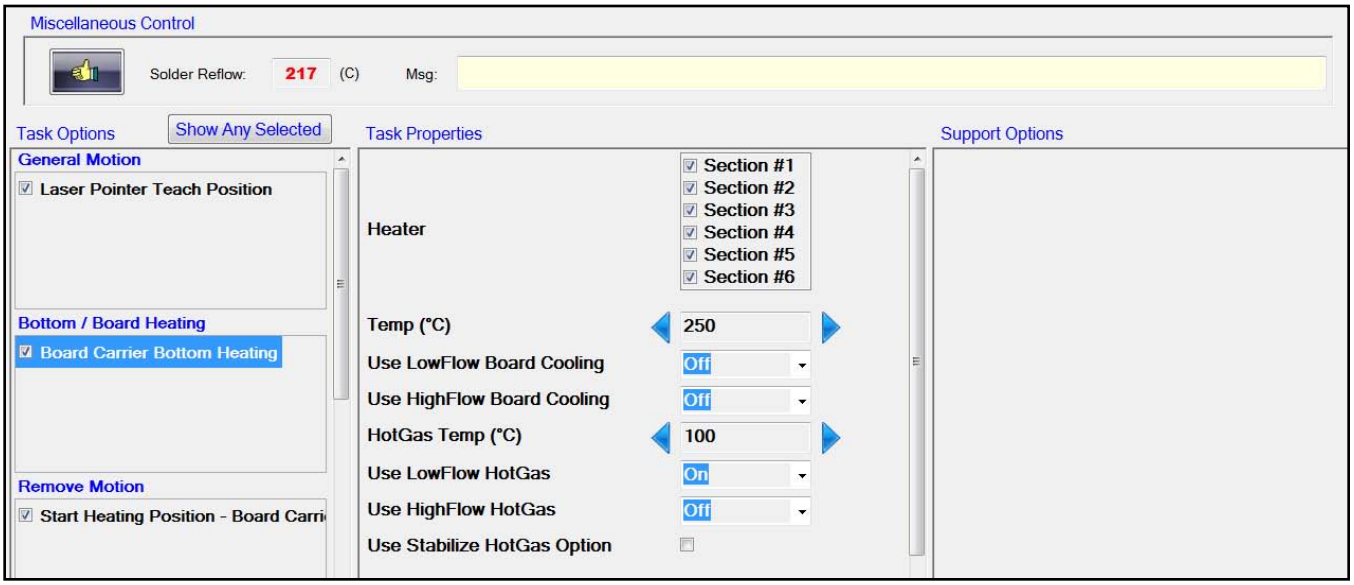

- The nozzle heater is then shut off.



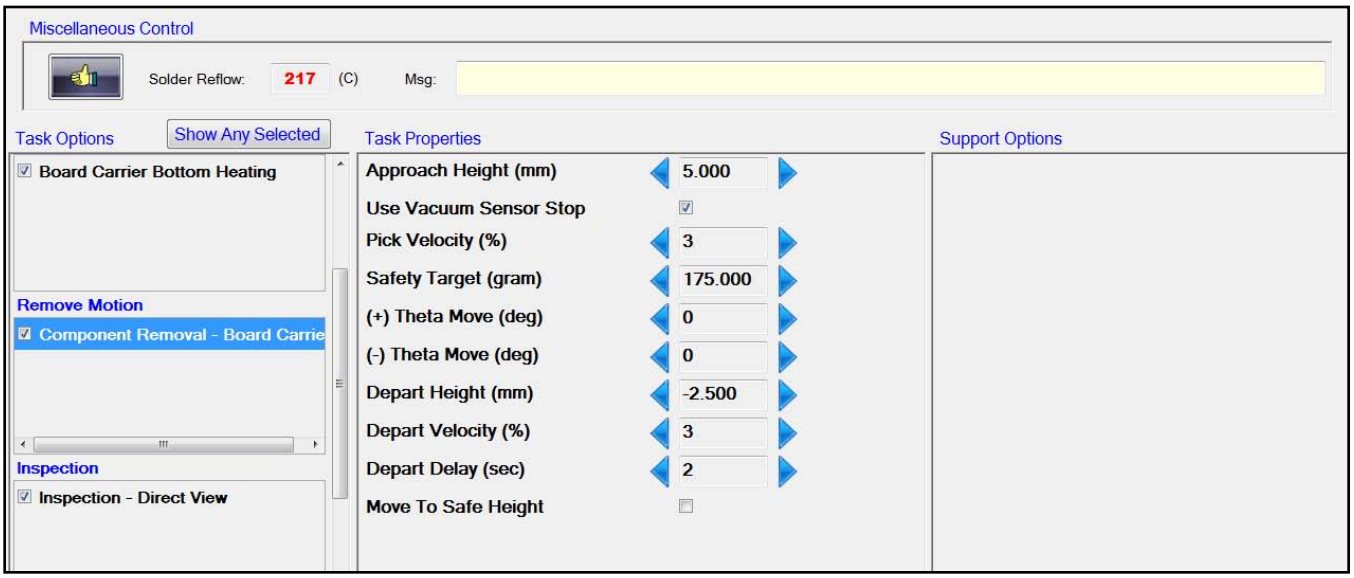
- The Laser Pointer Teach is used to locate the component.
- The operator is instructed to position the IR sensor.



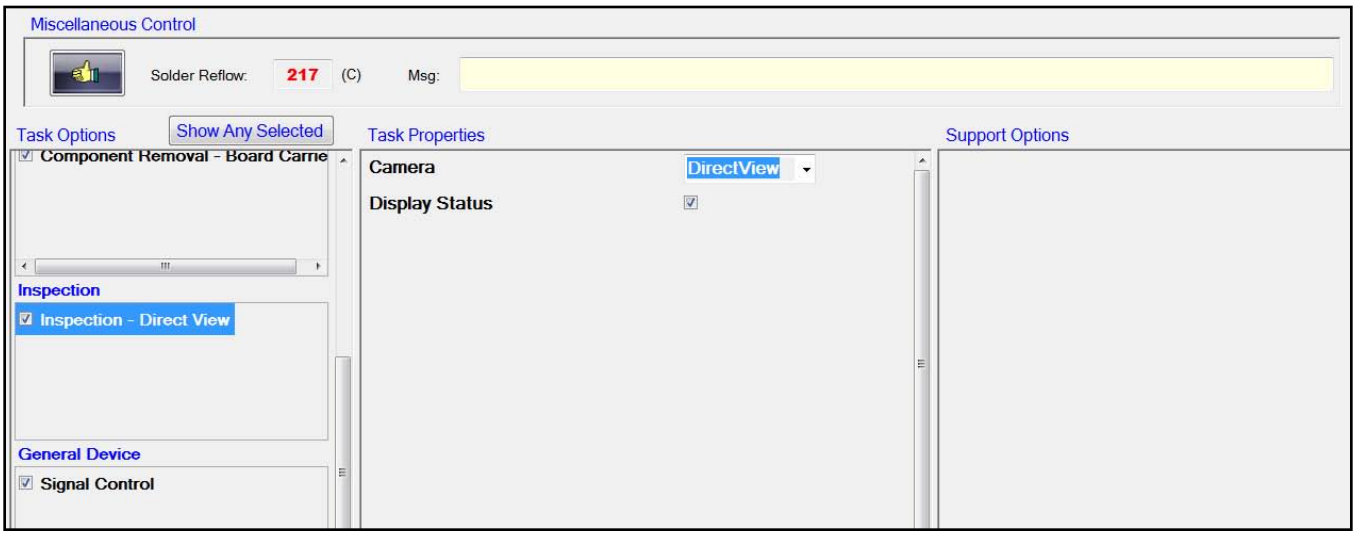

- The bottom heater and spot heater are activated.



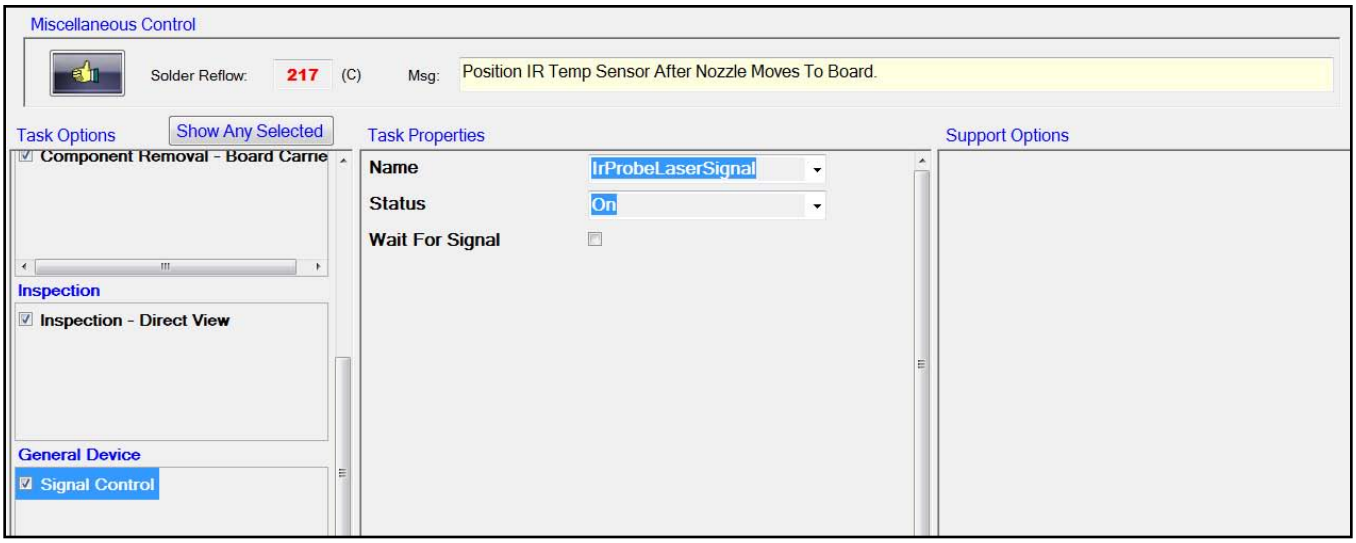
- The nozzle force touches the component and retracts the programmed distance (A).



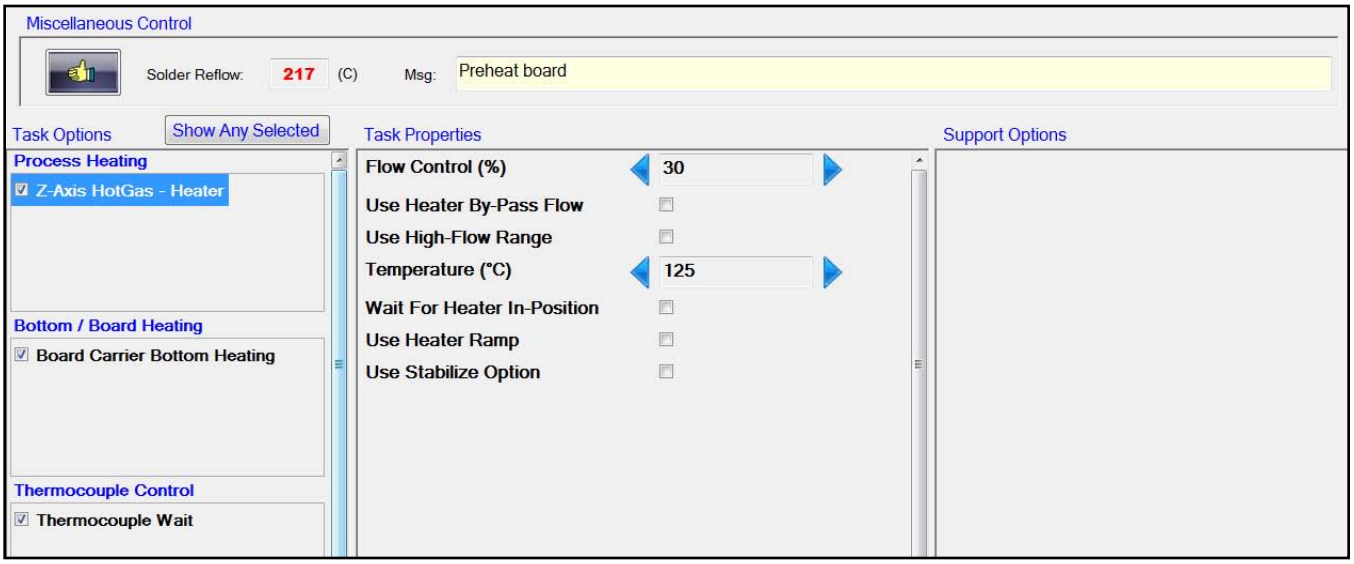

- The direct view camera activates.



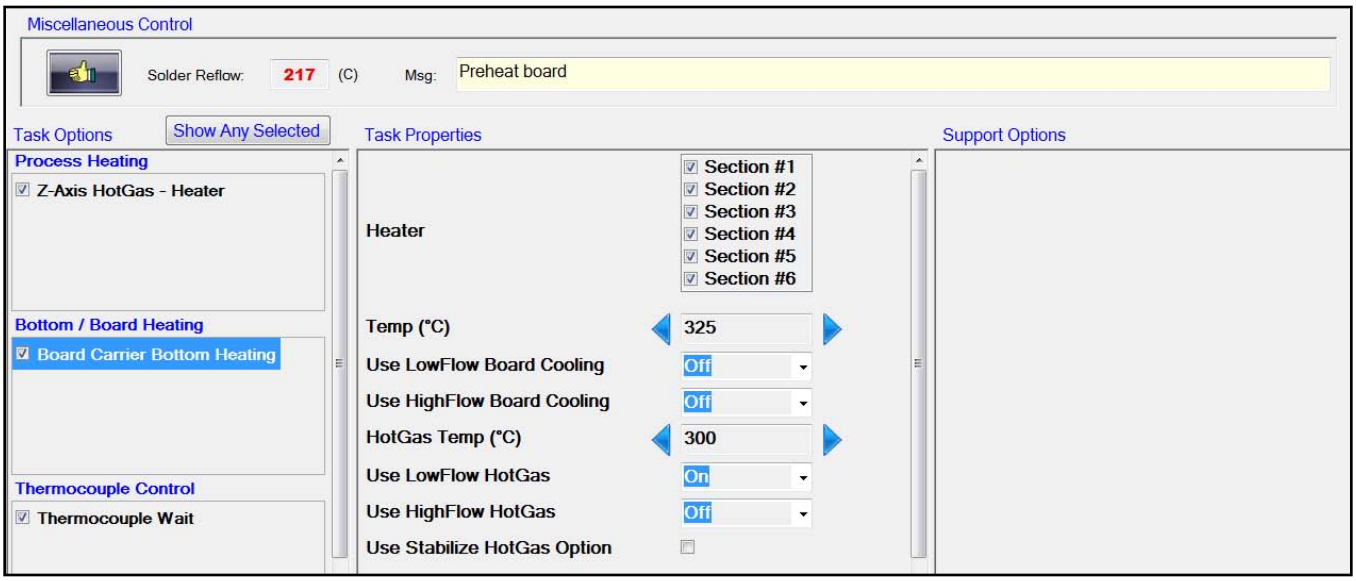
- The laser pointer on the IR temperature sensor is activated.
- The operator is prompted to position the IR sensor.



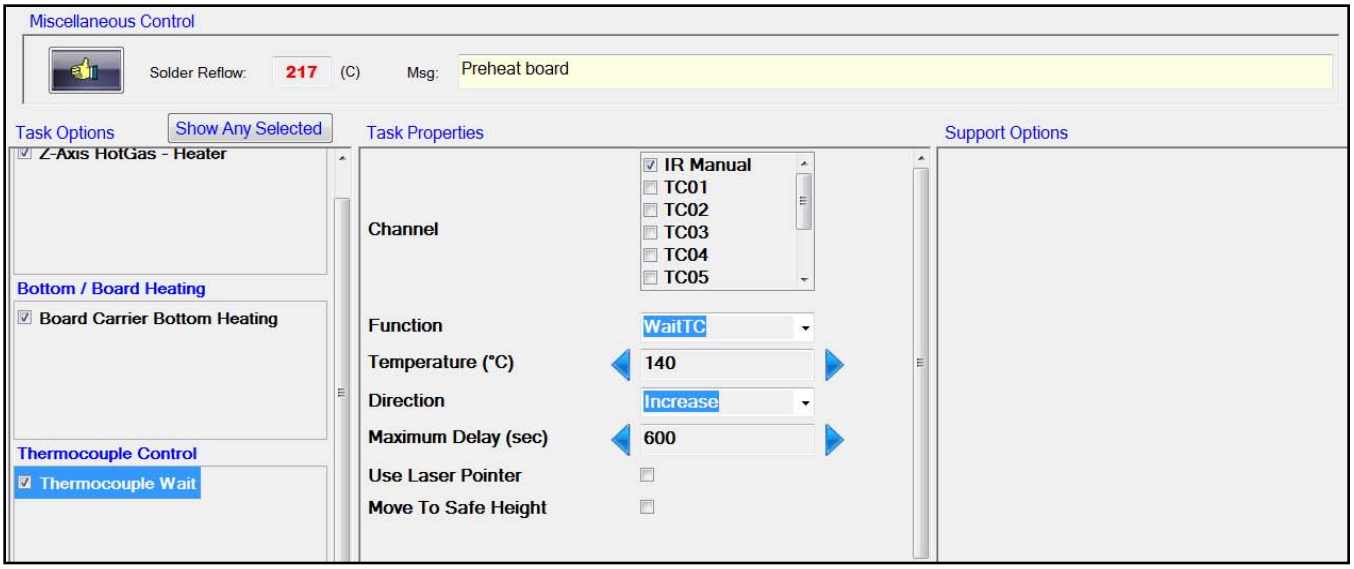

- The nozzle heater is activated.



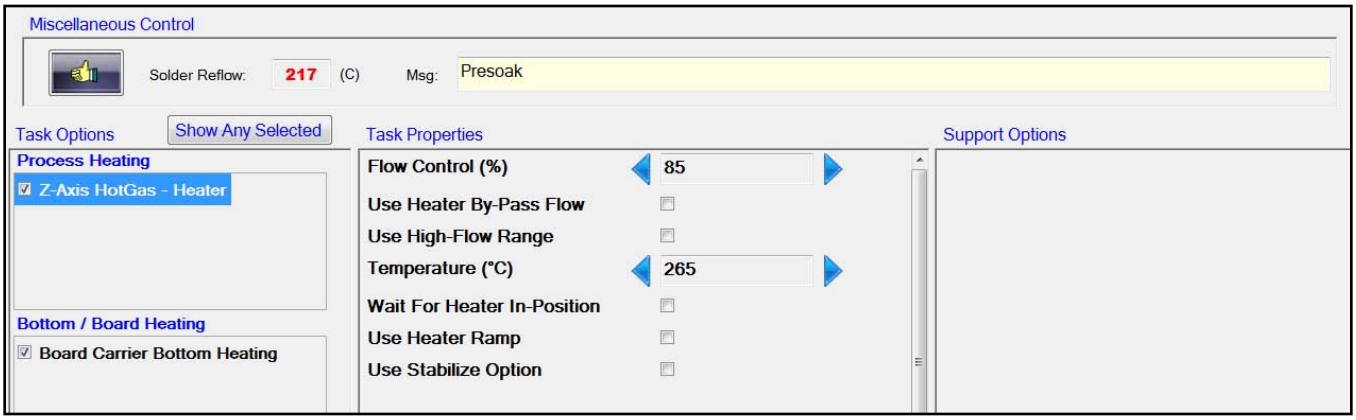
- The bottom heater and spot heaters are activated.



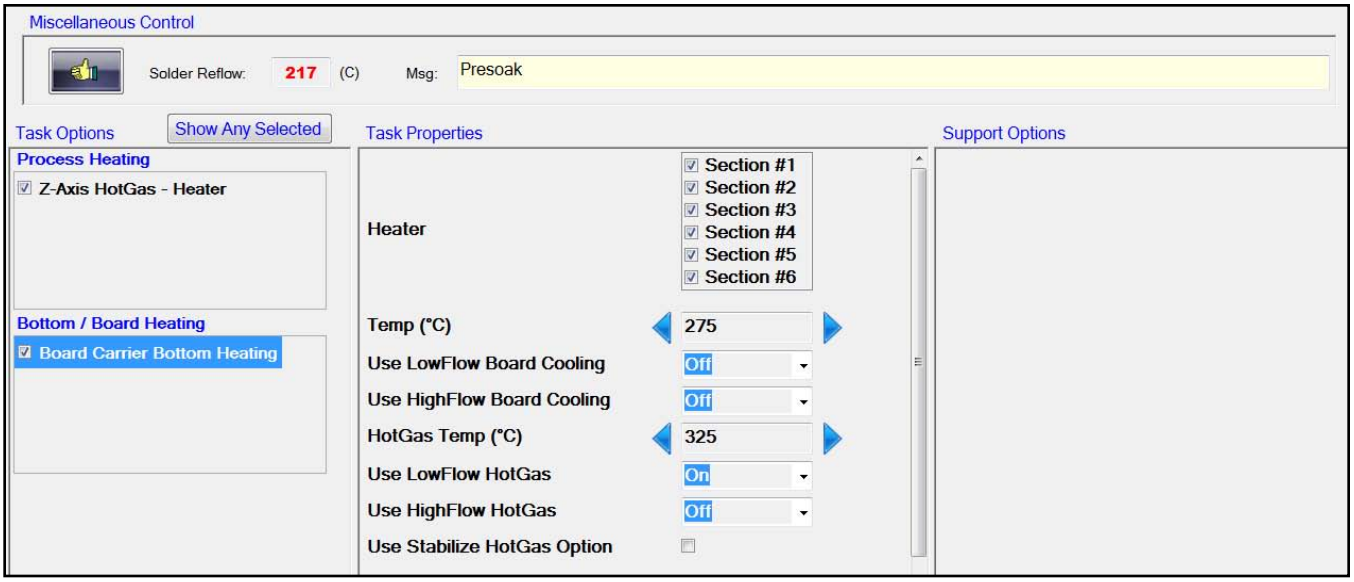

- The board is preheated to 140˚C from the thermal profile developed in profile tutor.



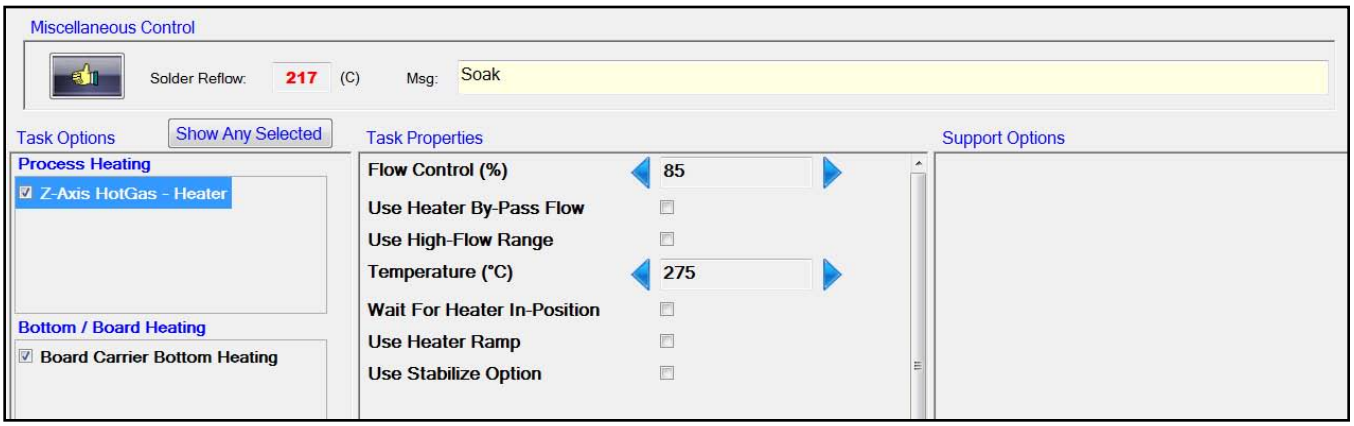
- The nozzle heater setting and time from the presoak stage in the thermal profile.



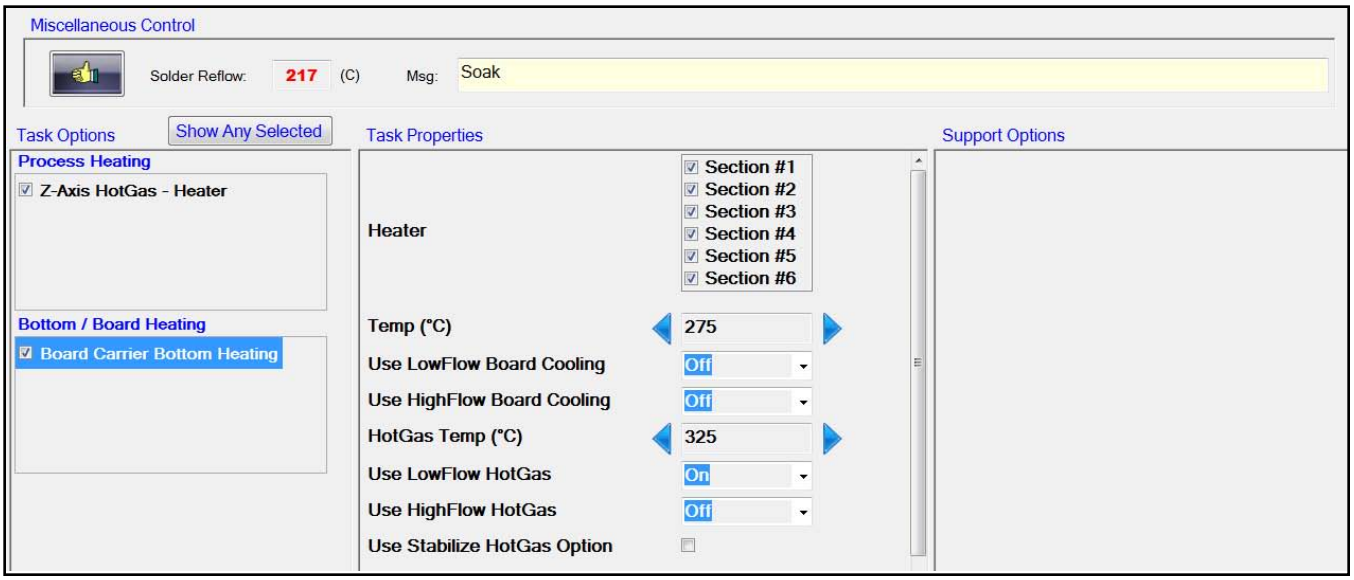

- The bottom heater and spot heater settings from the presoak stage in the thermal profile.



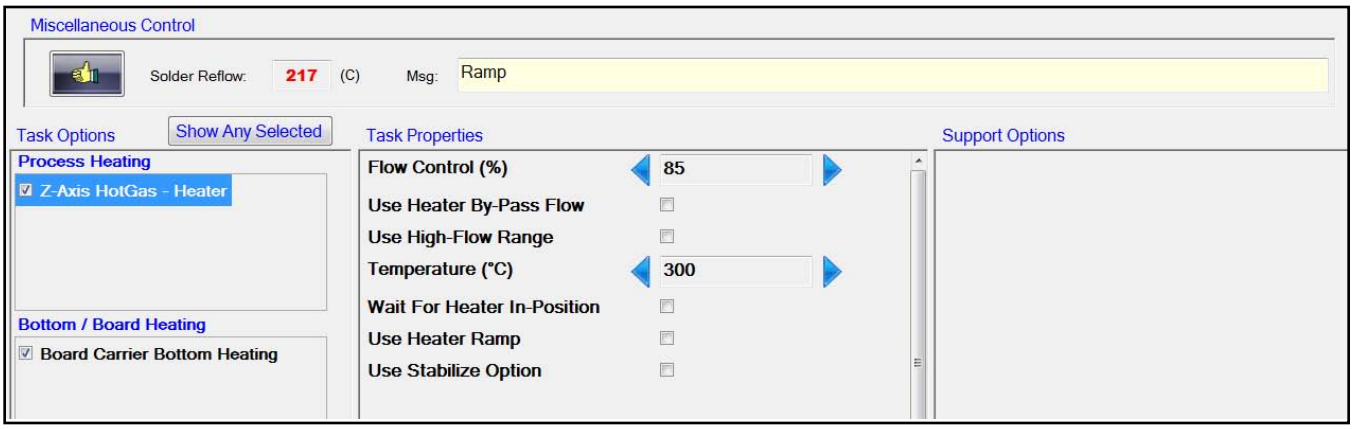
- Soak stage time and nozzle heater settings from the thermal profile.



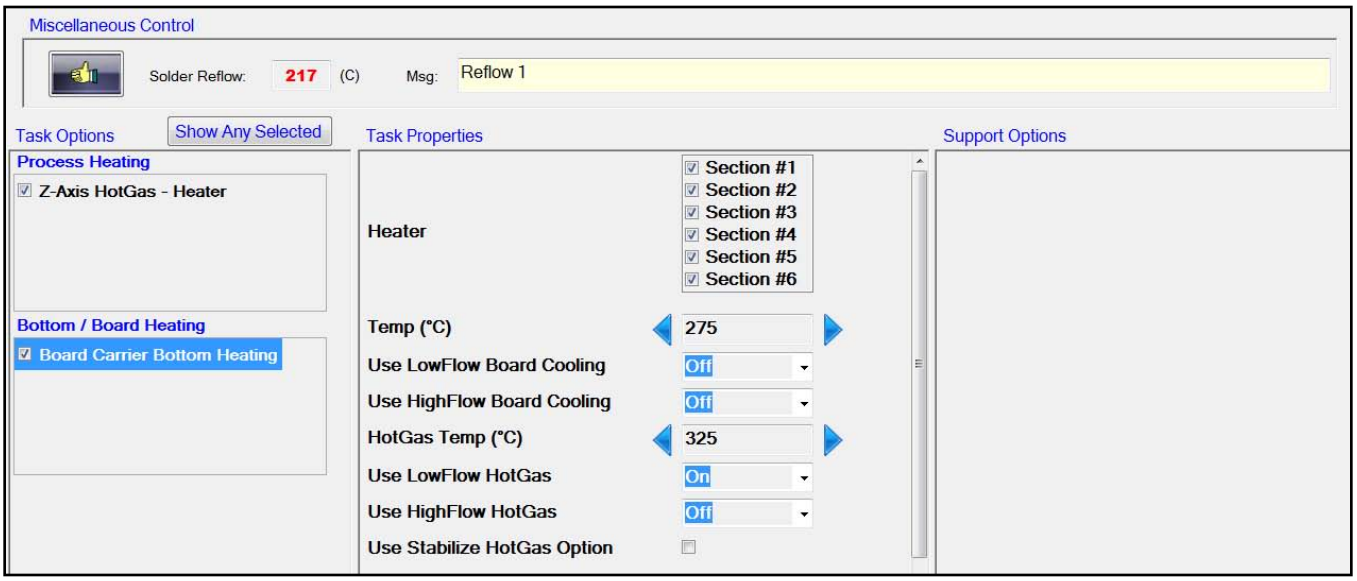

- Bottom and spot heater soak stage settings from the thermal profile.



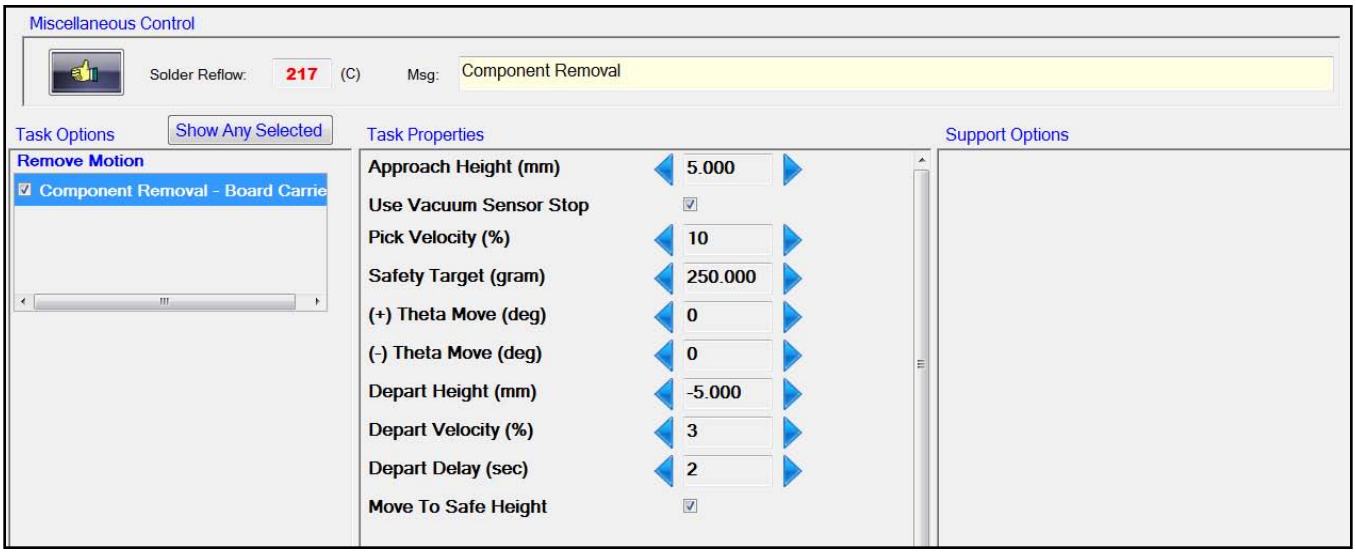
- Ramp stage time and nozzle heater settings from the thermal profile.



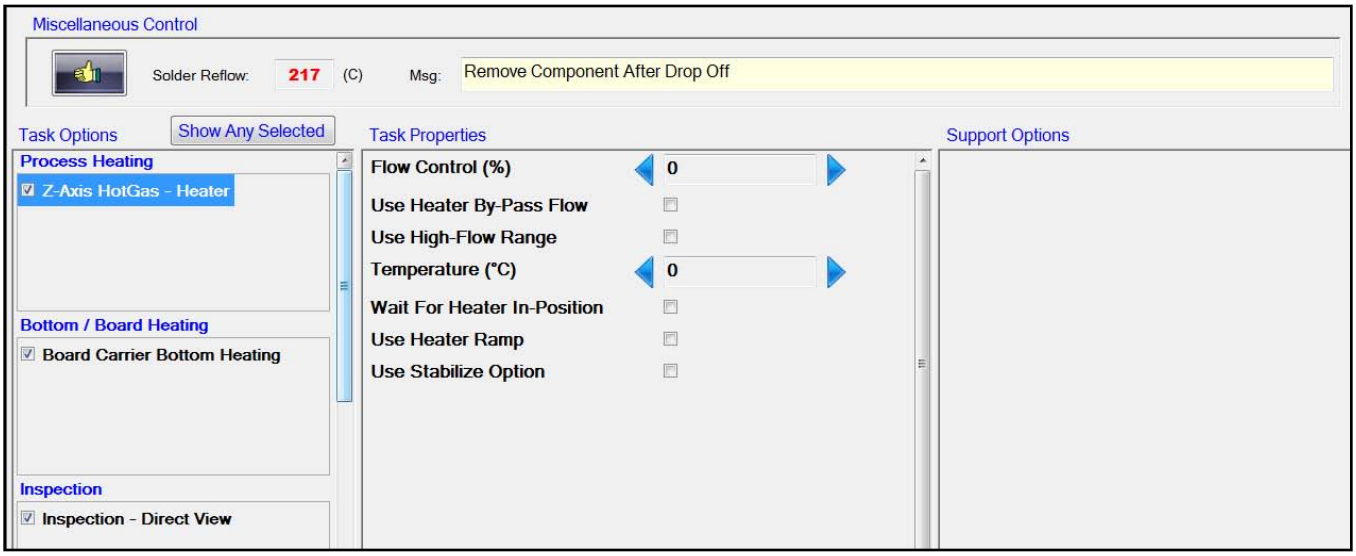

- Ramp stage bottom heater and spot heater settings from the thermal profile.



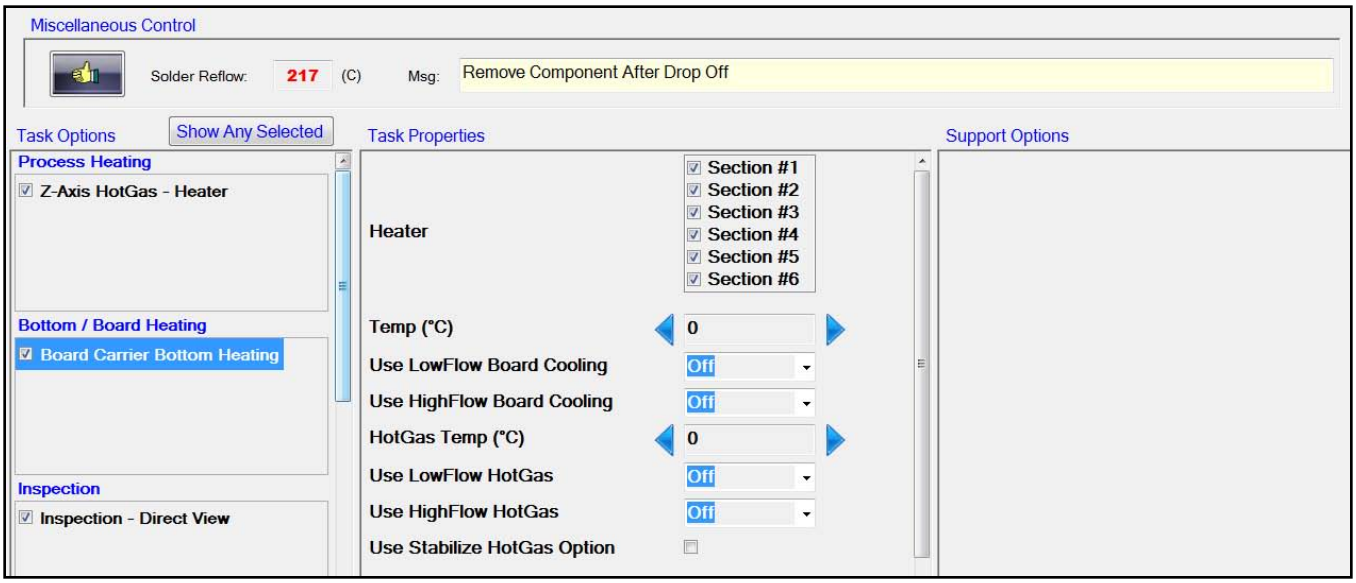
- Automated component removal using the vacuum sensor. **NOTE: The Reflow 1 (cooldown) stage from the thermal profile was automatically deleted in the build function.**



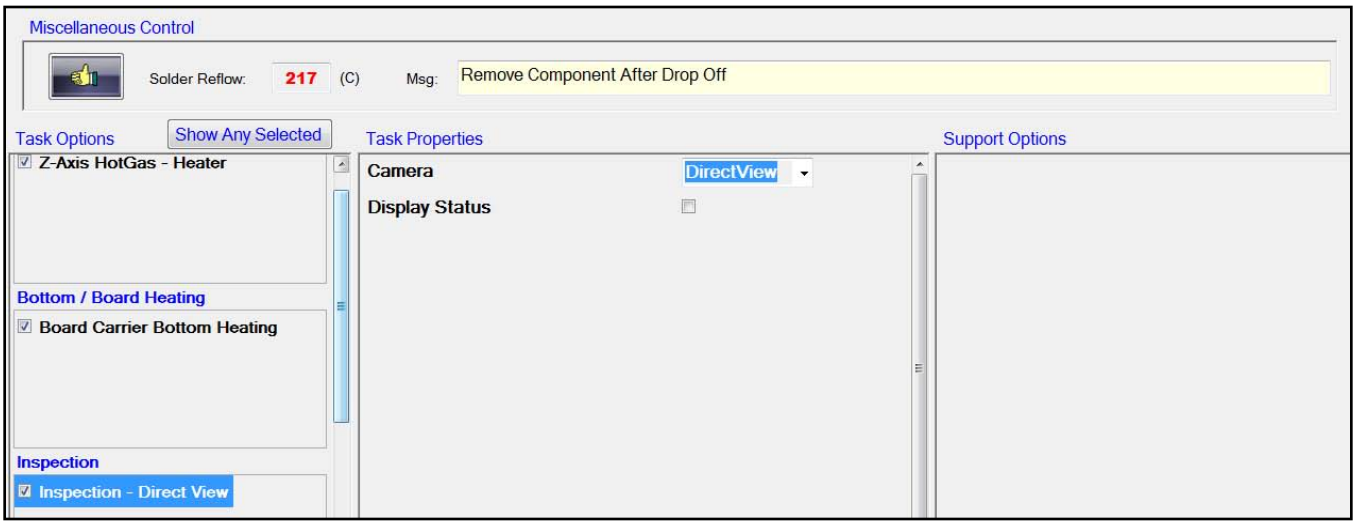

- Nozzle heater off after component removal.



- Bottom and spot heaters off.

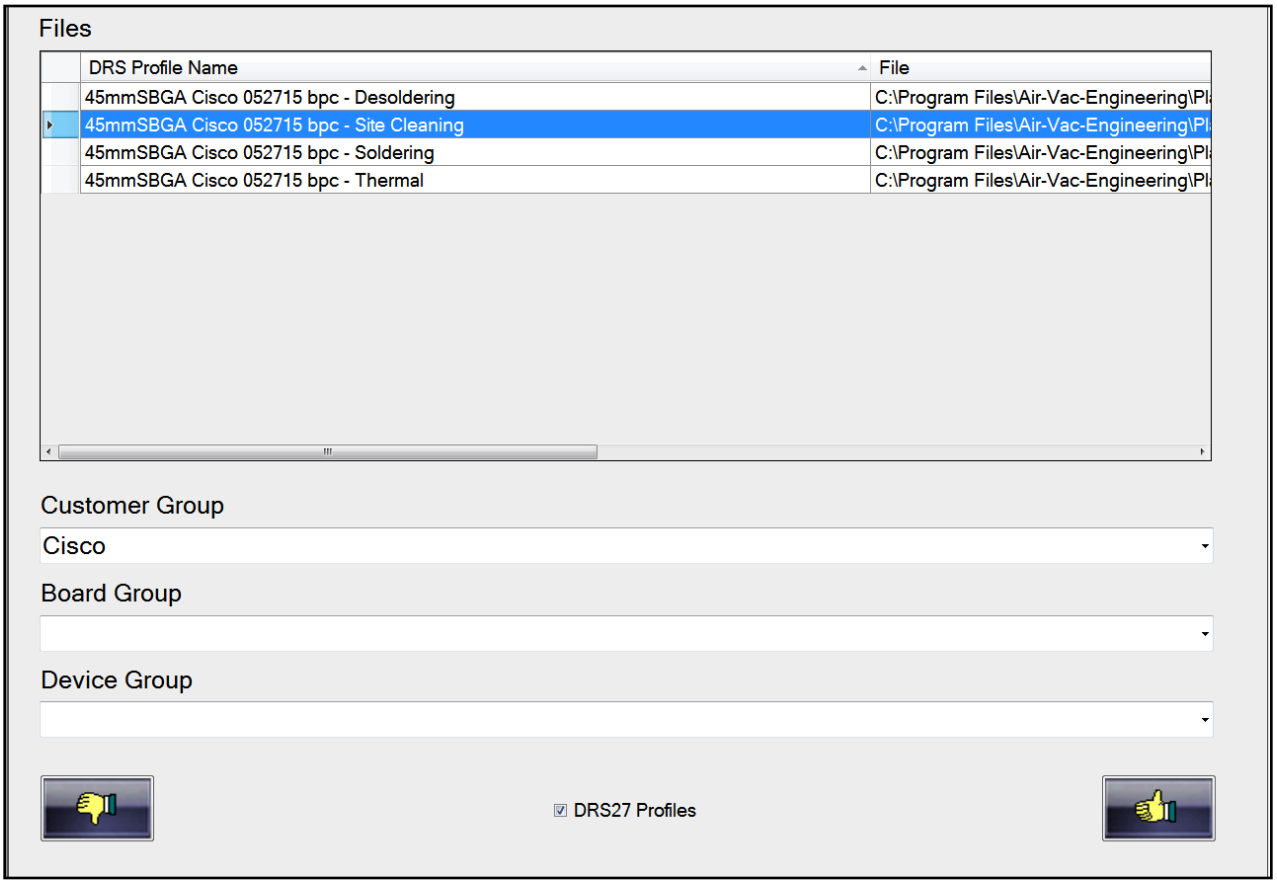



- Direct view camera off.

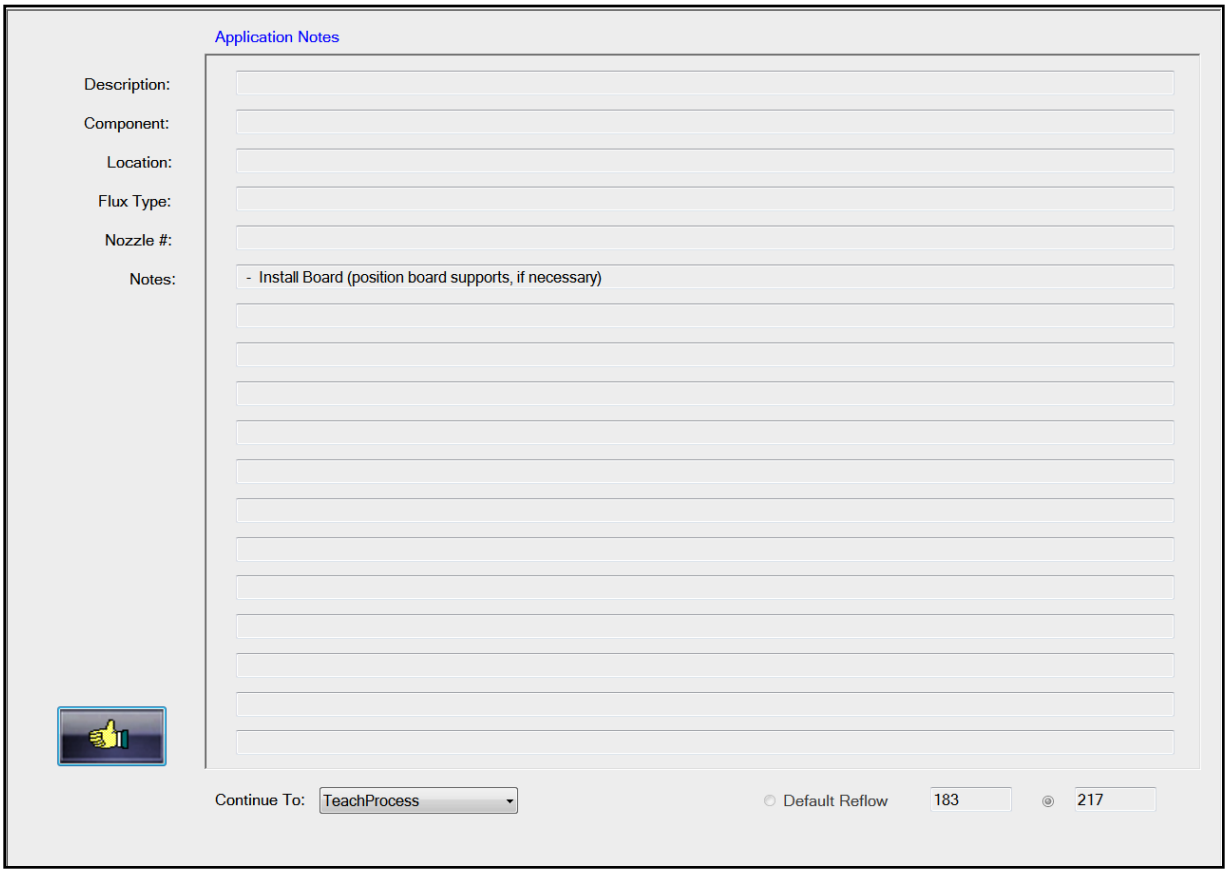


## 6.2 Site Clean Template

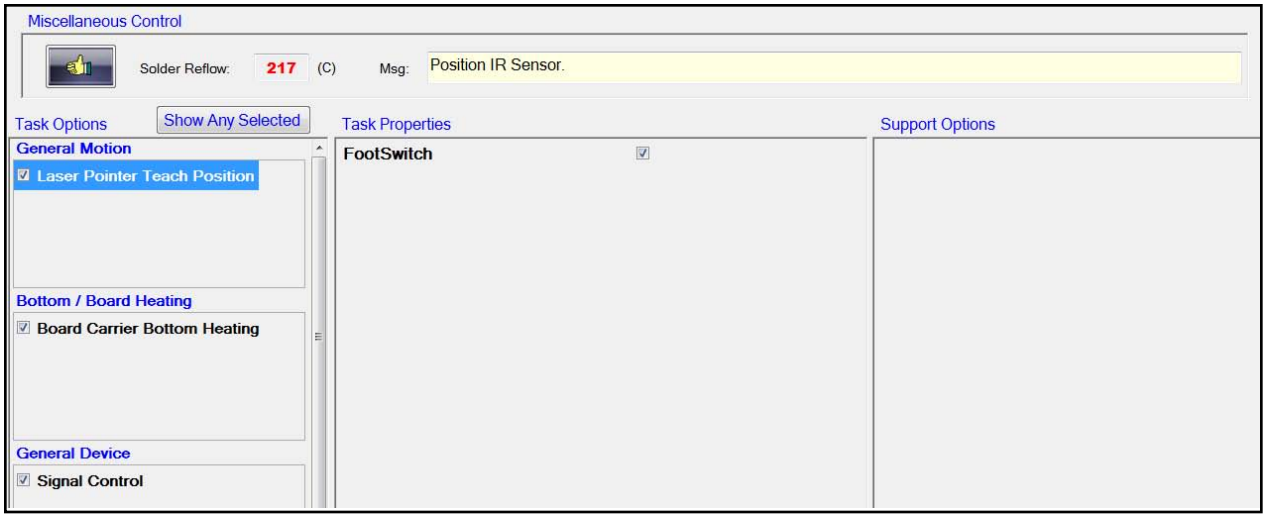
- Select Options/Open/Profile Open.
- Highlight the Site Cleaning profile.
- Thumbs up to proceed.



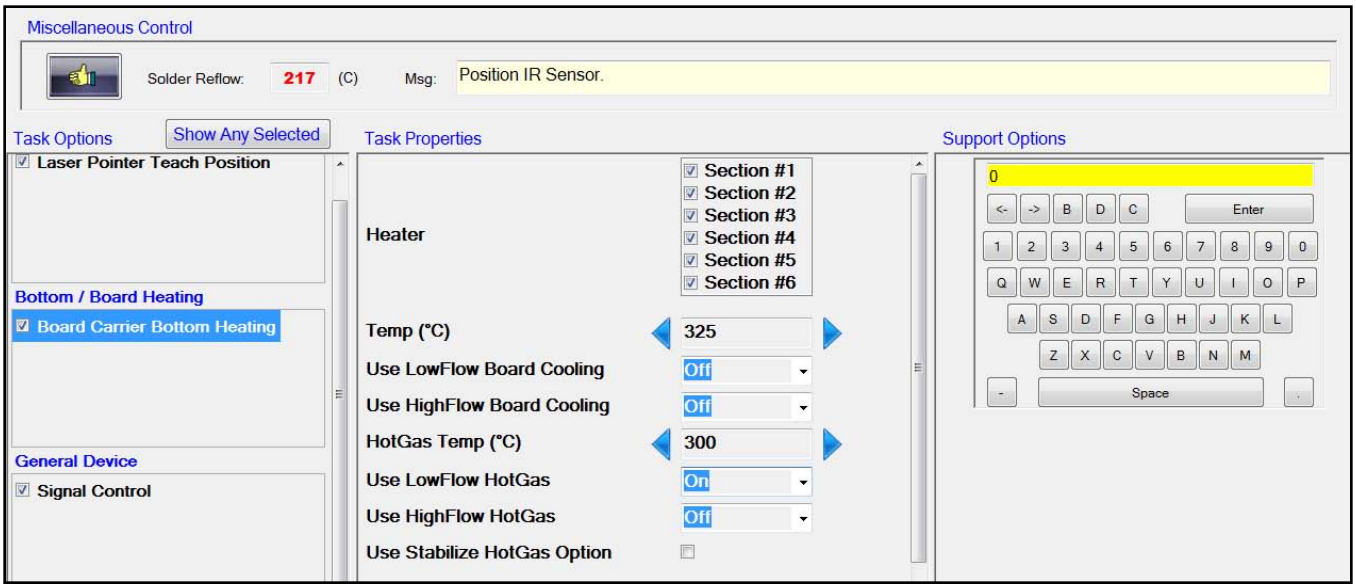
- Select TeachProcess from the pull down menu.



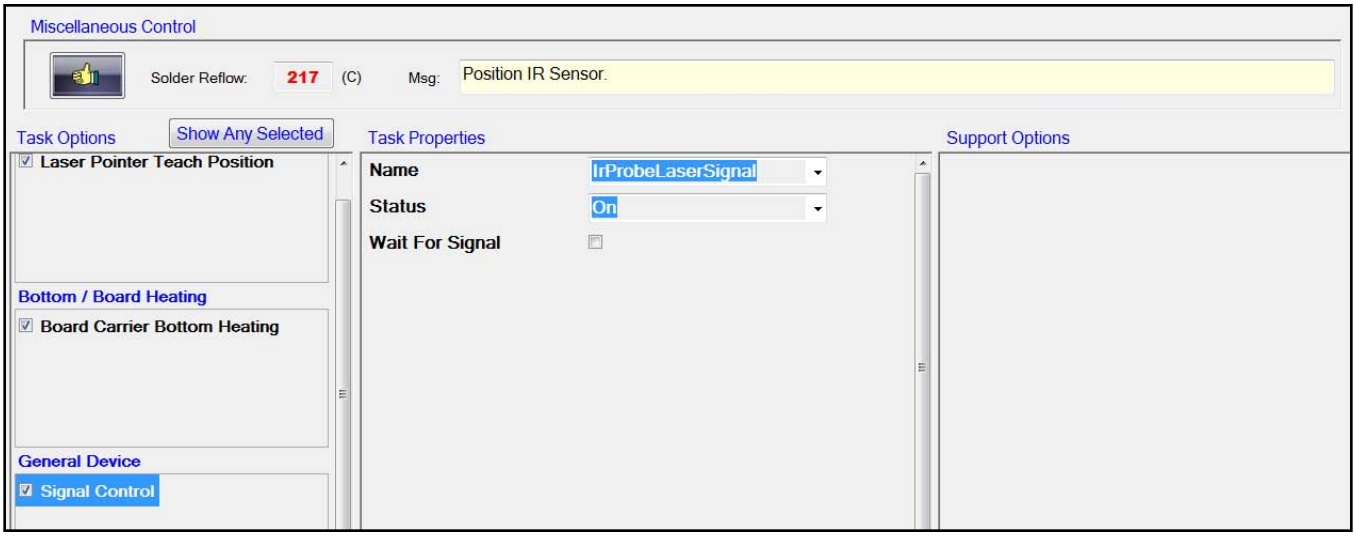

- Use the Laser Pointer Teach to locate the component.
- Position the IR sensor 2-3 inches away from the component.



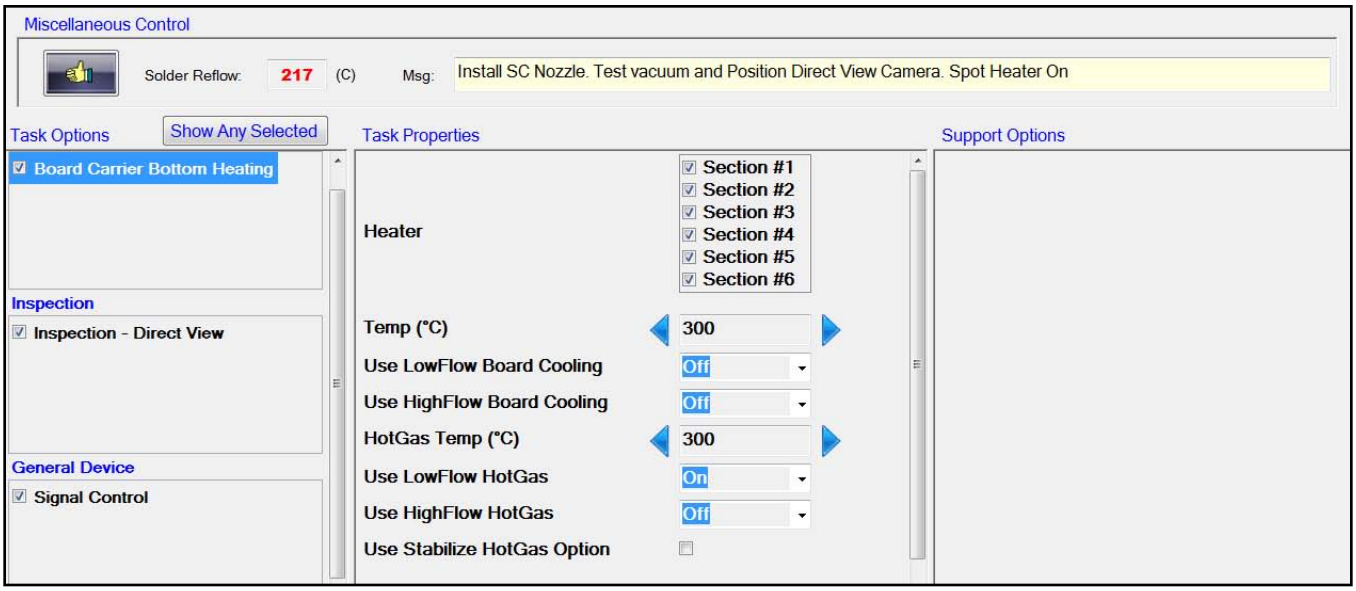
- Bottom and spot heaters on.



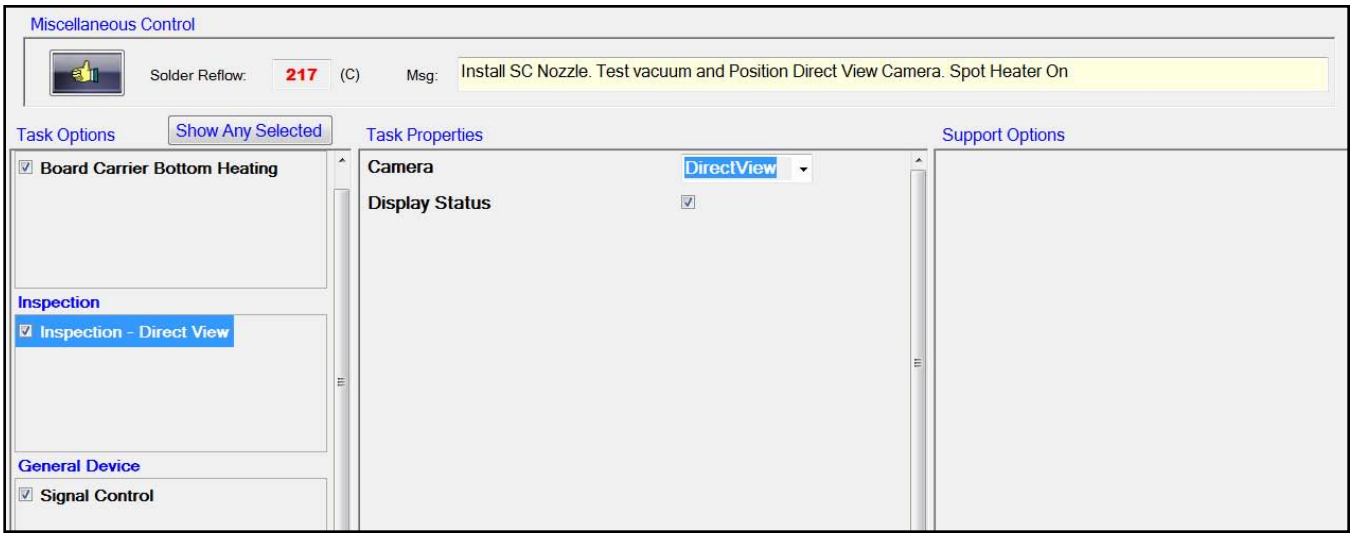

- IR probe laser on.



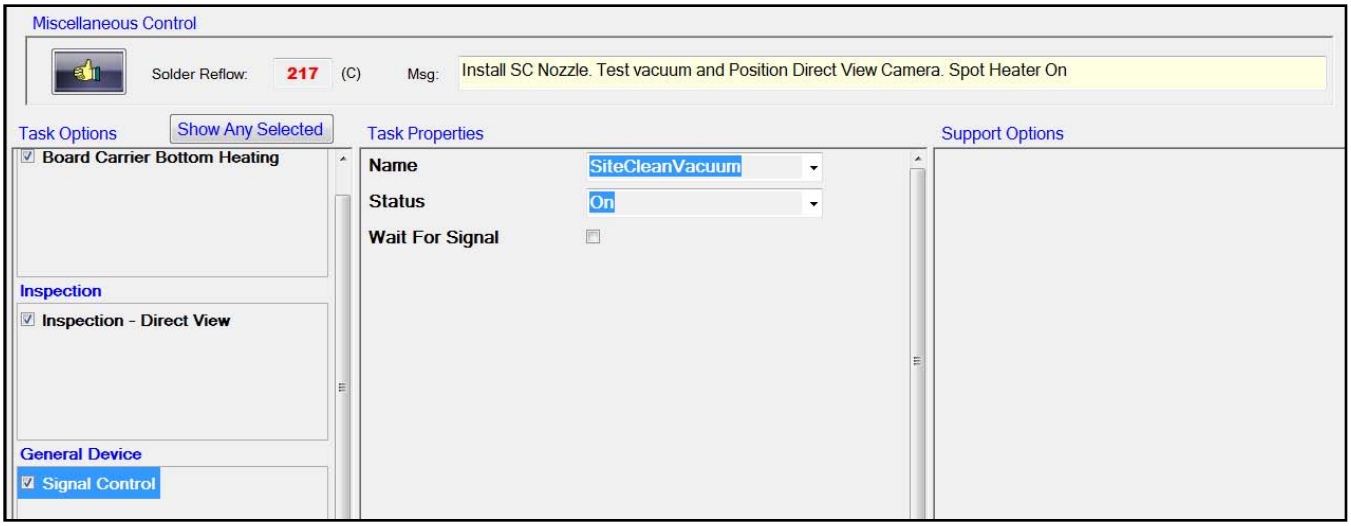
- Operator prompted to Install SC Nozzle, Test vacuum and Position Direct View Camera.
- Bottom and spot heater on.



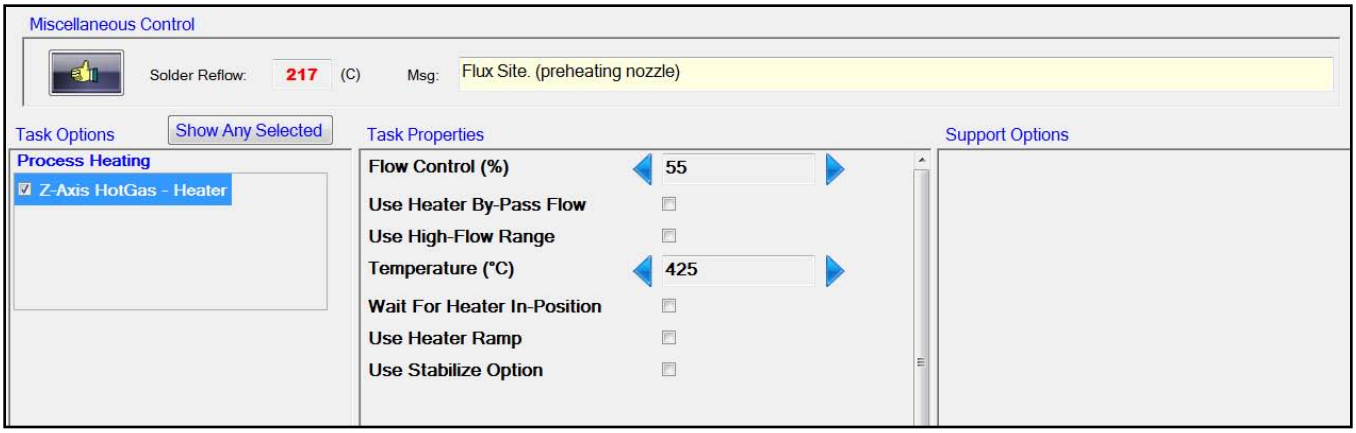

- Direct view camera on.



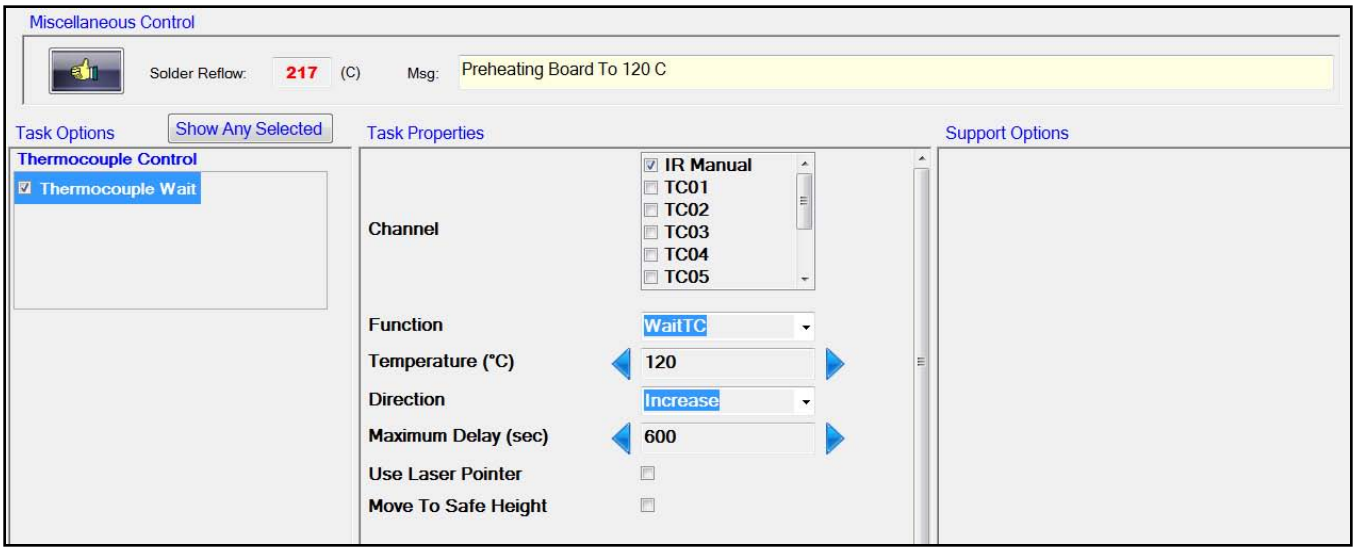
- Site cleaning nozzle vacuum on.



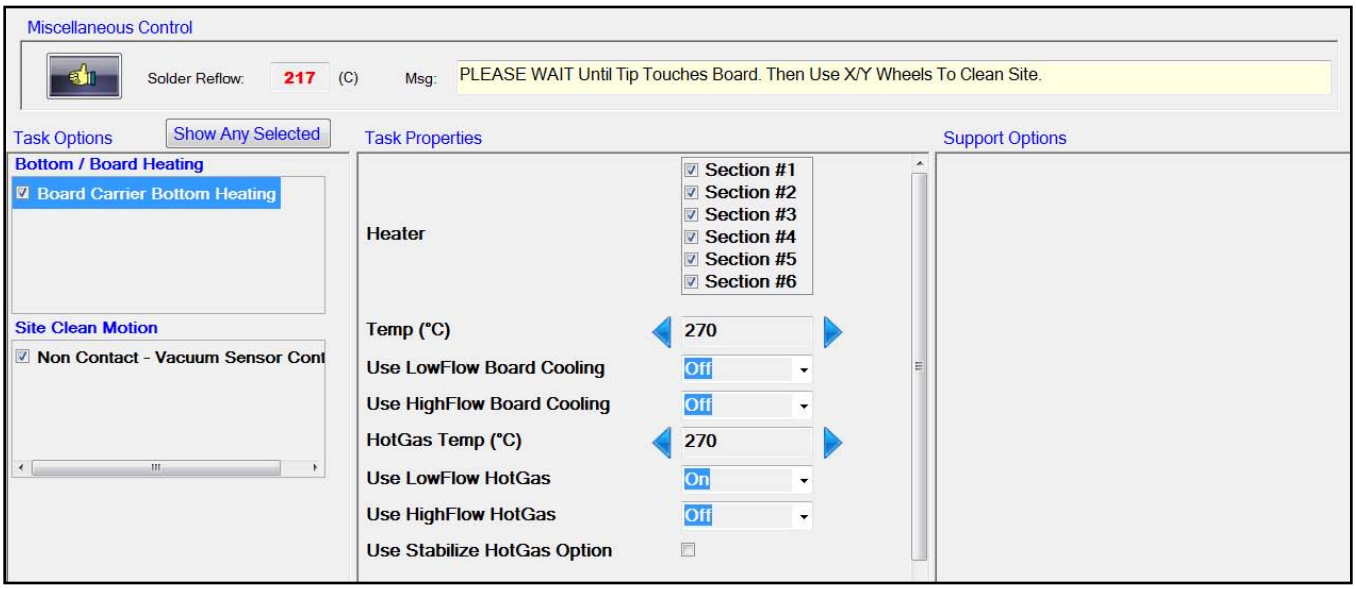

- Nozzle heater on.
- Operator prompted to flux site.



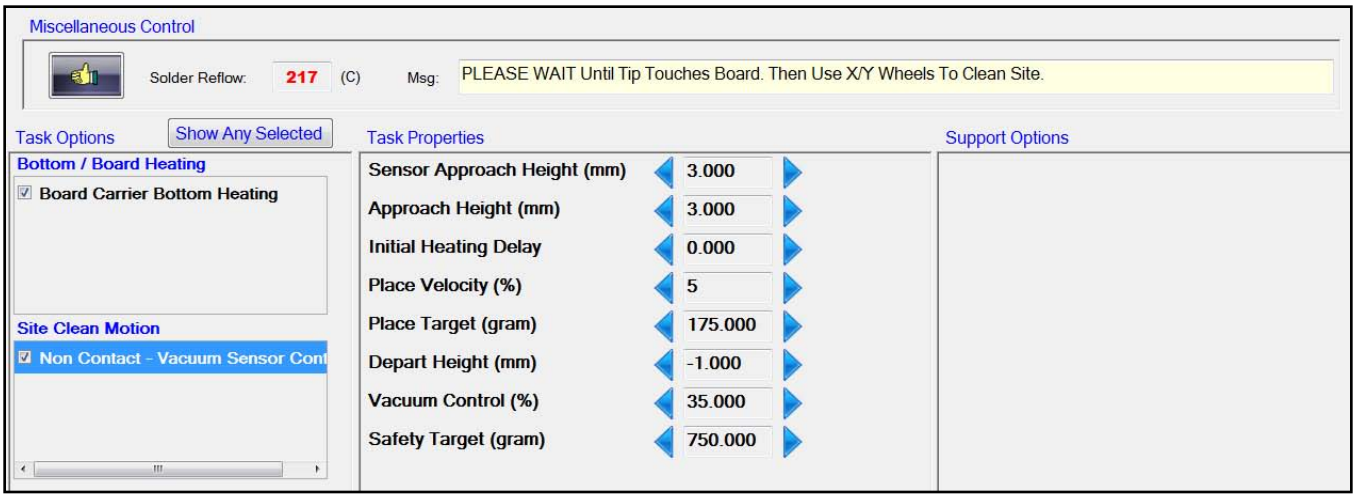
- Preheating board to 120˚C.



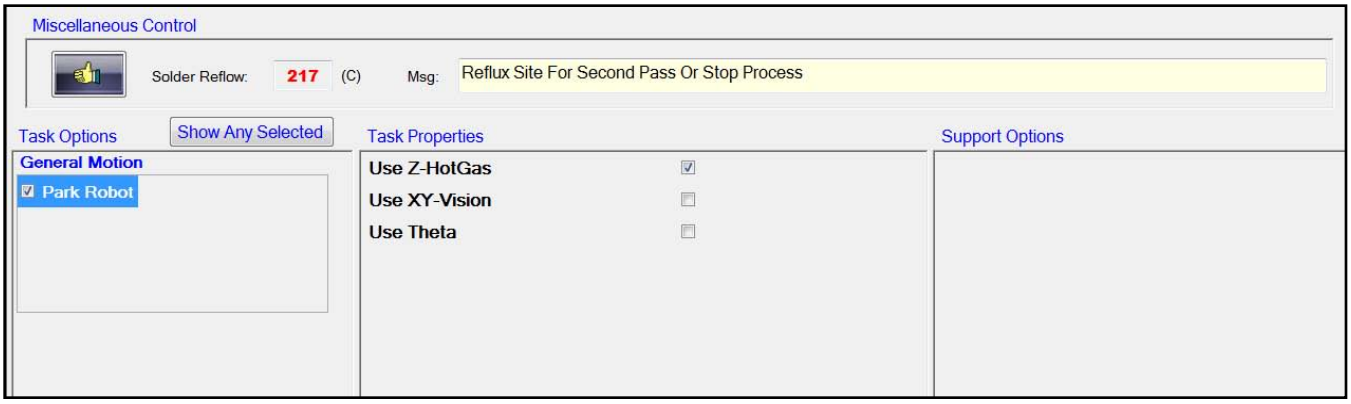

- Bottom ans spot heater temperatures reduced after board reaches 120˚C.



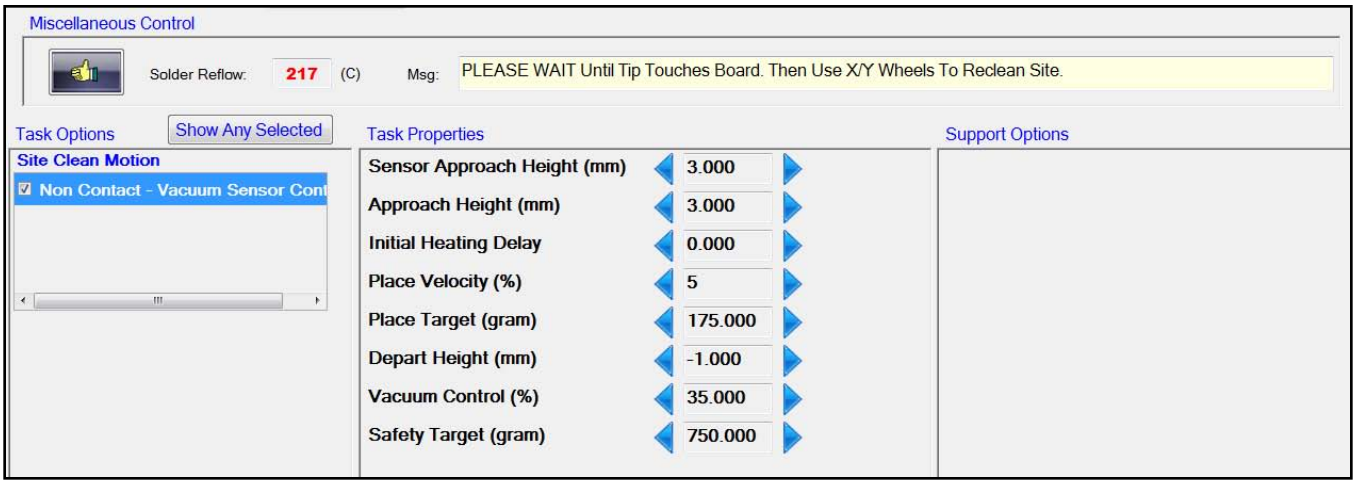
- Force touch and retract of site clean vacuum tip.



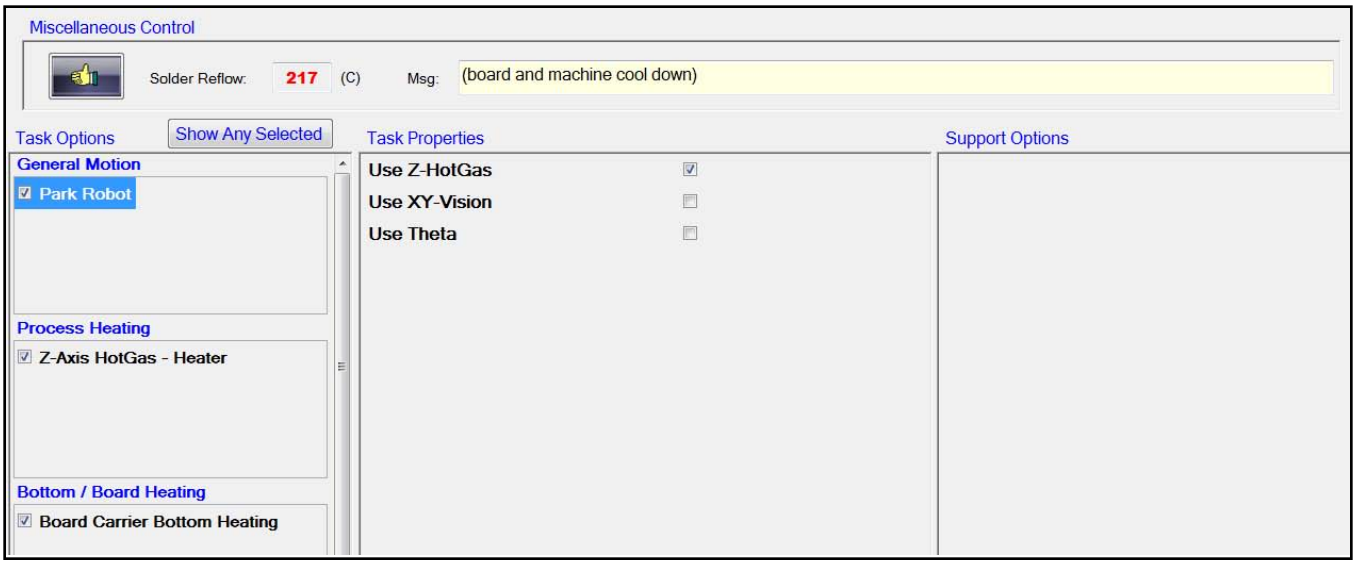

- Site clean nozzle retracts.
- Operator prompted to reflux site for second pass cleaning or stop process.



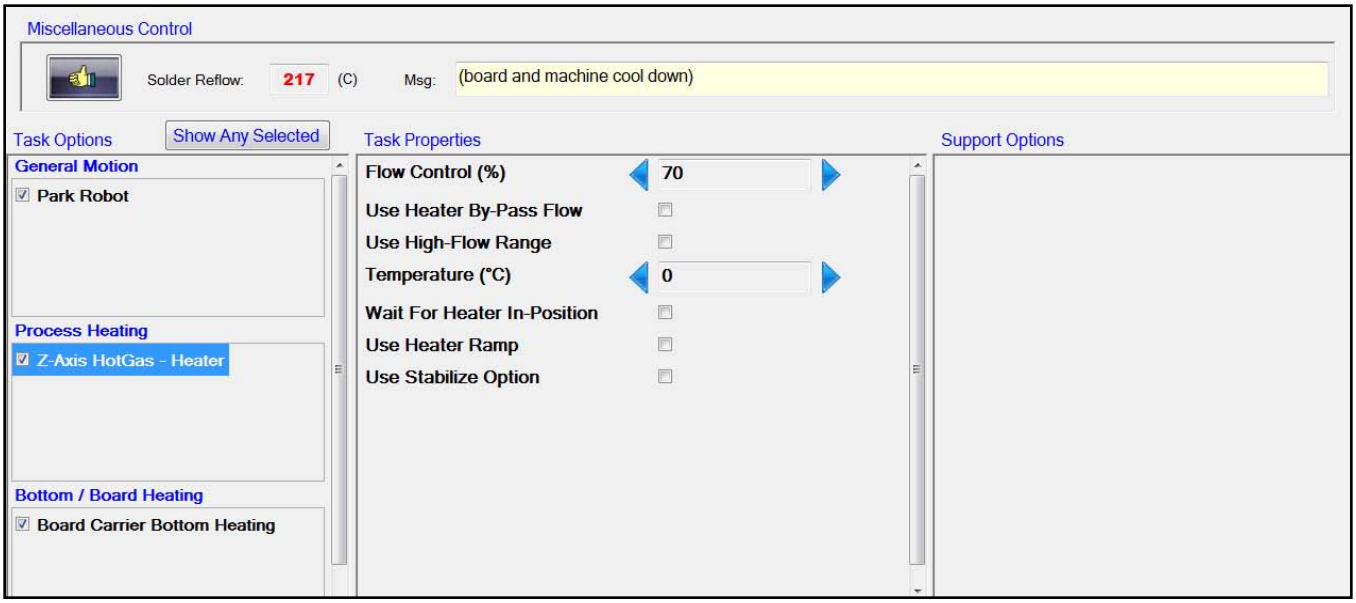
- Second pass force touch and retract of site clean vacuum tip.



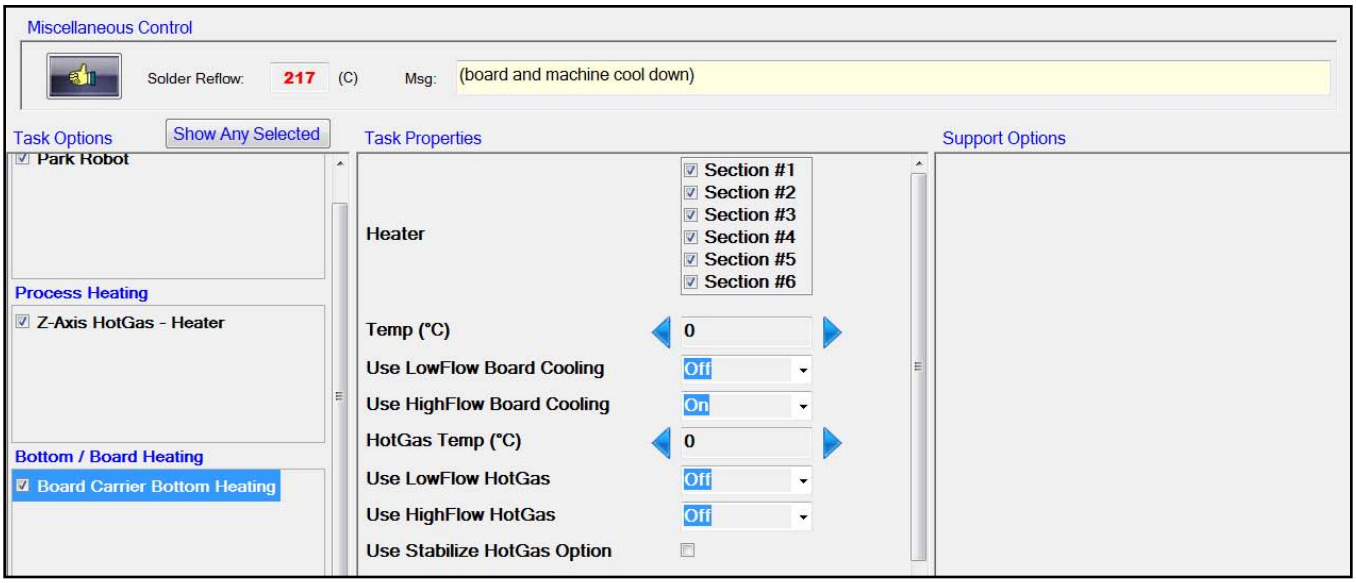

- Nozzle moves to park position.



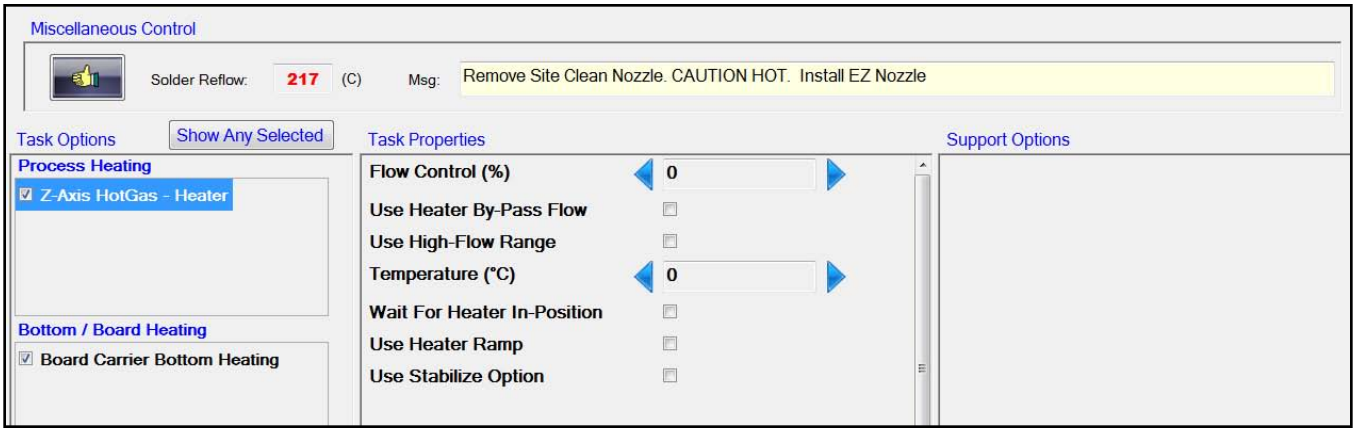
- Site clean nozzle heater cool down.

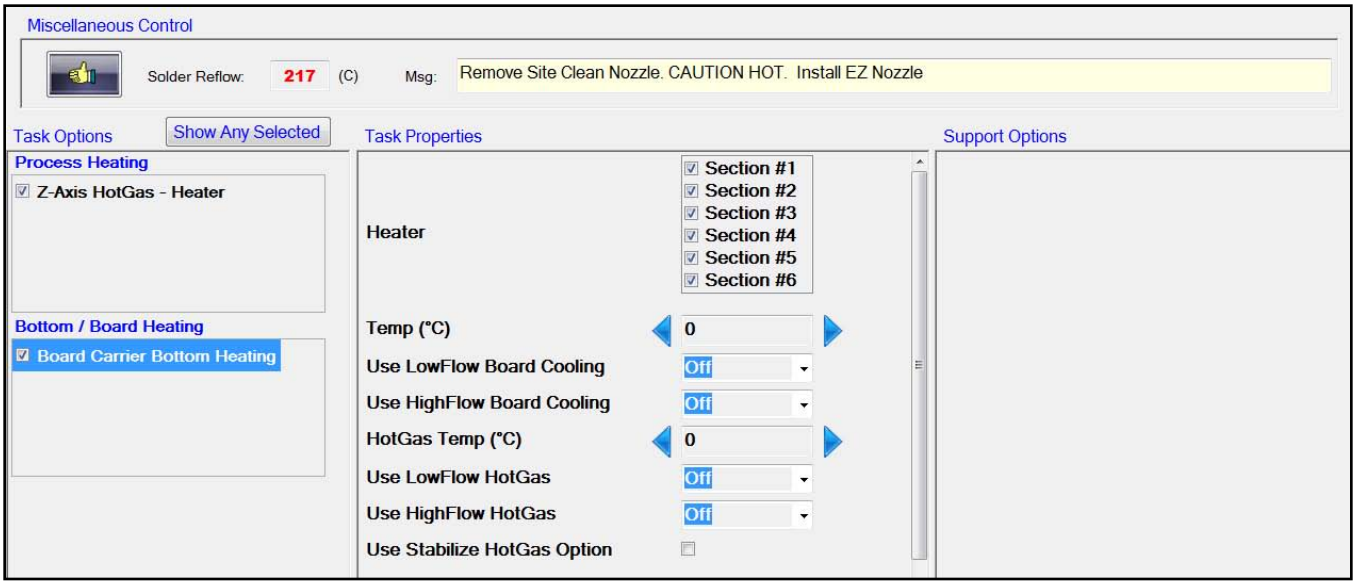



- Board cool down.



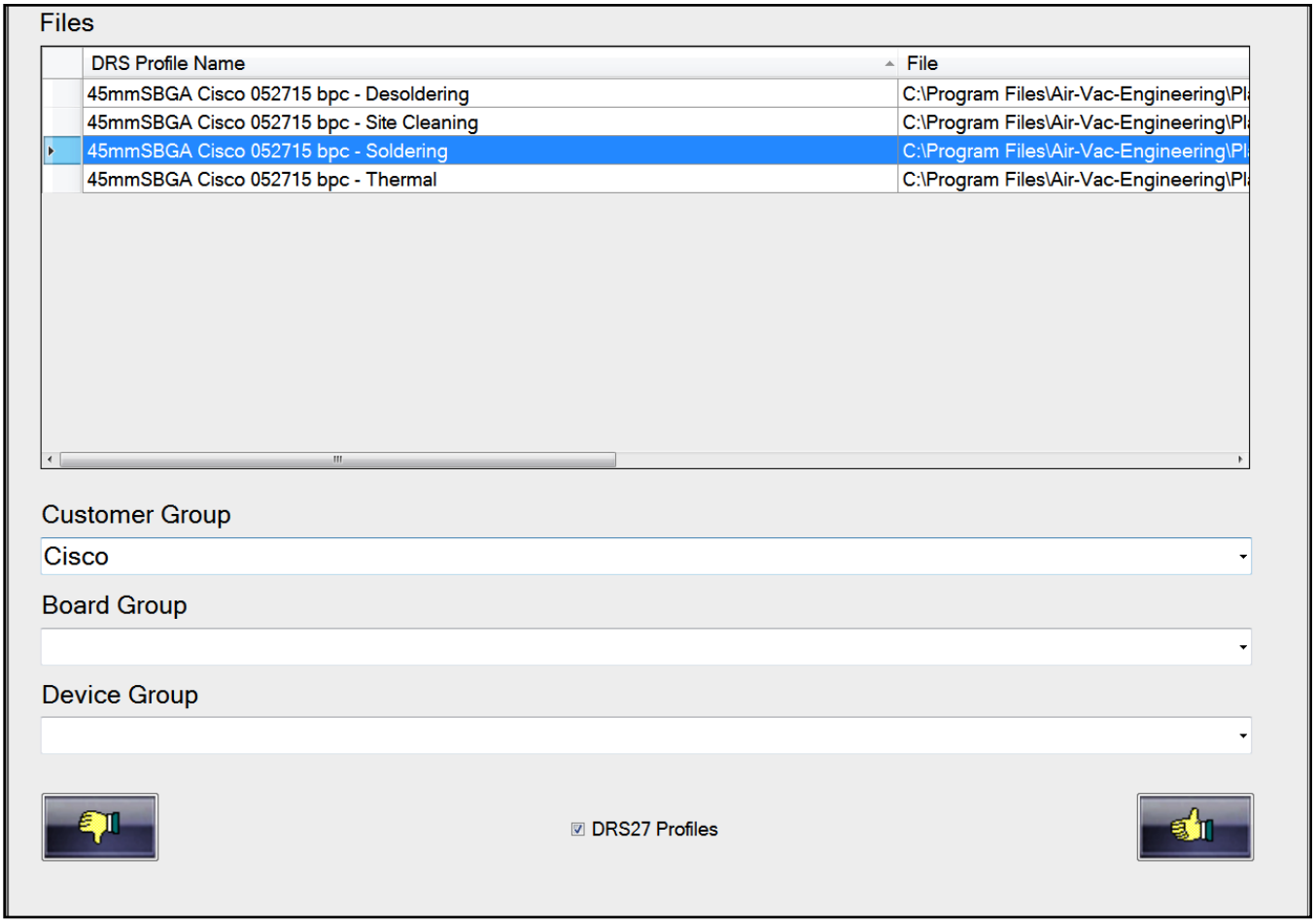
- Site clean nozzle heater off.
- Operator prompted to remove site clean nozzle and install EZ nozzle for component replacement (soldering) process.



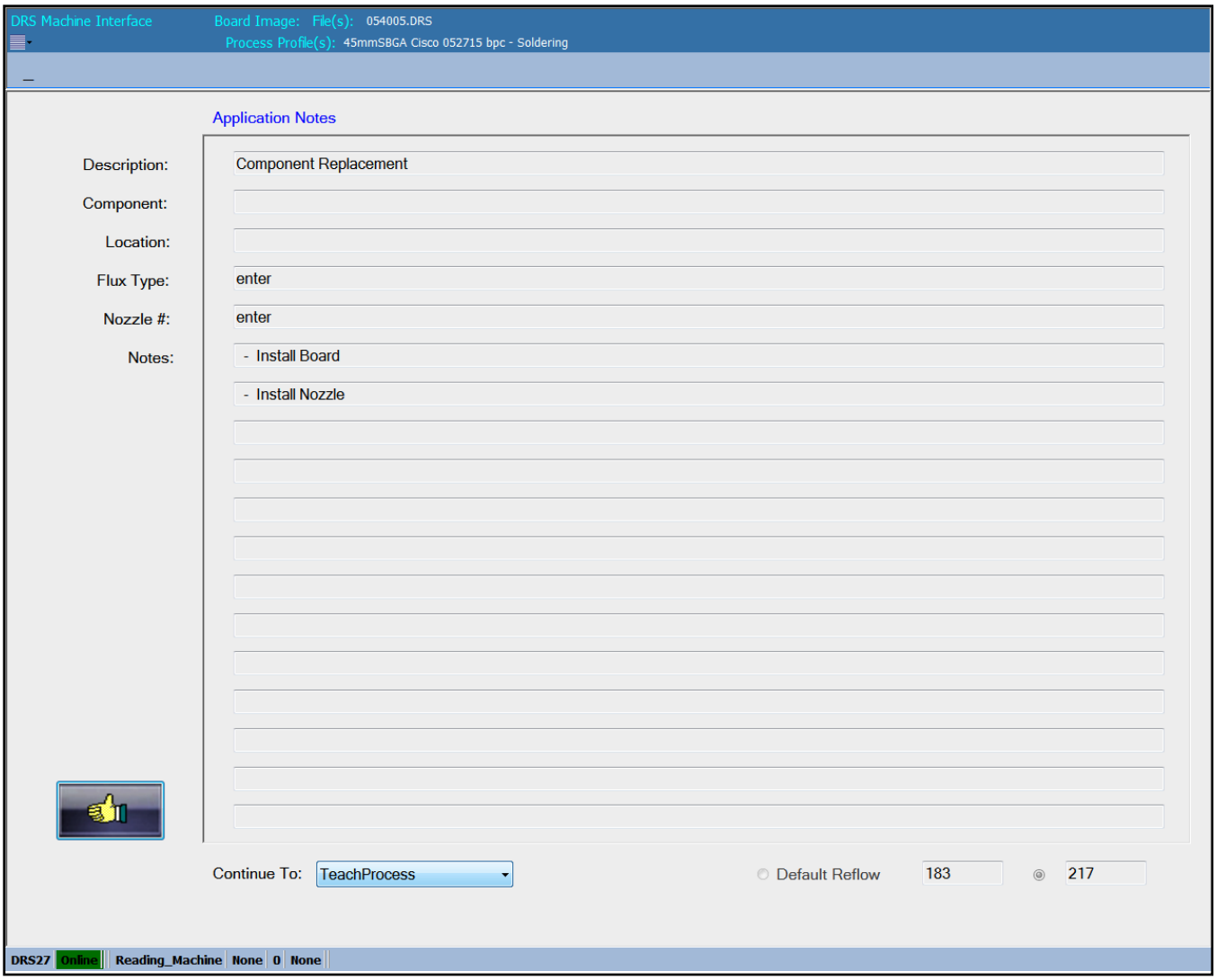



## 6.3 Replacement Template (Soldering)

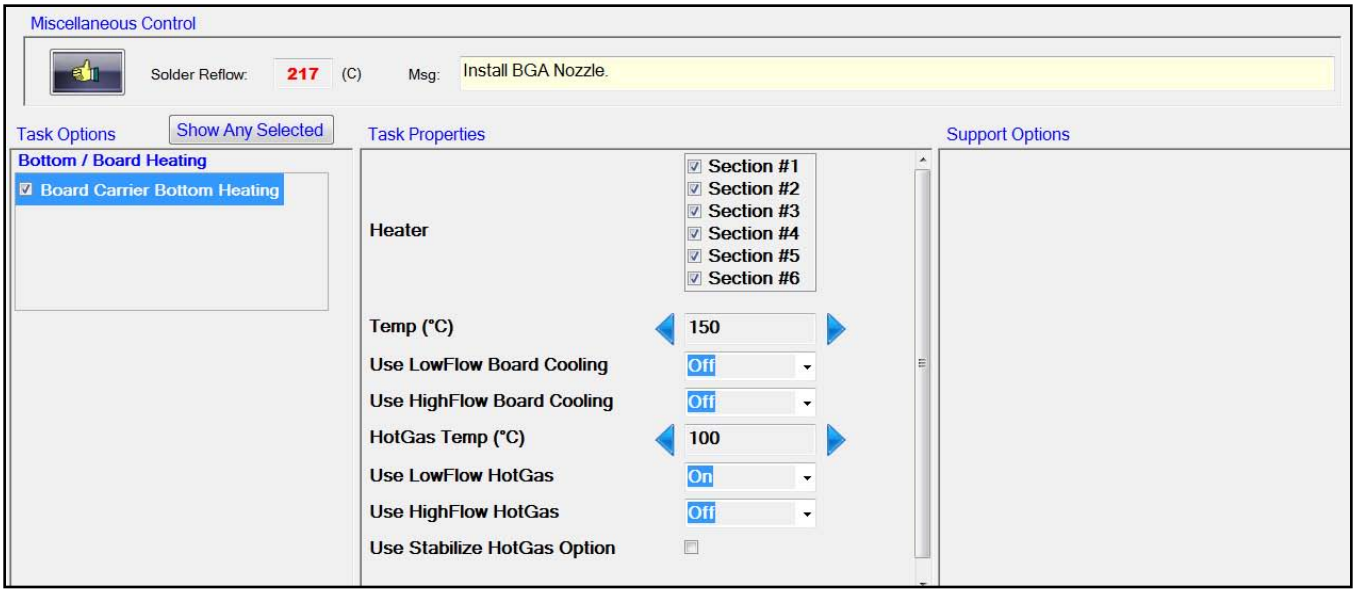
- Select Options/Open/Profile Open.
- Highlight Soldering process.
- Thumbs up to continue.



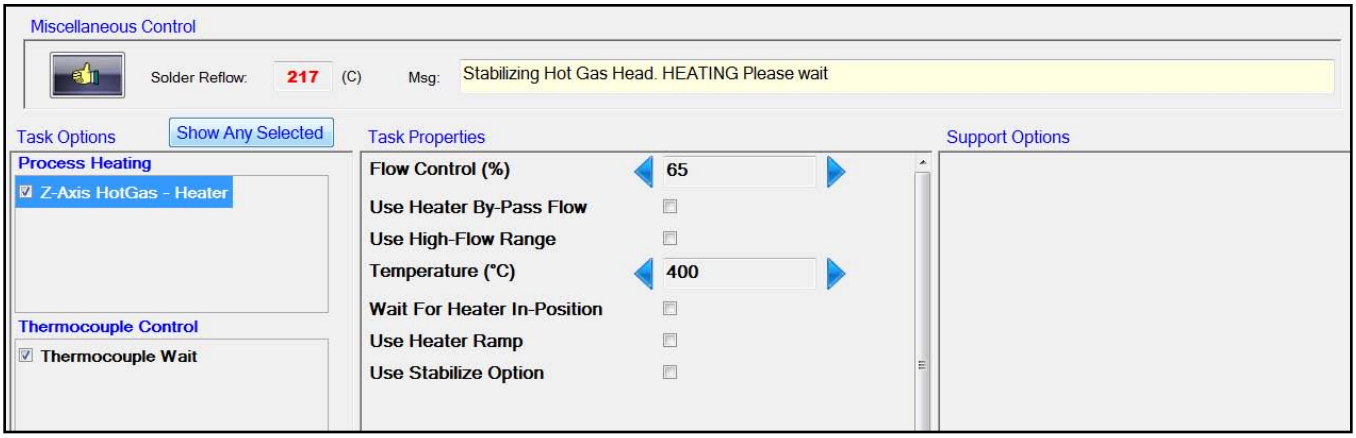
- Change pull down list to **TeachProcess.**



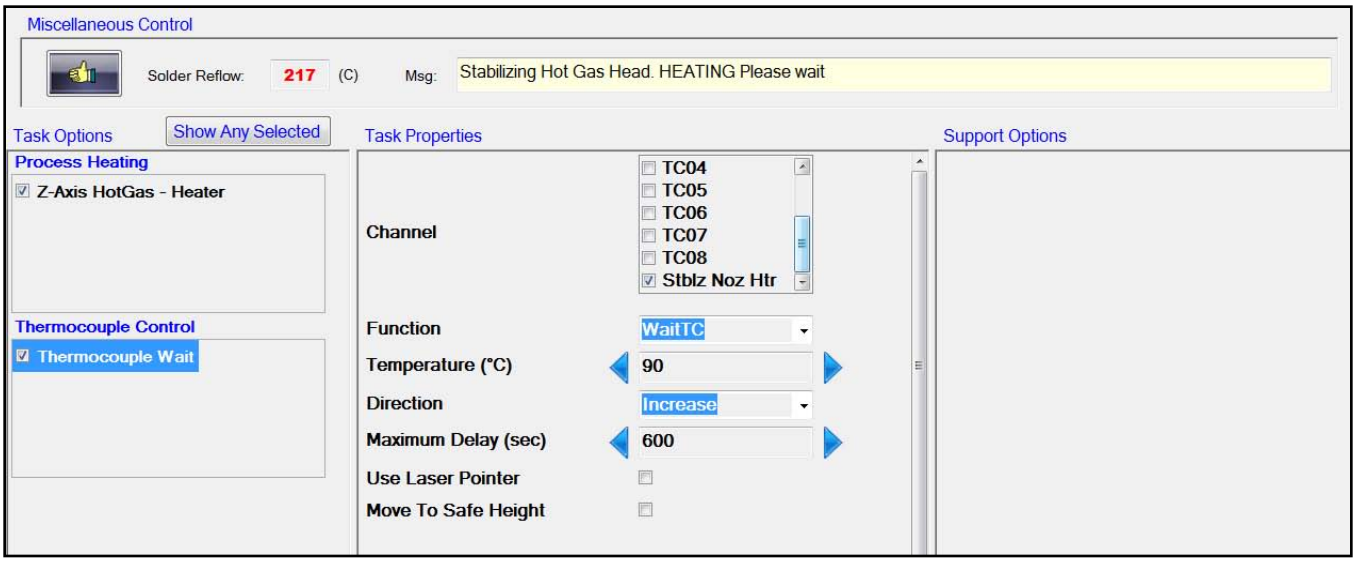
- Bottom heater and spot heater on low temperature.



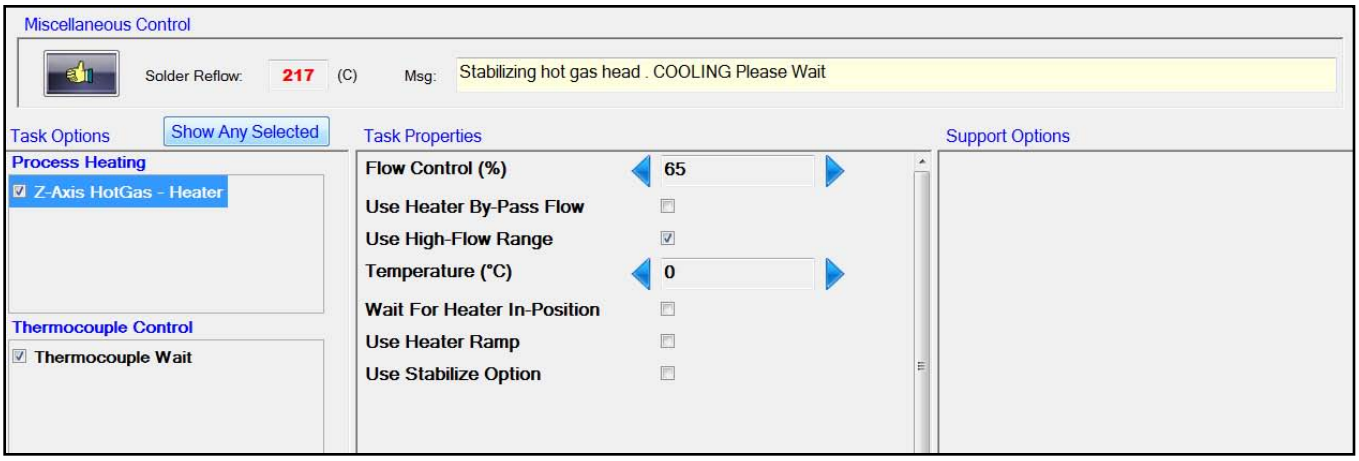

- Nozzle heater activated for stabilization.



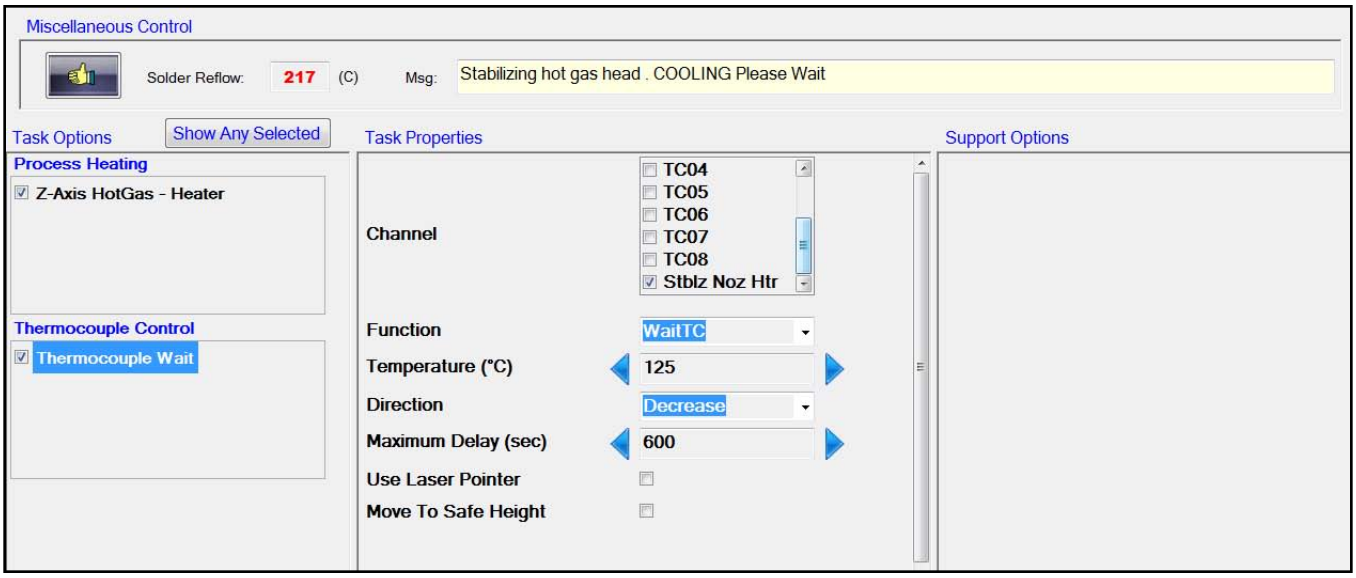
- Stabilization continues until the head thermocoouple reaches 90˚C.



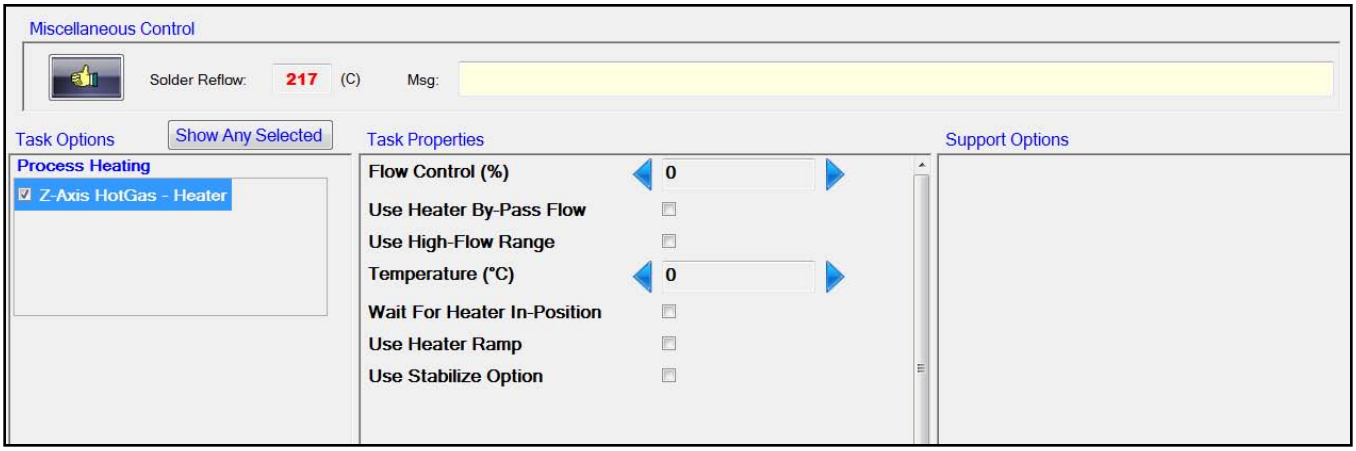

- If the head thermocouple is above 125˚C, nozzle cooling will turn.



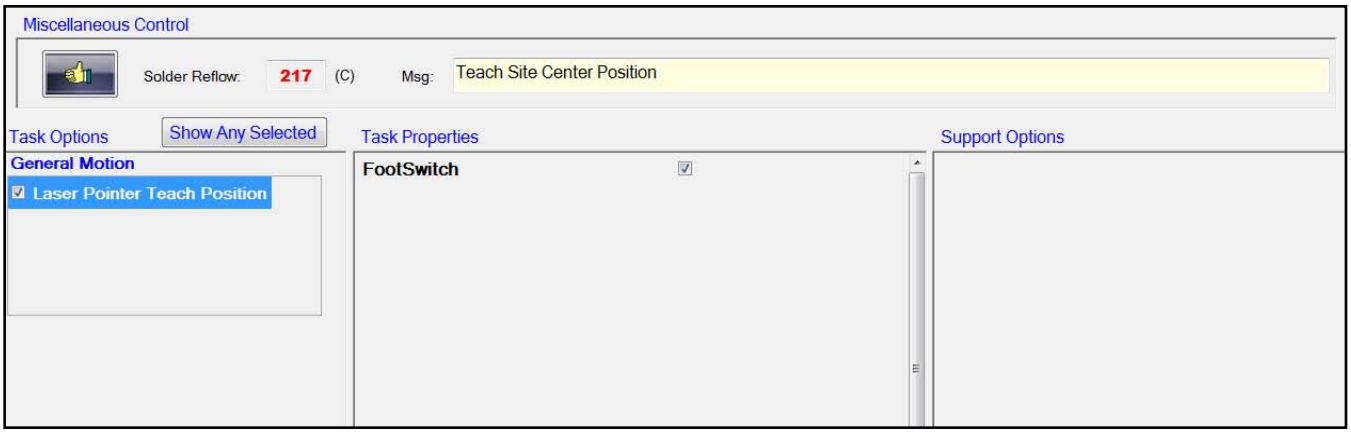
- Nozzle cooling continues until the head thermocouple falls below 125˚C.
- **NOTE: The head thermocouple will be at a high temperature at the end of the site cleaning process. If a soldering process is run immediately after site cleaning, cooling of the head will take time. Cooling down the head is important for thermal repeatability.**



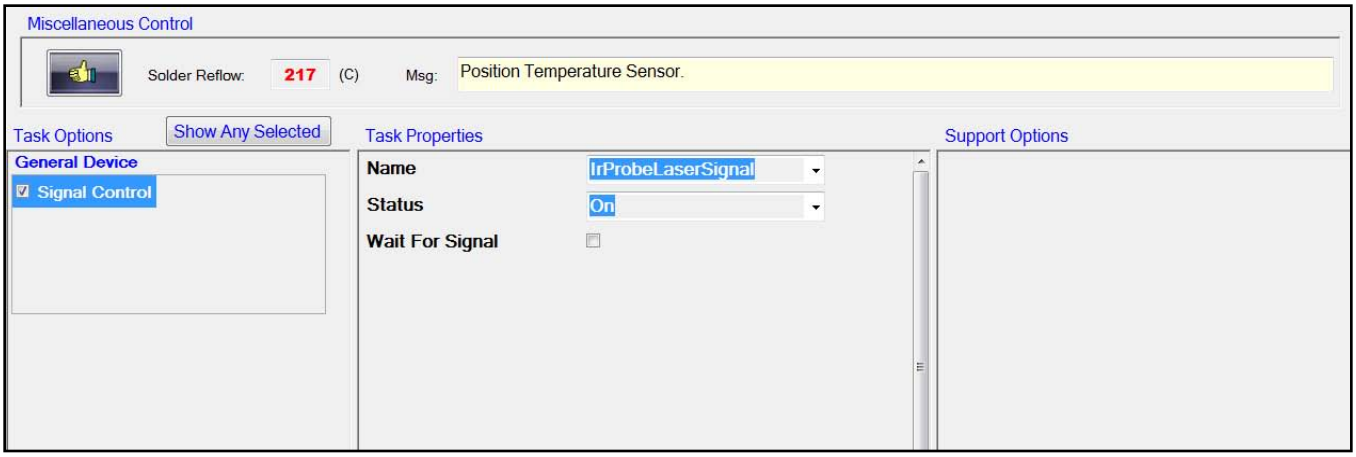

- The nozzle heater is shut off after heating/cooling of the head to the target temperature is complete.



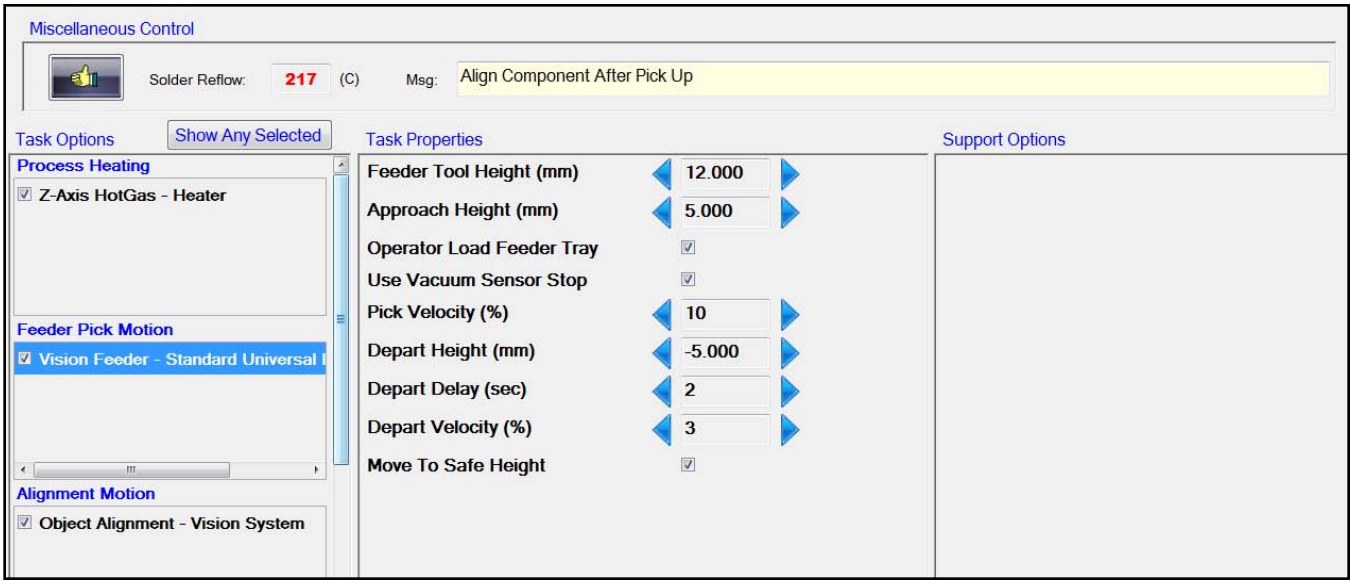
- The Laser Pointer Teach Position is activated and the operator is prompted to locate the component.



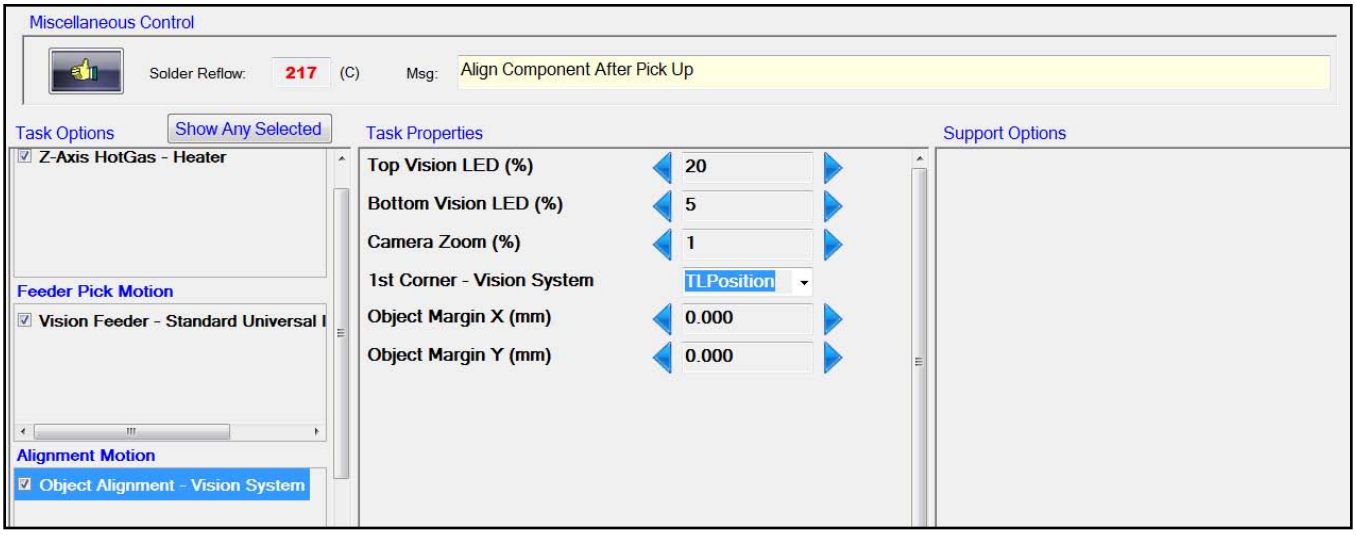

- The IR probe laser activates and the operator is prompted to position the IR probe 2-3 inches away from the component.



- The operator verifies component polarity and places the device in the universal insertion tool.
- The insertion tool is loaded in the component pickup station at the front of the vision housing.

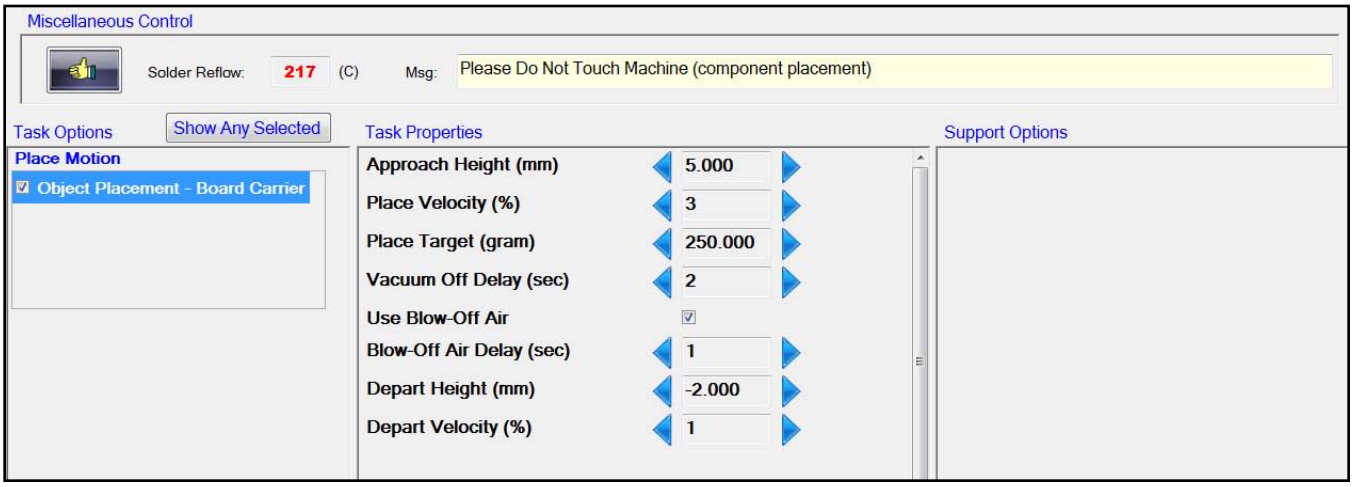



- Settings for the top and bottom LED lights, camera zoom, and initial corner view in vision during alignment.

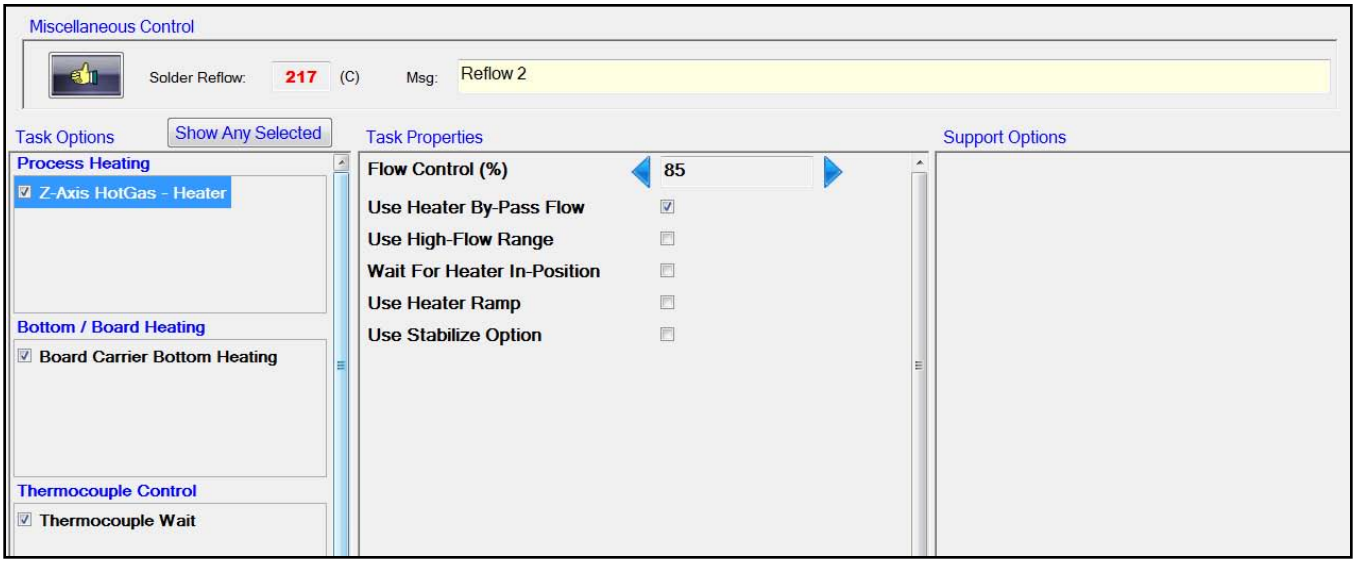


- The direct view camera activates.
- After alignment is complete, the vision retracts and the operator is prompted to flux the site.
- **NOTE: Tacky flux should be used to hold the component in place and to improve wetting.**

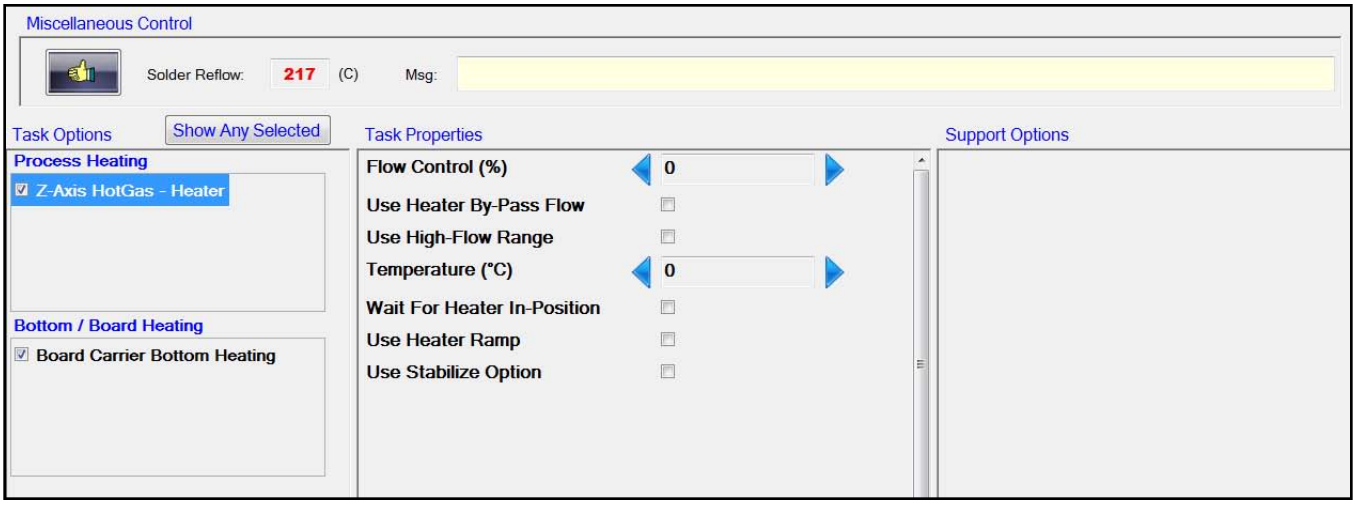

- Automatic force placement of the component and retract of the nozzle.
- **NOTE: Do not touch machine during this event as it may create a false force trigger and drop the part.**



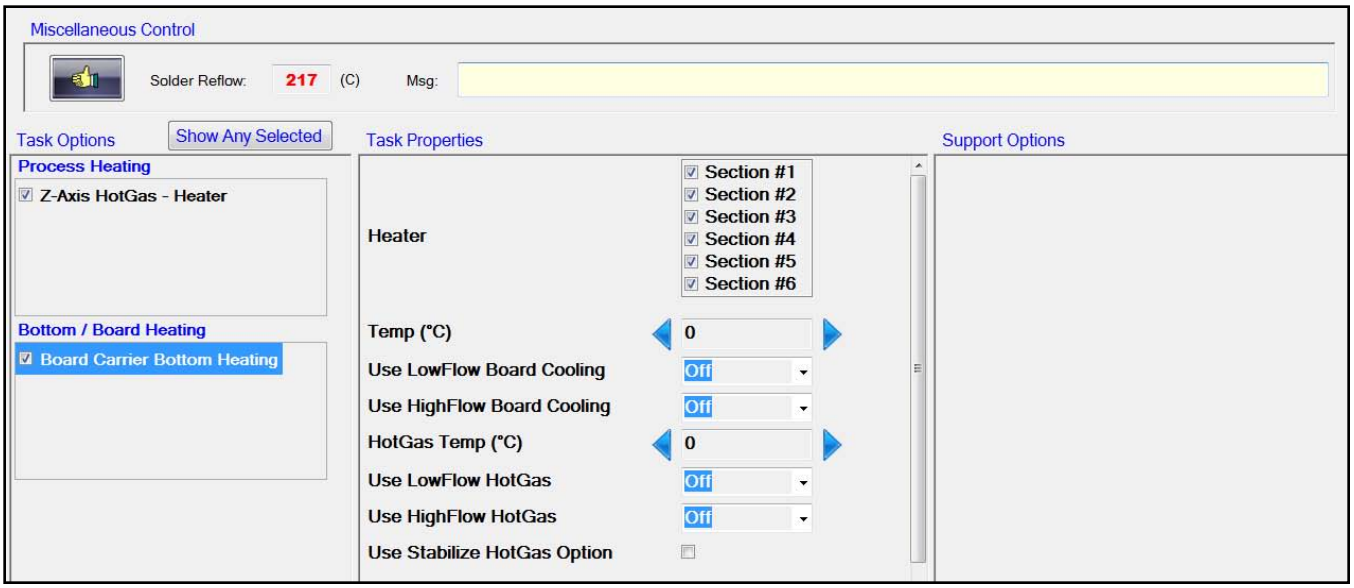
- Reflow 2 (cooling the component down from maximum temperature to below liquidus) will then execute.
- The Preheat/Presoak/Soak/Ramp/Reflow 1 stages from the thermal profile (same as in the desoldering profile) will run.



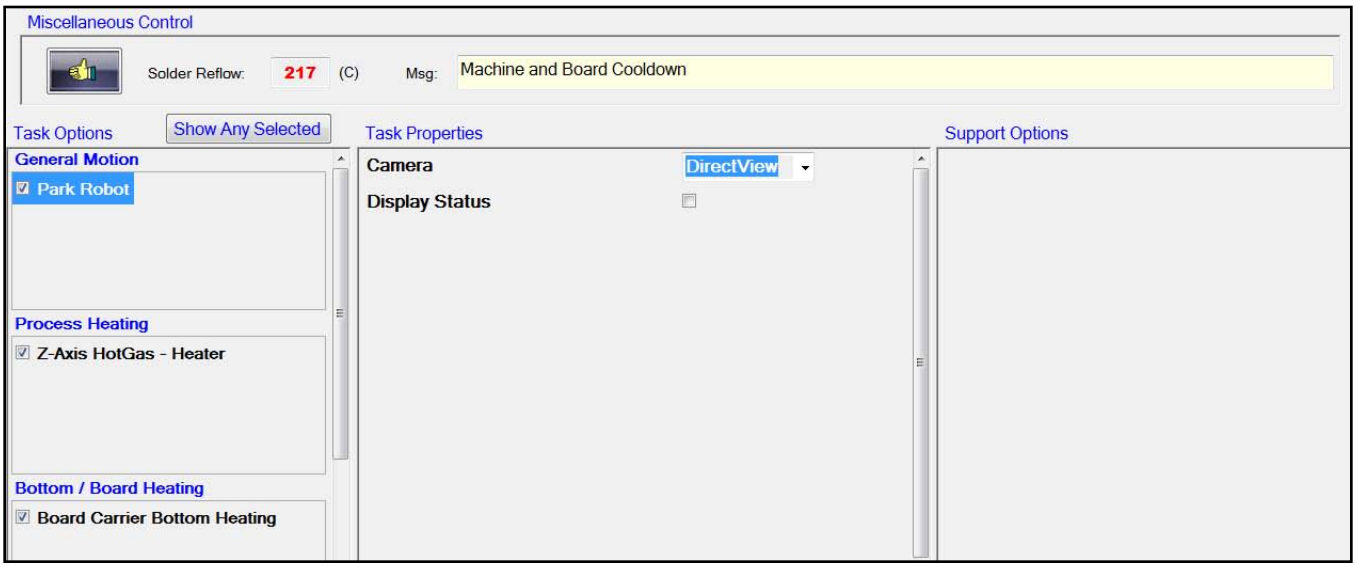

- Nozzle cooling off.



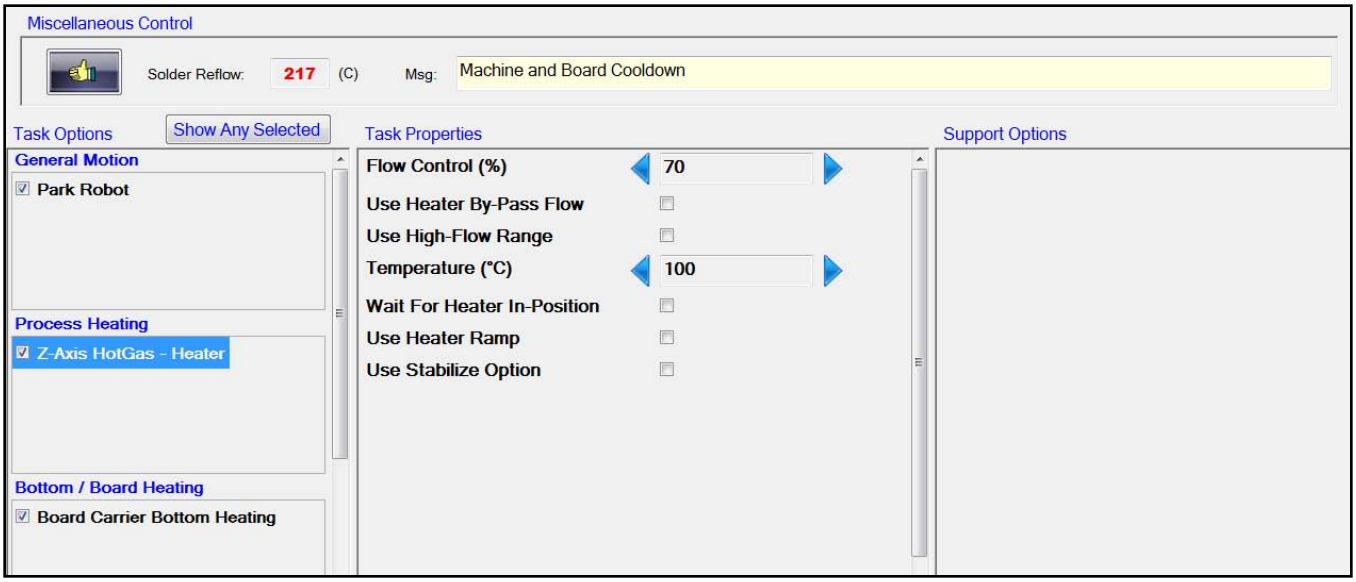
- Board cooling off.



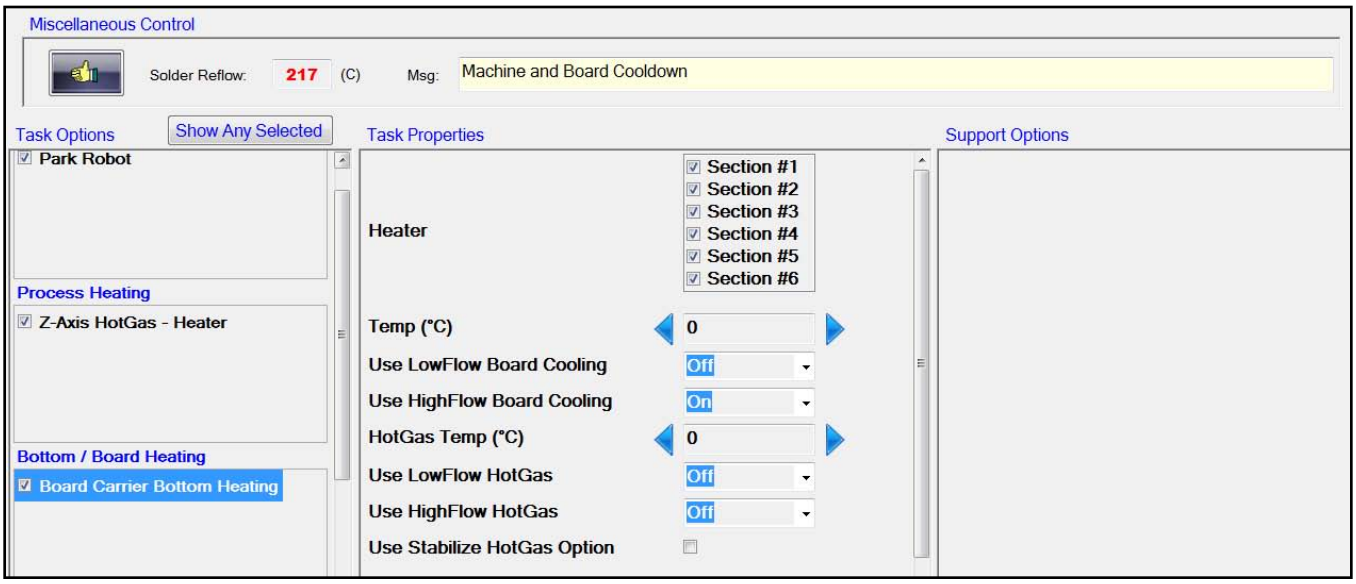

- Head to park position.



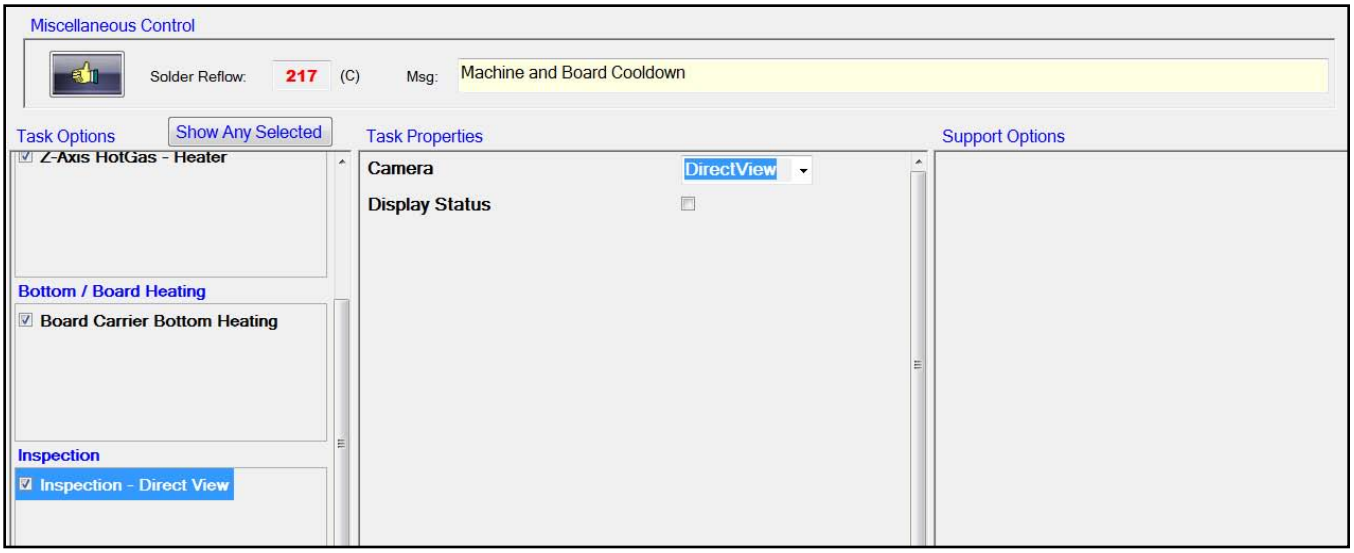
- Nozzle cool down.



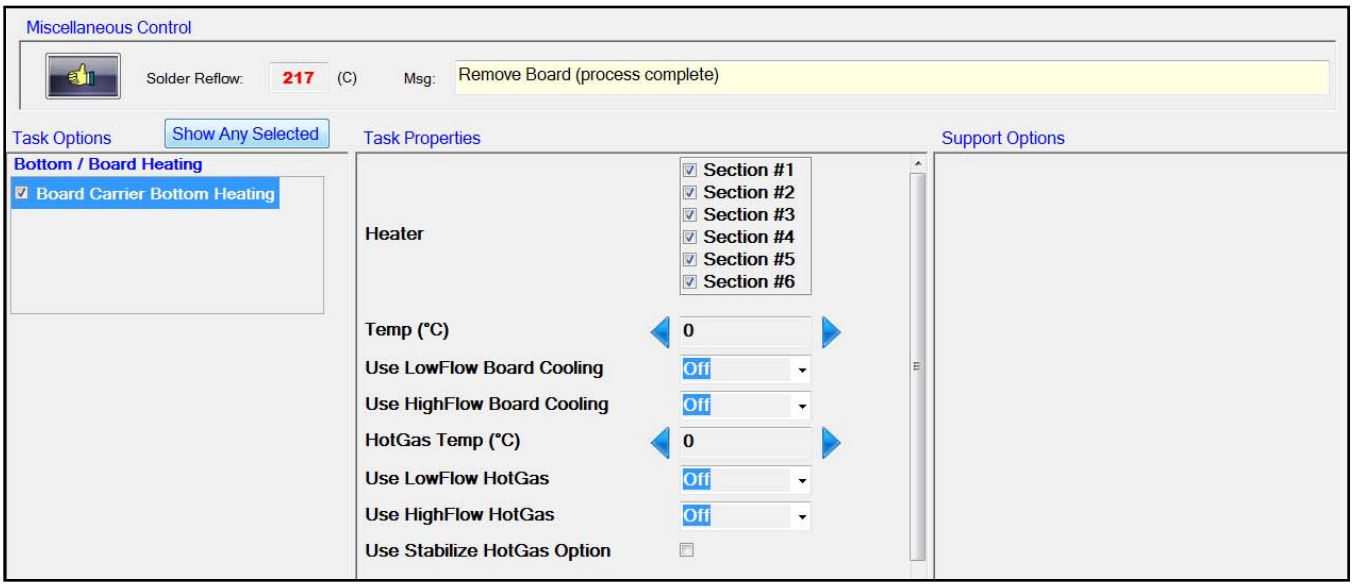

- Board cool down.



- Direct view camera off.




- Process complete.



# 7: Operator Training

**7 OPERATOR TRAINING: EXECUTING A NEWLY CREATED PROFILE ..... 3**

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# 7 Operator Training: Executing a Newly Created Profile

## 7.0 Overview: BGA Removal, Site Cleaning, Soldering

The following outline is an illustration of typical steps performed for BGA removal, site cleaning, and soldering.

1- Register as an operator.
2- Select the appropriate profile.
3- Follow the instructions of the first (note detail) screen such as load nozzle, load PCB, and position board supports.

### Removal Program

1- Press the cycle start icon. Follow message prompts.
2- Automatic component removal.
3- Select "linking file" function to go to site cleaning program.

### Site Cleaning Program

1- Press the cycle start icon. Follow message prompts.
2- Remove component nozzle with handling tools, install site cleaning nozzle.
3- Position nozzle tip at site, position direct view camera and flux site.
4- Move x/y wheels as solder melts to clean site.
5- Clean area and inspect.
6- Select "Linking File" function to go to the Soldering program.

### Soldering Program

1- Remove site cleaning nozzle with handling tools and install component nozzle.
2- Follow message prompts..

**WARNING!**
The DRS machine is configured to run on the dedicated PC provided. The custom software is configured for optimum machine performance in conjunction with the Windows® operating system. Additional software loaded may affect performance and system integrity. The pc is not intended for personal/other use. The operator should not be in any screen other than the Air-Vac DRS27 program.

The intent of this section is to assist the operator in becoming familiar with the DRS27 Hardware and Software. In addition to this information, operator training should be supplemented by formal training from a qualified individual.

The DRS27 software is Windows®-based. When the module is powered, it automatically boots to the customized software. Extensive software knowledge is not required. The graphics interface is based on symbols (icon) or word buttons for operator functions. Operators use the software to run pre-tested/pre-approved profiles. Automatic steps and helpful prompt messages provide clear operation. Password protection restricts access to high security areas.

## 7.1 Power-Up/Log In

- Turn on machine power. (Disengage e-stop and turn power key.) The Green light next to the key will illuminate.
- Turn PC on and let it boot up to the Administrator screen. Click inside the black Air-Vac box. The administrator password is AirVac.
- Double click on the AV DRS27 icon to start the software.


- The Operator Registration screen will appear. Enter your operator name and click on Thumbs Up. If access is denied, contact supervisor.

- Enter Password. The Password screen will automatically appear after the Operator Registration screen. Enter a password and click on the Up Thumb icon to continue. If access is denied, consult supervisor.


**NOTE: Operator Names and Passwords must be correct to access software. Low priority will only allow access to minimal screens. (The machine is shipped with "operator" and "no password" under low priority/limited access.)**

Machine will perform a home operation – remove nozzle and click OK.

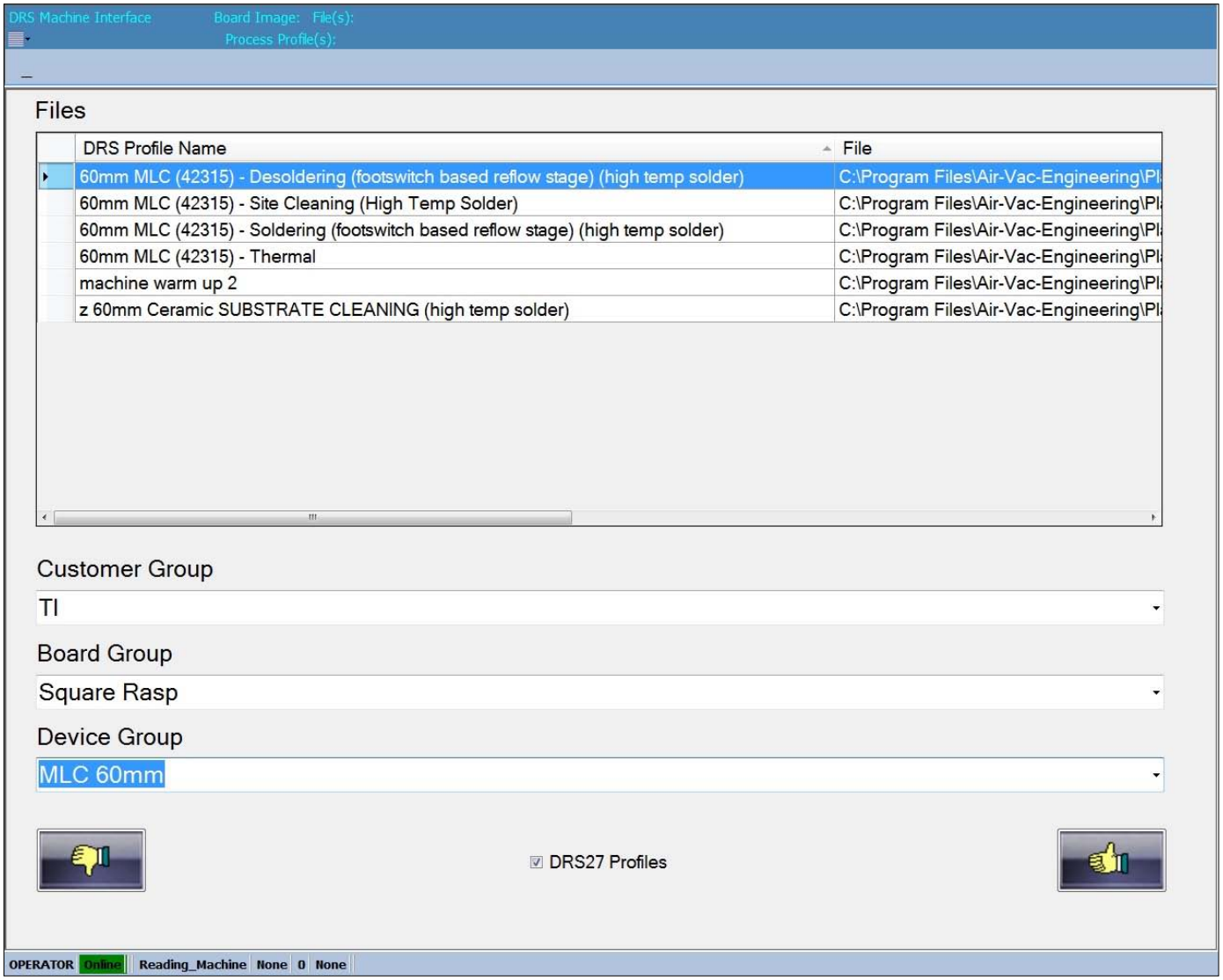
## 7.2 Main Screen Overview


**Note:**

Using the low priority password limits the operator access to computer screens and restricts parameters from being changed. This allows all profiles to be run as programmed.

## Options:


**Open/Profile Open:** The programs are opened and executed. A file directory will be shown listing all created programs. In that directory, change the directory to open and execute other programs.



**About DRS:** Provides the current version of the software on the machine. Please note software upgrades are available; contact Air-Vac.

**Exit:** Closes the software prior to shutting the machine down.

**Note**

DO NOT TURN OFF MACHINE PRIOR BEFORE CLOSING THE SOFTWARE.

**Control:**

**Run Process:** Activates screen to run the program. This screen is automatically displayed after a program is opened and the **Open Profile screen** is presented.

**Reset Operator:**

Allows a new operator to log on.

**Note**

IT IS GOOD PROCEDURE TO PRESS **RESET OPERATOR** WHEN LEAVING THE MACHINE. THIS PREVENTS UNQUALIFIED PERSONNEL FROM USING THE MACHINE (UNDER THIS OPERATOR'S NAME). PROGRAMS AND OPERATOR NAMES ARE RECORDED IN A **HISTORY FILE.**

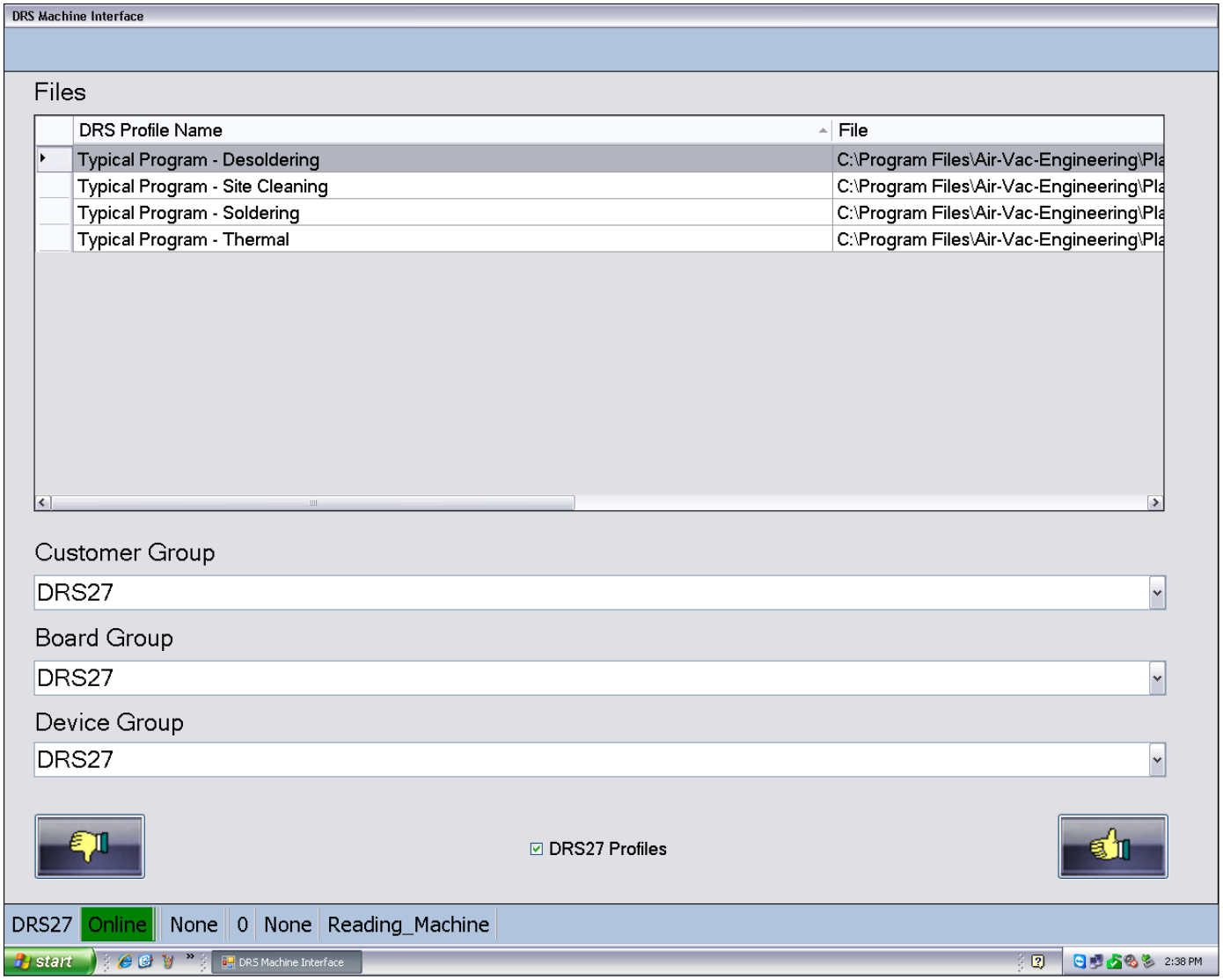
**Camera:**

**Open:** Opens screen to allow direct view or vision camera to be accessed.

## 7.3 Open A Typical Program

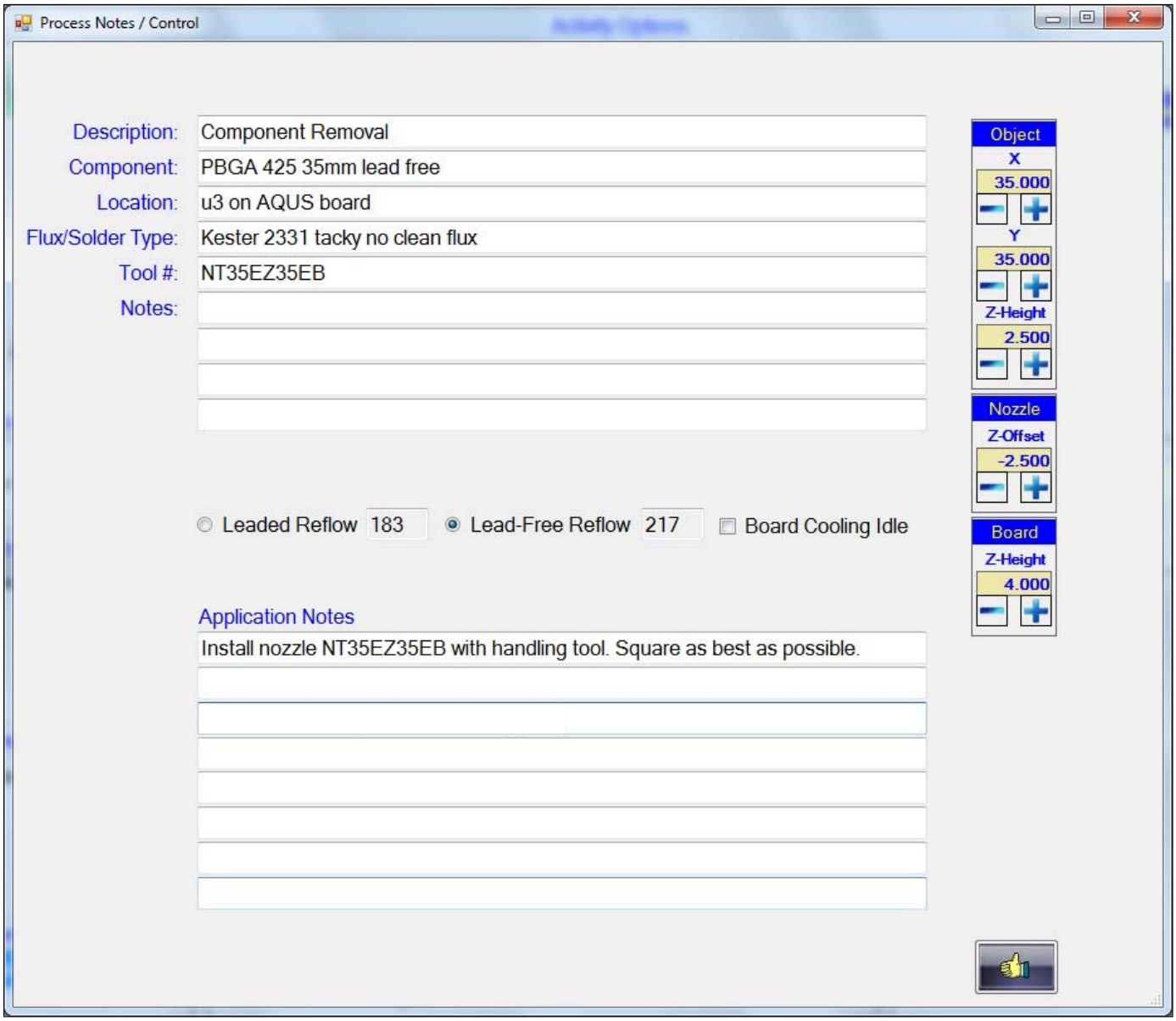
### - Open Profile (All Listings Screen)

Selecting **Options**, then **Open/Profile Open** will present the **Open Profile – All Listings Screen**




- **Select Group.** The operator must select the correct Customer, Board and Device Group directory. Using the Up/Down Arrows at the right side of the each group box to select a BGA "file".
- **Select Program.** Under files highlight a program file.
- Click on **Thumbs Up** icon.

The **Open Profile Note screen** will appear. It provides information prior to running the program.



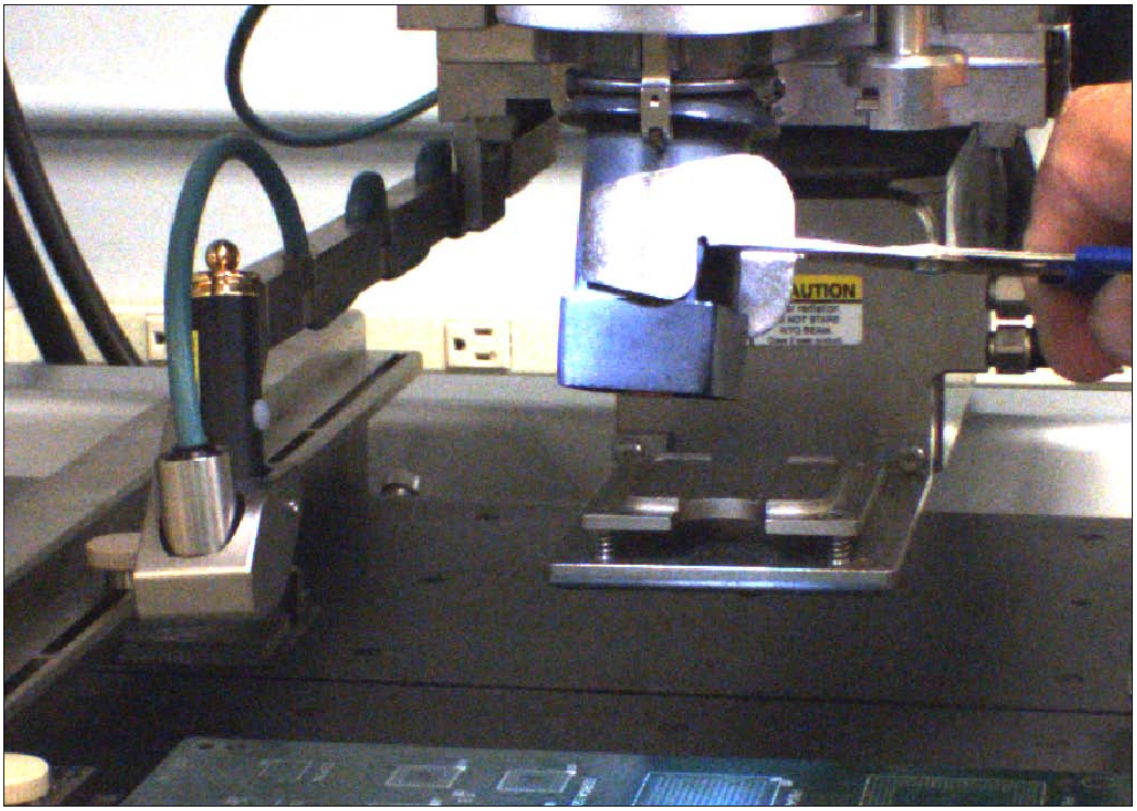

- Follow all instructions on the Open Profile.

**Description**: Provides generic program title.
**Component**: Describes the device to be reworked. For example, PBGA 425 35mm Lead-Free
**Location:** Describes location and board. For example, U3 on Aqus Board.
**Flux Type**: Describes the flux to be used. For example, Kester 2331 NC Tacky Flux.
**Tool #:** The nozzle used. For example, N35EZ35EB.
**Notes:** Saves helpful information about the assembly. Provides operator tasks and checks prior to running the program. (Prior to going to the Run Screen.)

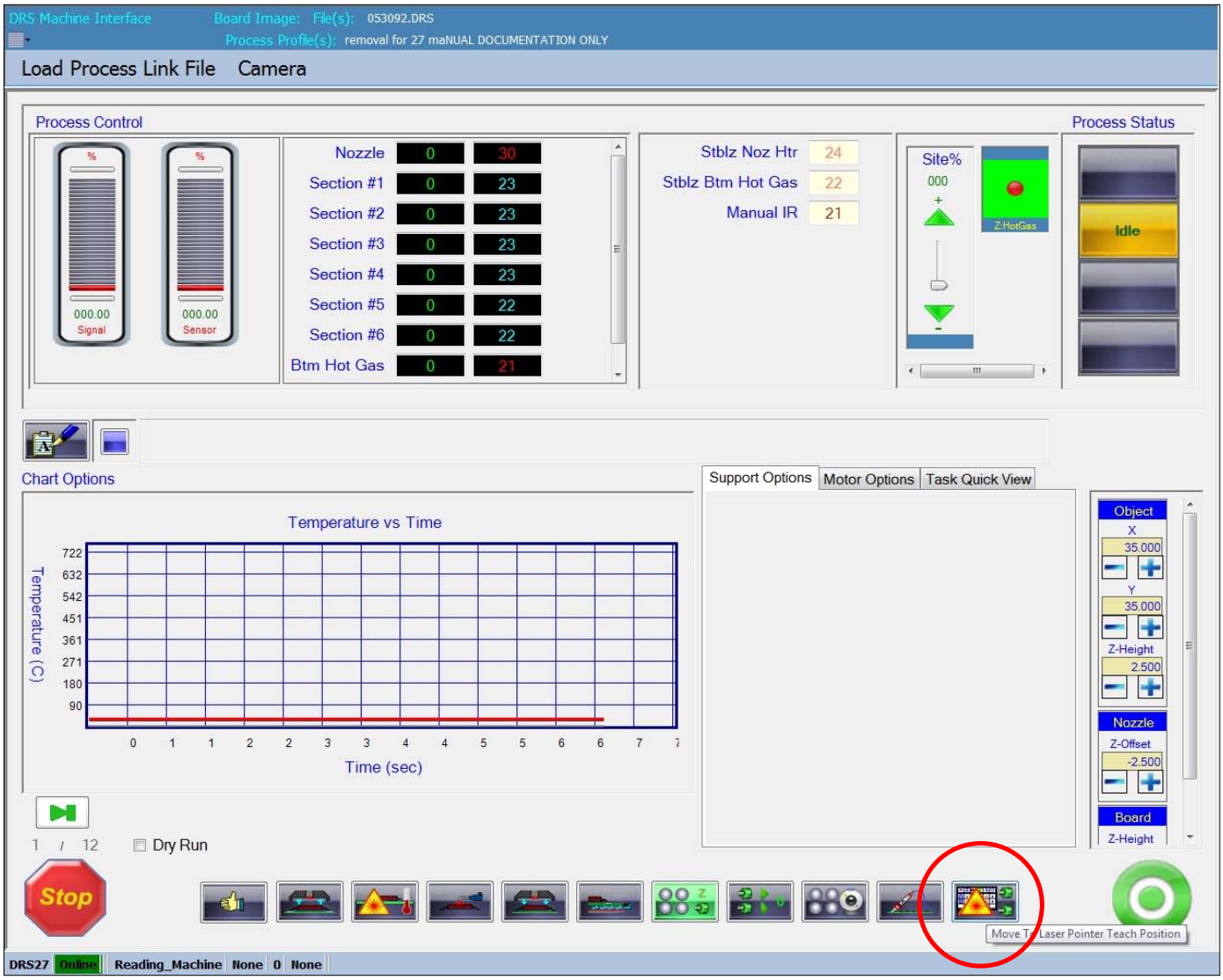
- INSTALL NOZZLE
- INSTALL BOARD INTO CARRIER
- POSITION BOARD SUPPORTS

## 7.4 Install Nozzle

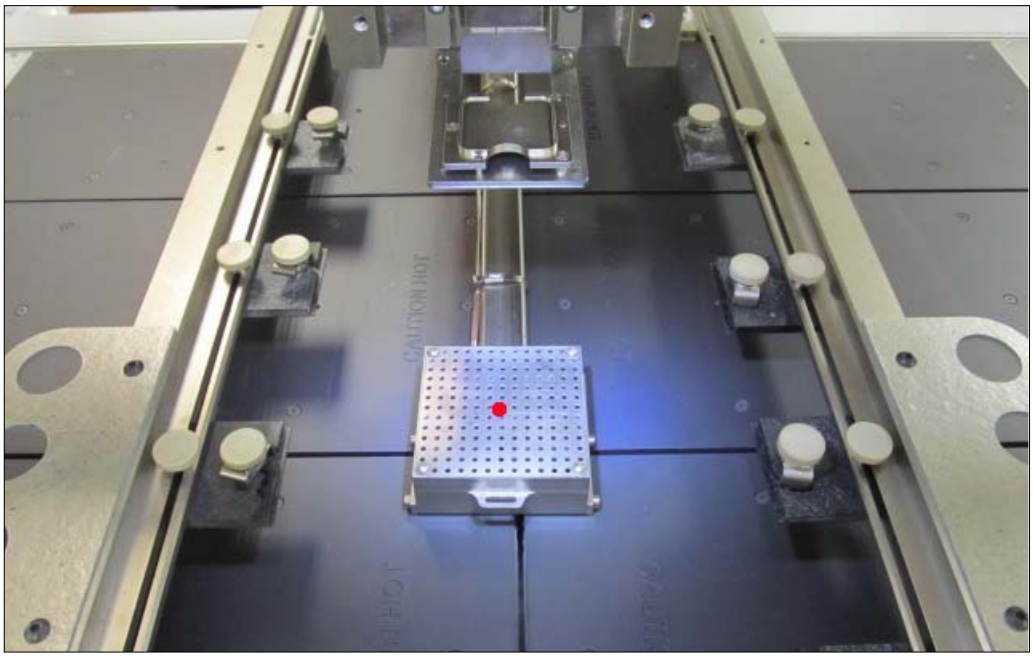
Install the nozzle relatively square into the nozzle fingers with pliers (supplied).



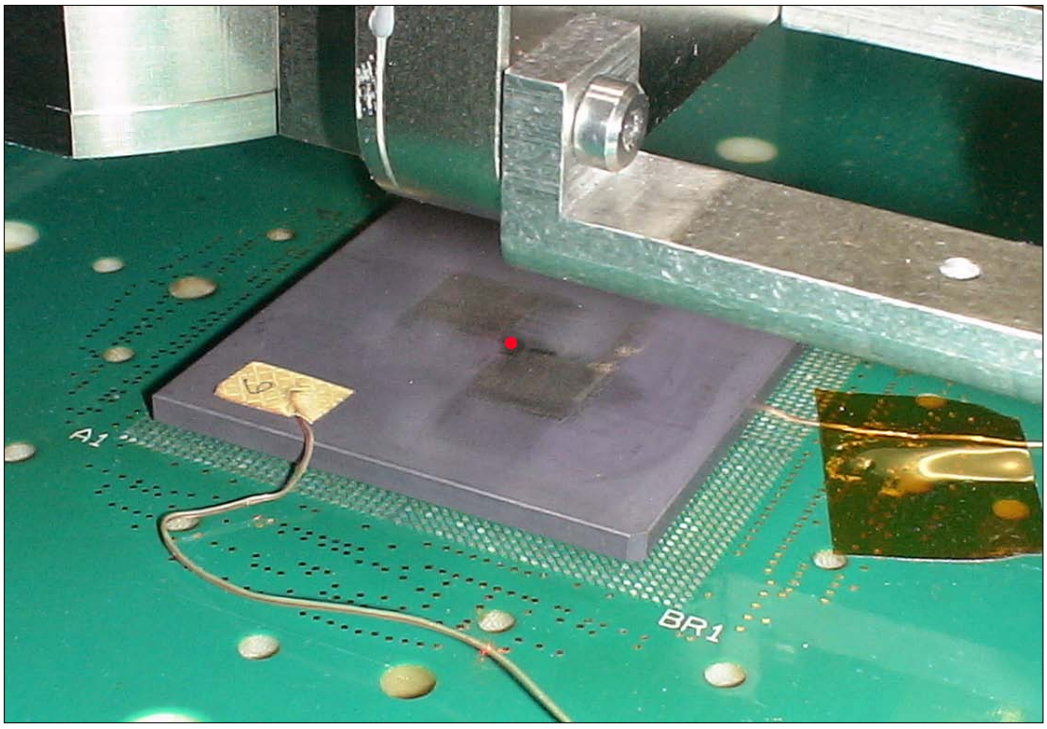
Prior to starting the Removal Process, click on the Move to Laser Pointer Teach Position icon.



If the machine has the optional Spot Heater, position the Spot Heater (using tool provided) so that the Spot Heater is near the center of the Bottom Heater plate and the Laser is centered over the Spot Heater plate.



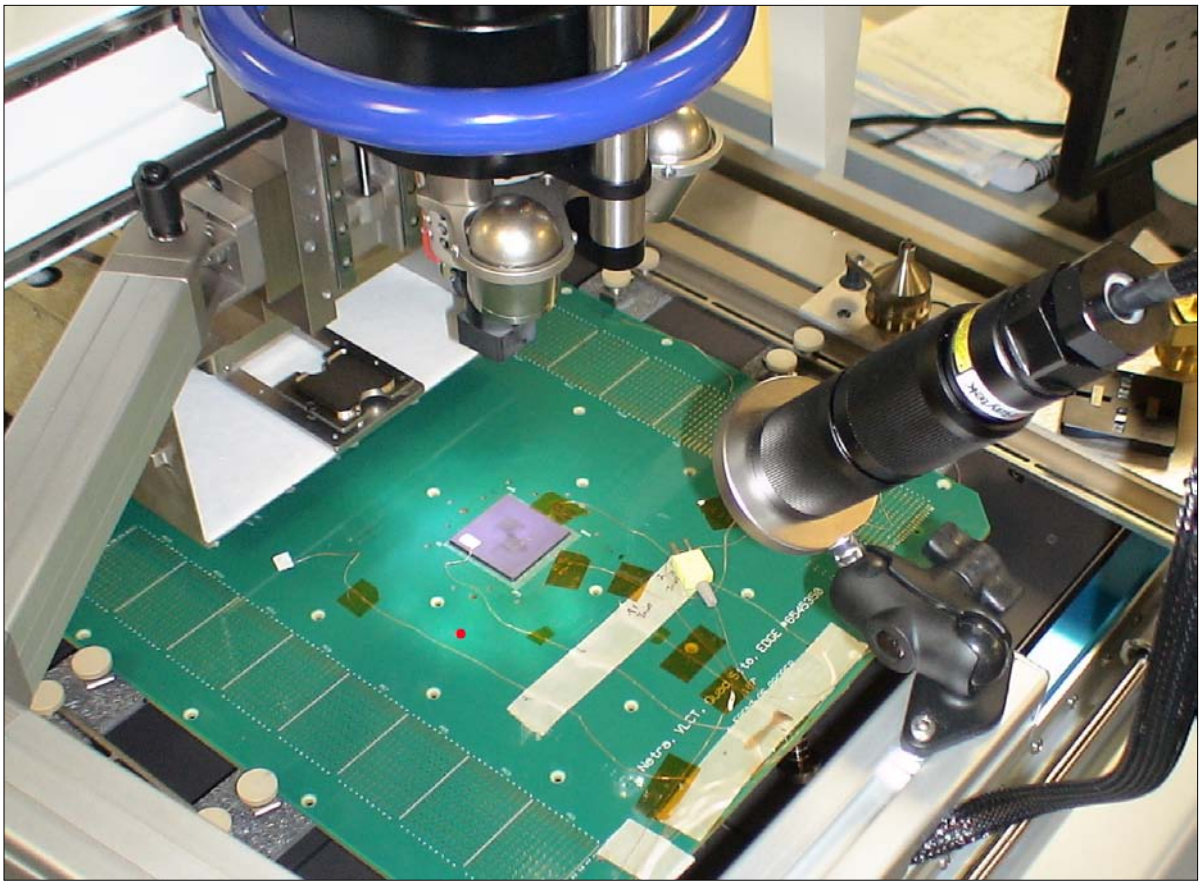
Reinstall the board so that the Laser Pointer is also centered on the component to be reworked. Tighten the hold down clamps and position board supports if necessary.



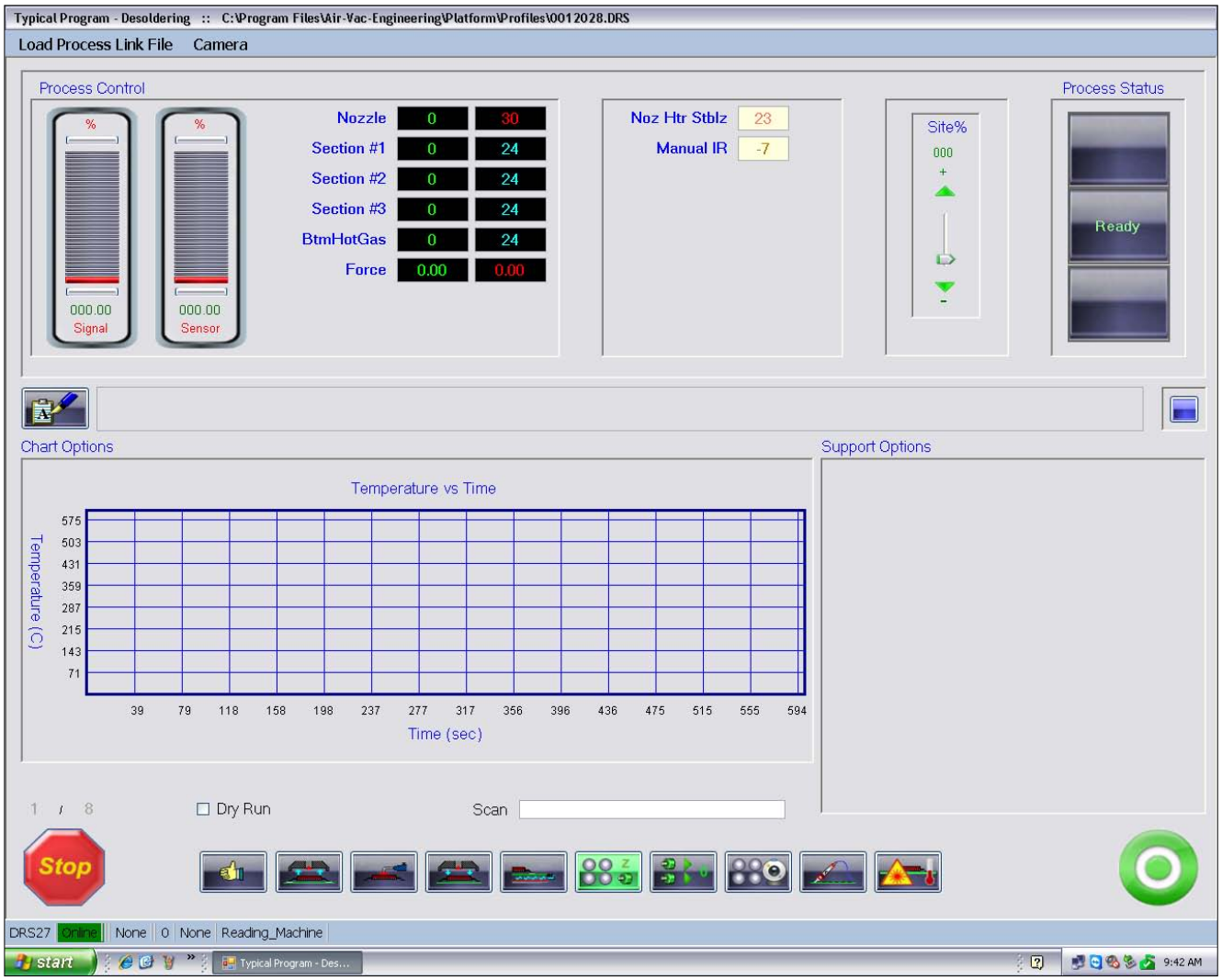

These two steps insure that both the Spot Heater and Nozzle are in the correct location. Click on the yellow footswitch message to retract the laser and vision.

Next, position the IR Sensor prior to starting the process. Click on the Toggle IR Probe Laser Pointer icon. The icon will turn green and the Fine Spot Laser Pointer will illuminate.


Position the laser dot approximately 2-3 inches away from the BGA on an open area of the board.



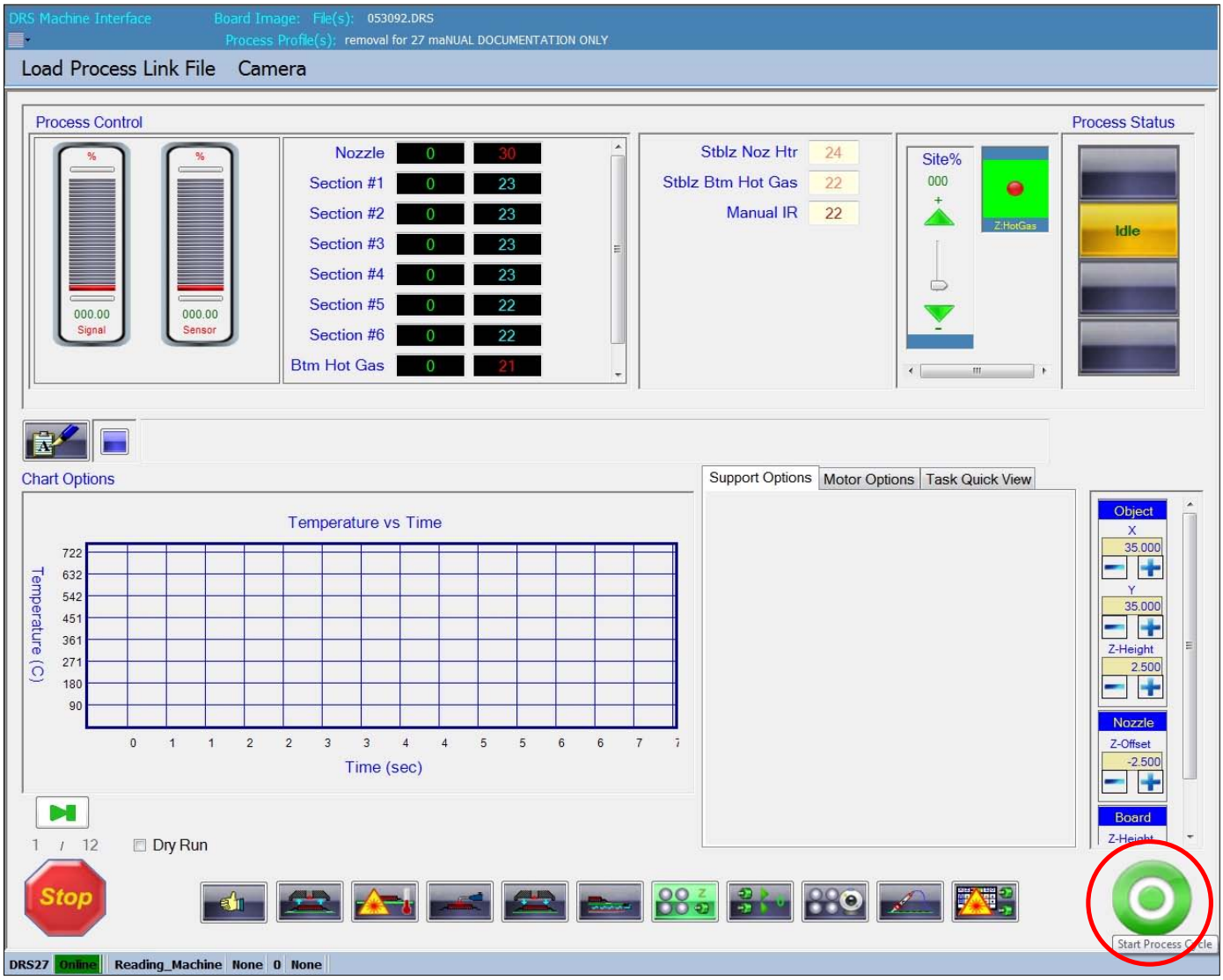
## 7.5 Running A Typical Removal Program




A program consists of a number of steps or events. The **Message Box** will change for each event to provide instructions.

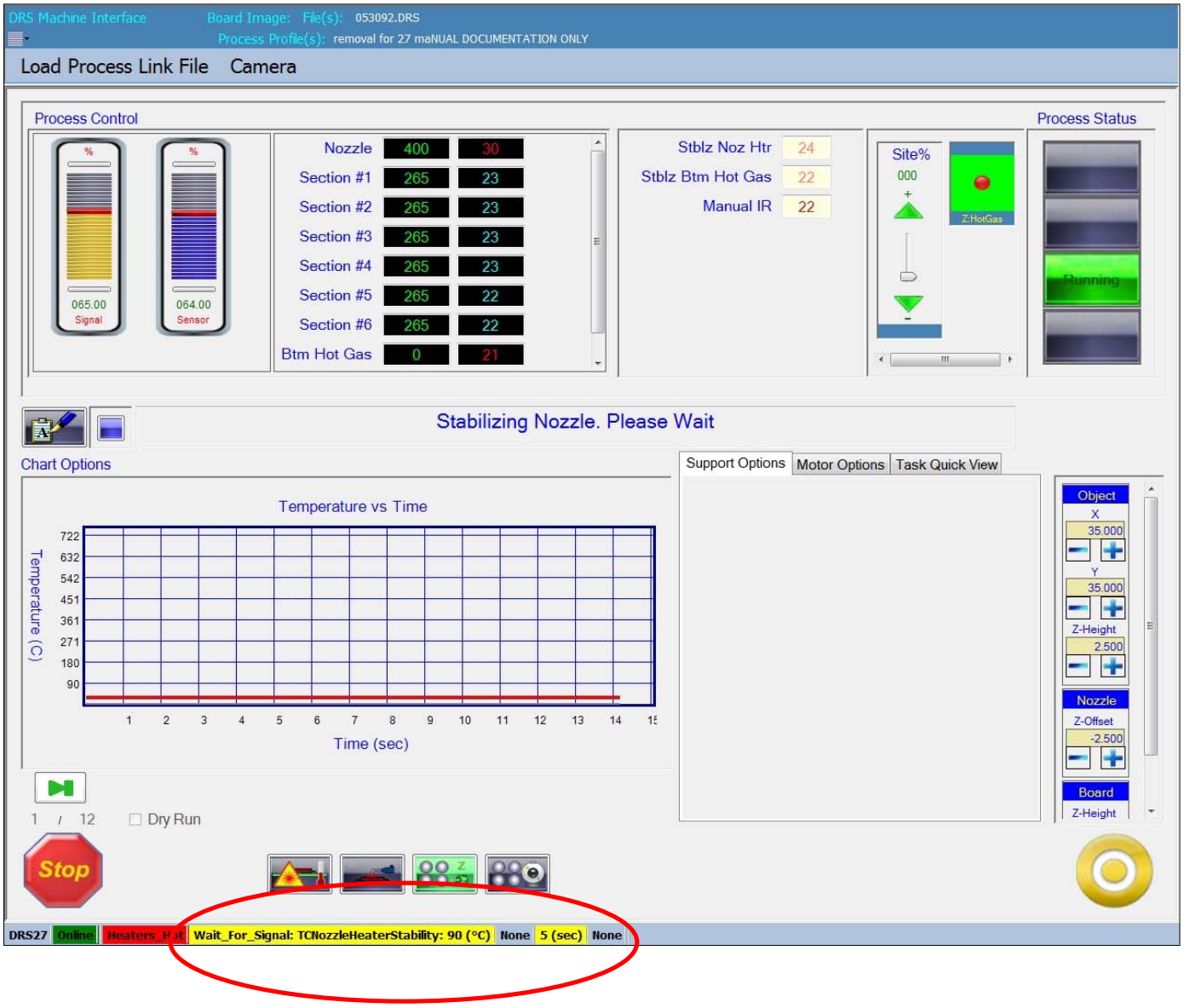
The information on the screen is only for recording to a history file. The operator is not responsible for process development. Temperatures, times and air flow settings cannot be changed on this screen.

Click on the green and white bullseye to start the process.



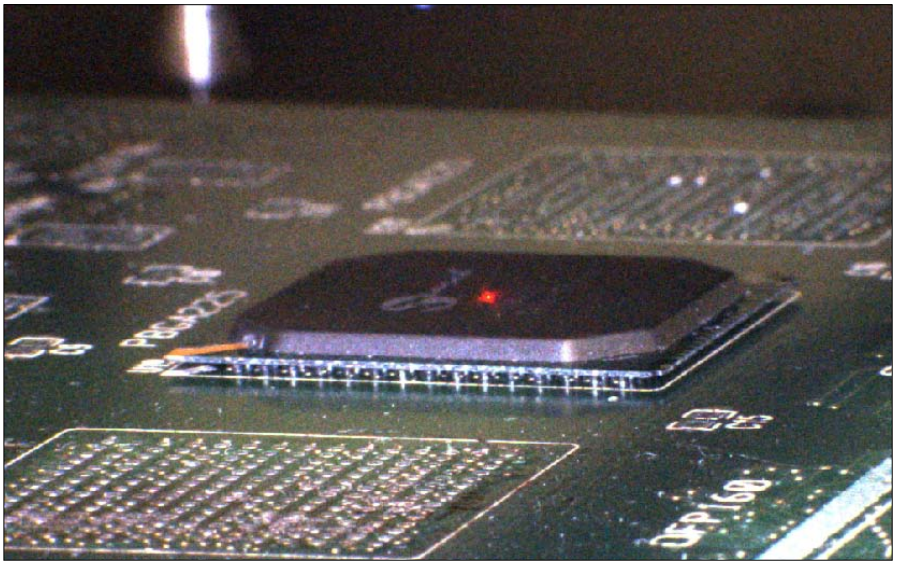
**Event #1: Stabilizing Hot Gas Head.**

It is important from a thermal repeatability standpoint to condition the tempearture of the hot gas head prior to running a process. Event 1 stabilizes the hot gas head to a minimum temperature of 90˚C.



**Event #2: Component Location Teach.**

- The Laser Pointer will activate and should already be centered on the component. Footswitch to continue.

- The Laser Pointer and Vision Housing will retract automatically.
- The Nozzle will move to the near place position.
- The Force System will control the Nozzle touch off of the component.
- The Nozzle will retract the programmed distance.

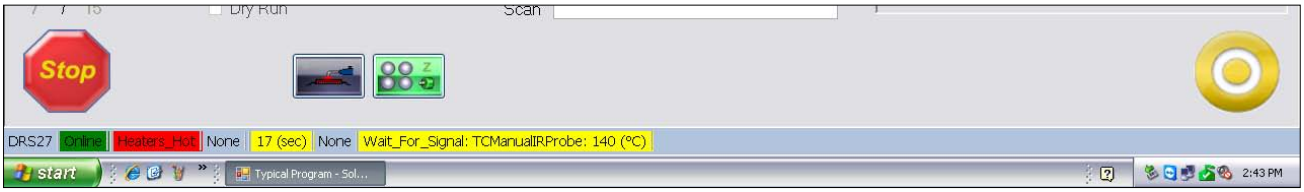
### Event #3: Preheat Board

- The Direct View Camera will activate. Position the Camera so that reflow of the solder joints can be viewed.
- There is no operator involvement during this event, it is a temperature based event.
- The IR sensor will monitor the board temperature.
- The bottom heater temperature is displayed and will heat the board until the programmed board temperature is reached.

**NOTE**

BOARD PREHEATING TIME WILL VARY DEPENDING ON THE INITIAL TEMPERATURE OF THE BOTTOM HEATER, BOARD AND MACHINE.

BOARD PREHEATING TARGET TEMPERATURE MAY BE PROGRAMMED DIFFERENTLY FOR VARIOUS ASSEMBLIES.



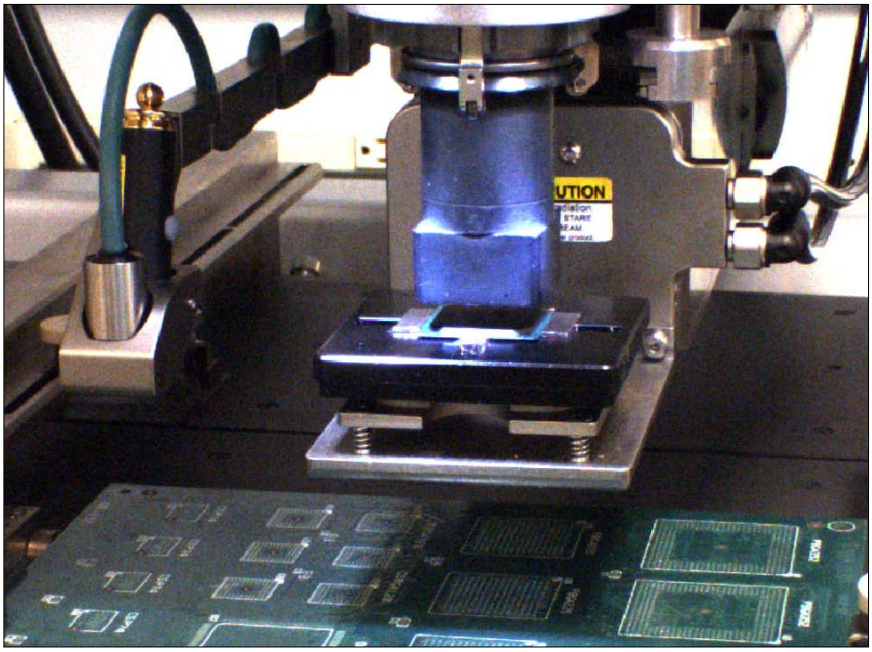

### Events #4 - 7: Presoak, Soak, Ramp, Reflow 1

- There is no operator involvement during these events. The programmed heating of the BGA is automatic. Theses are timed events based on previous thermal profiling.
- The time for each event is displayed at the bottom of the screen. The time counts down for each event.
- The programmed and actual temperatures and flow rates are displayed in the Process Control box.

### Events 8: Component Removal

- There is no operator involvement during this event.
- The nozzle will automatically move (slowly) to the BGA with the nozzle vacuum activated.
- The DRS27 has a vacuum sensor to sense the BGA, stop the Z-motion and remove the component automatically.

### Events 9: Remove Component After Drop Off



- The operator is prompted to empty the reject bin to prevent accidental hitting of previously removed components.
- The component is dropped onto the tray in front of the vision system.
- The vision system and nozzle retract.
- At the end of the process the operator has three options.

    - Select the **Load Process Link File** for the site cleaning.


    - Press the **Start Cycle icon** to start another removal cycle.
    - Press **Thumbs Up icon** to exit the screen.

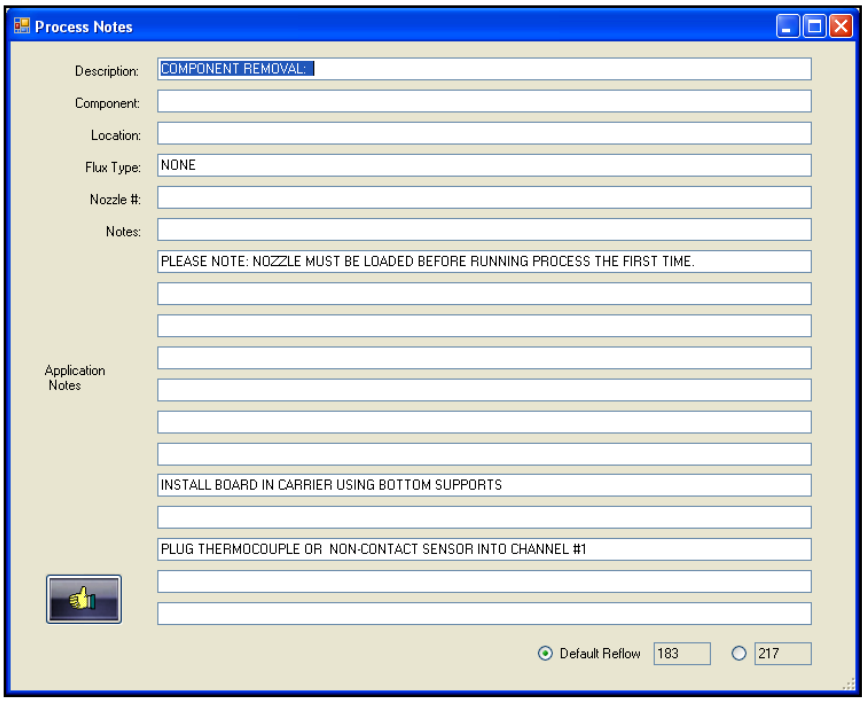
## 7.6 Running A Typical Site Cleaning Program

After the "Load Process Link File" is selected the profile name at the top of the Run Screen will change to the Site Cleaning Program.


To review the Application Notes for the Site Cleaning Program select the Application Notes icon.

The **Open Profile Note screen** will appear. It provides information prior to running the program.

It is important that the site cleaning nozzle be clean. See Maintenance Section.

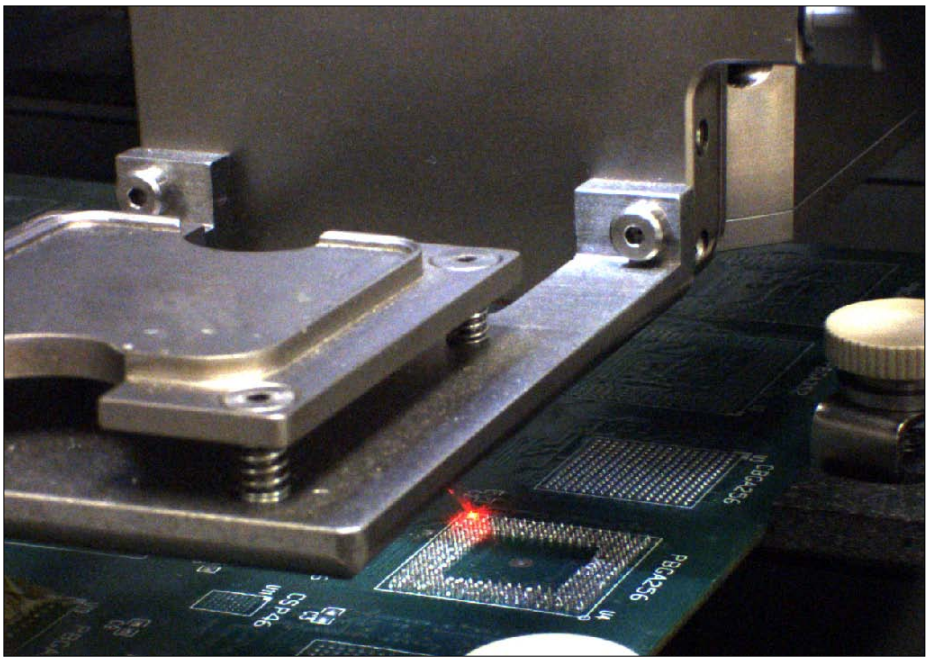



Select the Cycle Start/Stop icon to begin the site cleaning program.

**Process Hints:**
Running the site cleaning program immediately after the removal program will take advantage of the board being preheated. Less time will be required to heat the assembly.

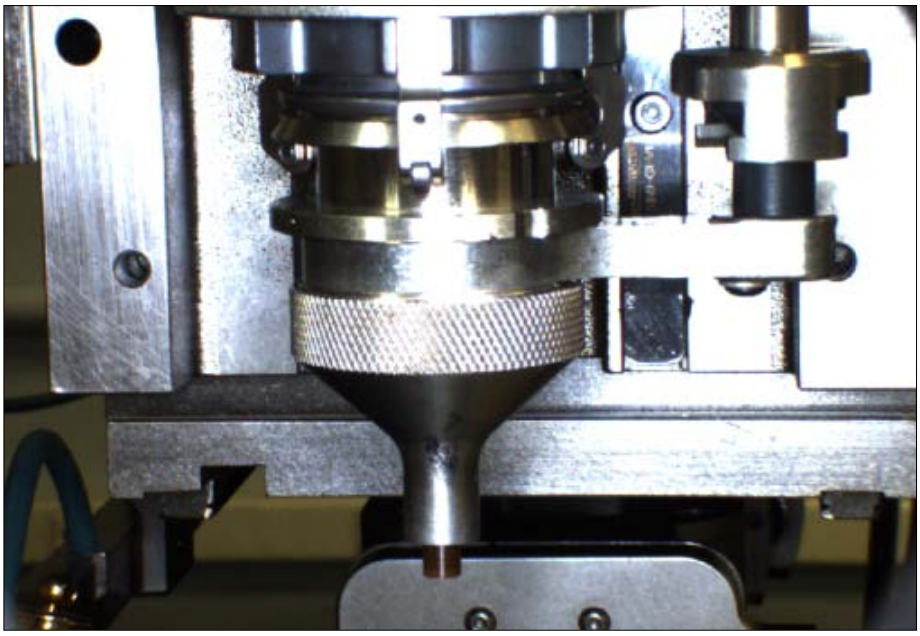
**Event #1: Position IR Sensor and Teach Site Position**

Locate target site using laser pointer. Position laser pointer to left/rear corner of site. This is advised to view solder reflow before moving site tool tip. Position IR Sensor 2-3 inches from site using the Fine Spot Laser. Footswitch to continue.

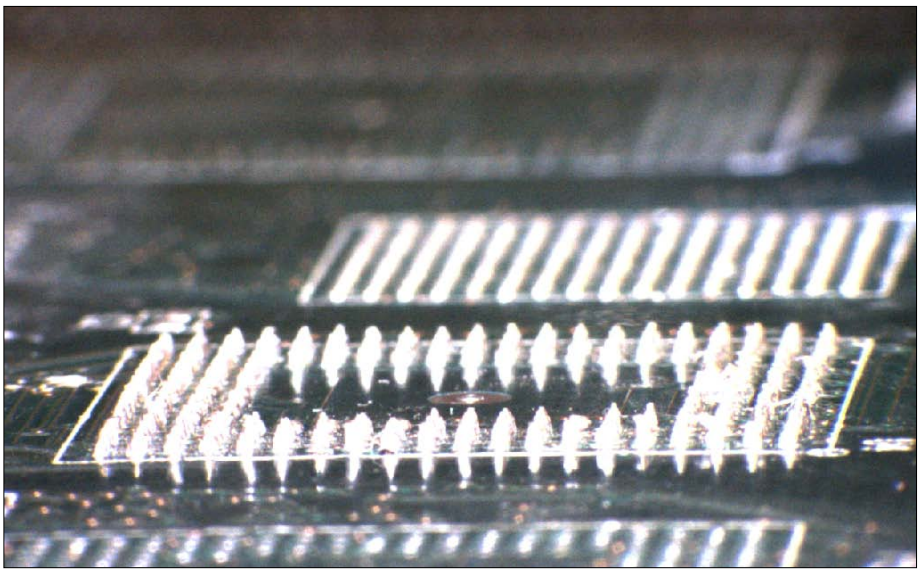


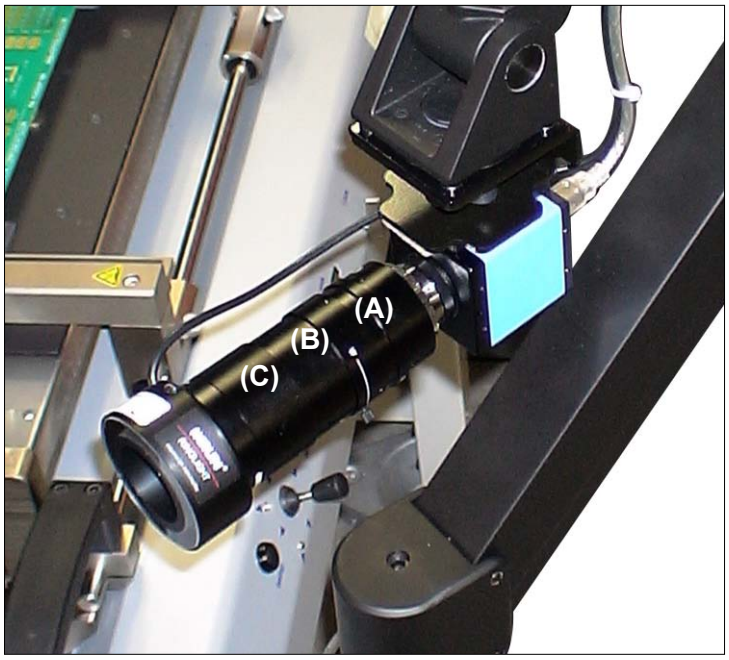
**Event #2: Install Site Cleaning Nozzle and Test Vacuum. Position Direct View Camera**

Install nozzle with vacuum port of nozzle to vacuum port of DRS27.



Position direct view camera to view site on screen.





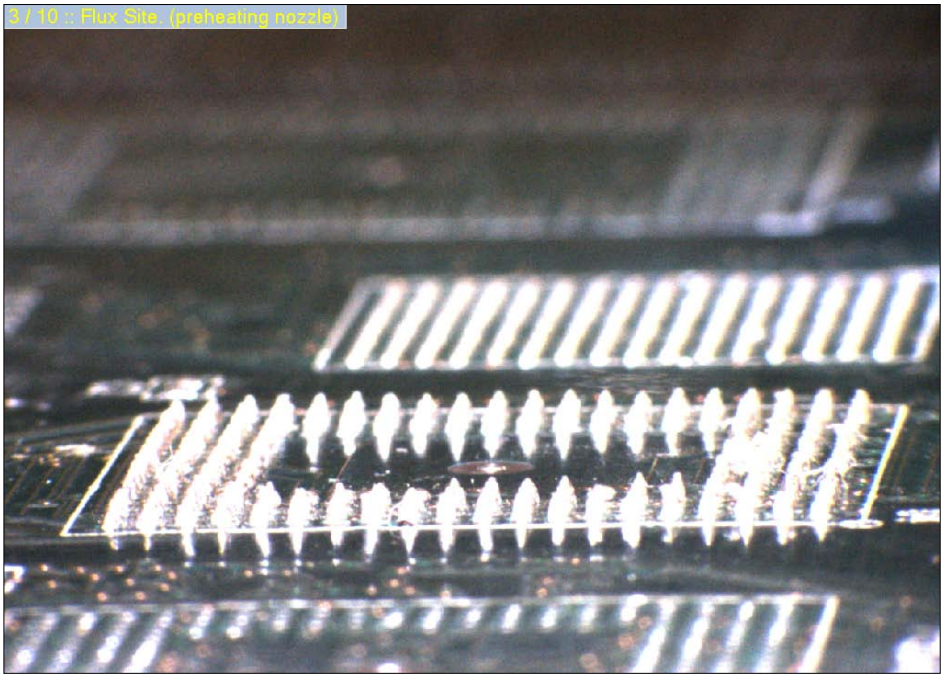

Camera Adjustments:
– Aperture adjusts the lighting.
– Zoom adjusts the magnification.
– Focus adjusts the focus.

**Event #3: Flux Site (Preheating Nozzle)**

This is a timed event (75 seconds) with the nozzle being heated during this time as the operator applies flux.

Apply flux paste generously over the entire site.

**IMPORTANT!: The nozzle must heat soak prior to positioning at the board level. This will allow the heat of the tool to be efficiently applied to the pads when lowered.**



**Event #4: Preheating Board to 120˚C**

There is no operator involvement during this event. This is a temperature based event.


The temperature sensor will monitor the board temperature. It is displayed under **Thermocouple System**. The bottom heater is displayed and will heat the board until the set/programmed temperature is reached.

**NOTES:**
**Board preheating time will vary depending on the initial temperature of the bottom heater, board and machine.**

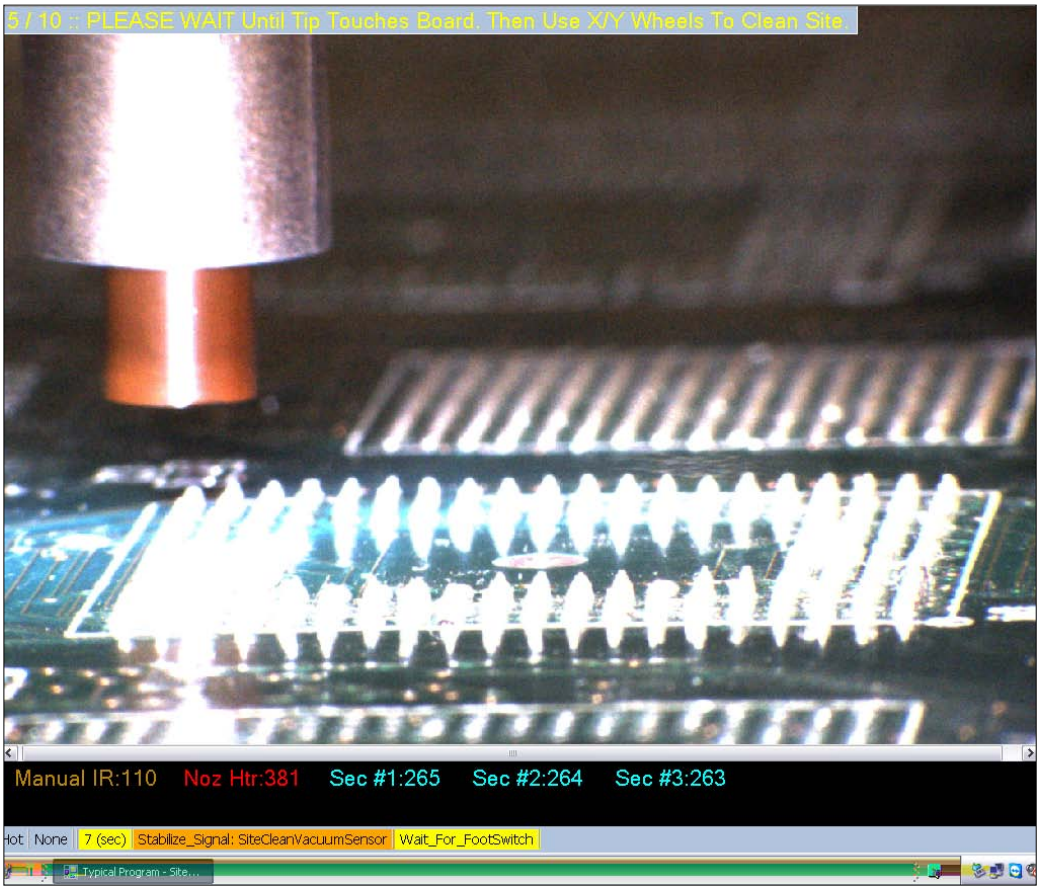
**Board preheating temperature may be programmed differently for various assemblies. During this step, there is no operator involvement. The bottom heater heats the board until the set/programmed temperature is reached. Preheating does take time, but is important for reliable rework.**

**The time to heat the board will vary depending on the board.**

**Event #5: Please Wait Until Tip Touches Board Then Use X/Y Wheels To Clean Site.**

The nozzle will automatically be lowered to just above the board. The heated air will melt the solder. The nozzle tip height will adjust after touching the board to right above the pads.

The operator uses the X/Y wheels to clean the site. **NOTE: If the site solder does not reflow immediately during the tip's initial touch, stop the process and contact a supervisor.**



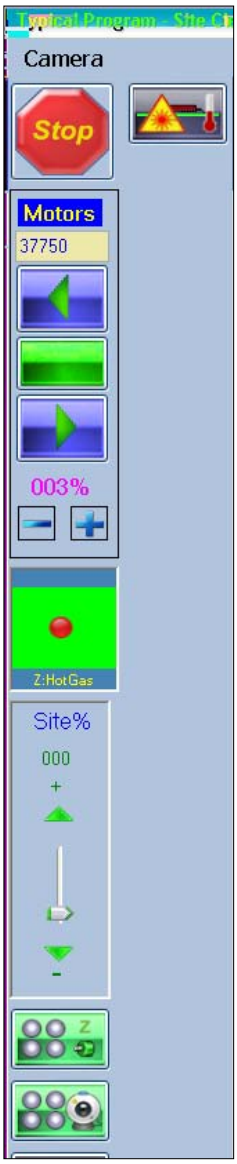


The tip will adjust according to programmed settings. The distance from the bottom of the tip to the board may be different on various boards as determined by the programmer.

A

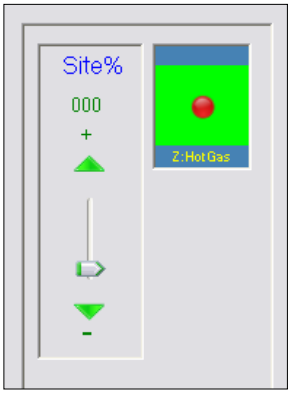

**NOTE: The overall controlling height (auto adjust mode) of the site clean nozzle can be adjusted during a process cycle. The site clean slide bar (A) can be used to raise or lower the auto height position. If the nozzle tip is too close to the board, move the slide bar slowly upwards until the overall position is optimized. If the nozzle is bouncing to far from the board (not collecting enough solder), move the slider bar slowly downwards until the overall position is optimized.**

Miscellaneous site clean functions:




- Camera – open/close
- Toggle IR probe laser pointer
- To move, site clean tip up/down, adjust the slide bar in the **Site%** box.
- Machine light
- Camera light

If the direct view camera option is not installed, the site clean tip up/down adjustment slide bar is on the run screen.



**Event #6: Reflux Site for Second Pass Cleaning or Stop Process**

The nozzle moves up. The operator has an optional second pass to site clean. Press footswitch to continue.

**Event #7: PLEASE WAIT Until Tip Touches Board, Then Use X/Y Wheels to Re-clean Site.**

The heated air will melt the solder. The time will vary depending on board. The nozzle tip height will adjust to right above the pads. The operator uses the x/y wheels to clean the site.

**Event #8: Board and Machine Cool Down**

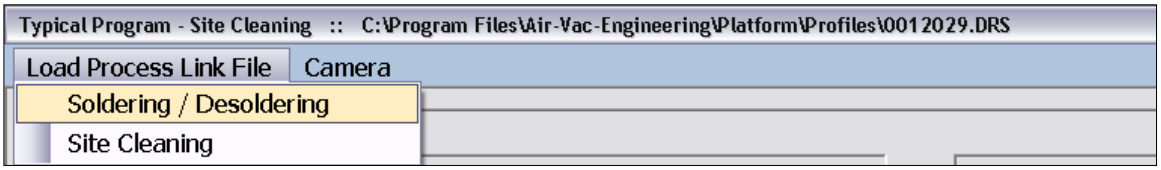
There is no operator involvement in this event. The nozzle goes to the park position and the nozzle heater is set at a low temperature to cool down.

**Event #9: Remove Site Clean Nozzle. CAUTION HOT! Install EZ Nozzle.**

The operator removes the site clean nozzle and installs EZ nozzle for the soldering process.

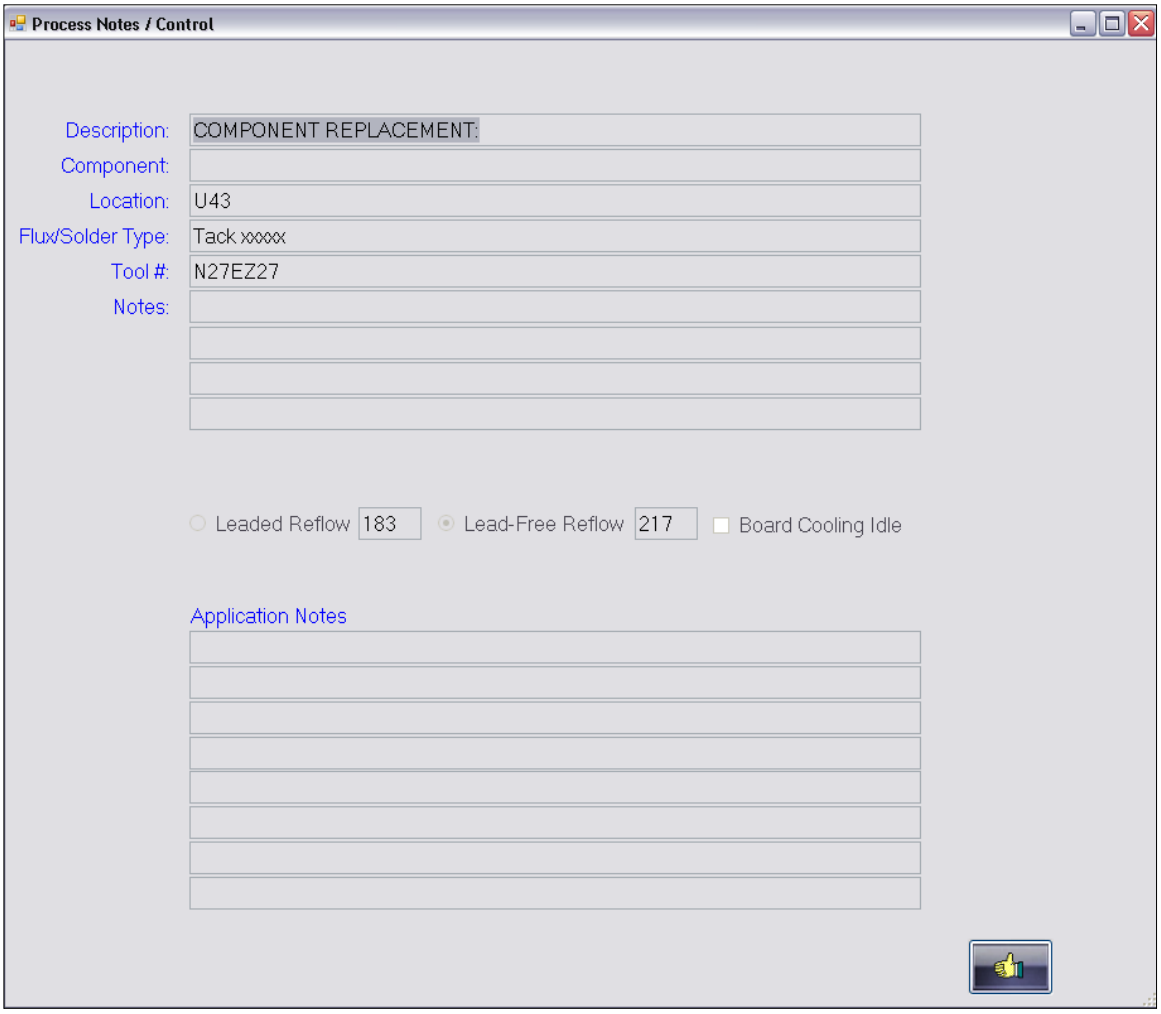
## 7.7 Running A Typical Soldering Program

After the "Load Process Link File" is selected the profile name at the top of the Run Screen will change to the Soldering Program.




To review the Application Notes for the Soldering Program select the Application Notes icon.

The **Open Profile Note screen** will appear.
It provides information prior to running the program.



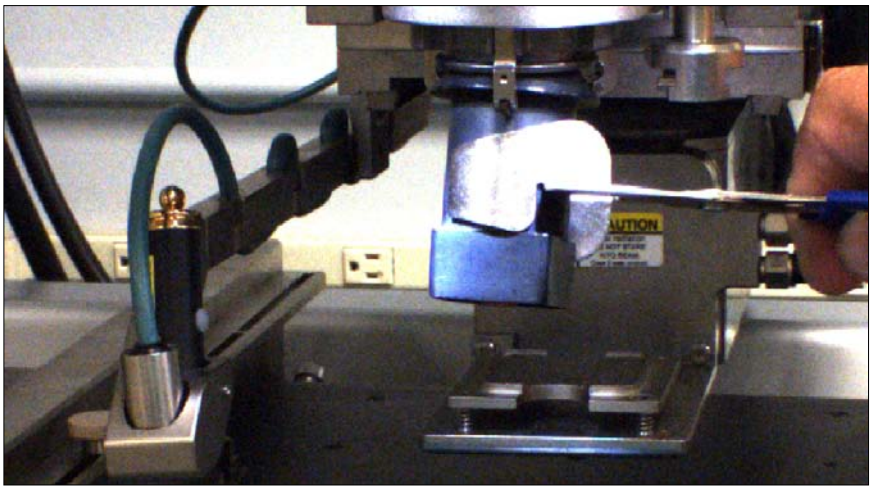

Select the Cycle Start/Stop icon to begin the soldering program.

### Event #1: Install BGA Nozzle

This is a footswitch based event. Install nozzle with handling tool. Square nozzle as best as possible. Footswitch to continue.

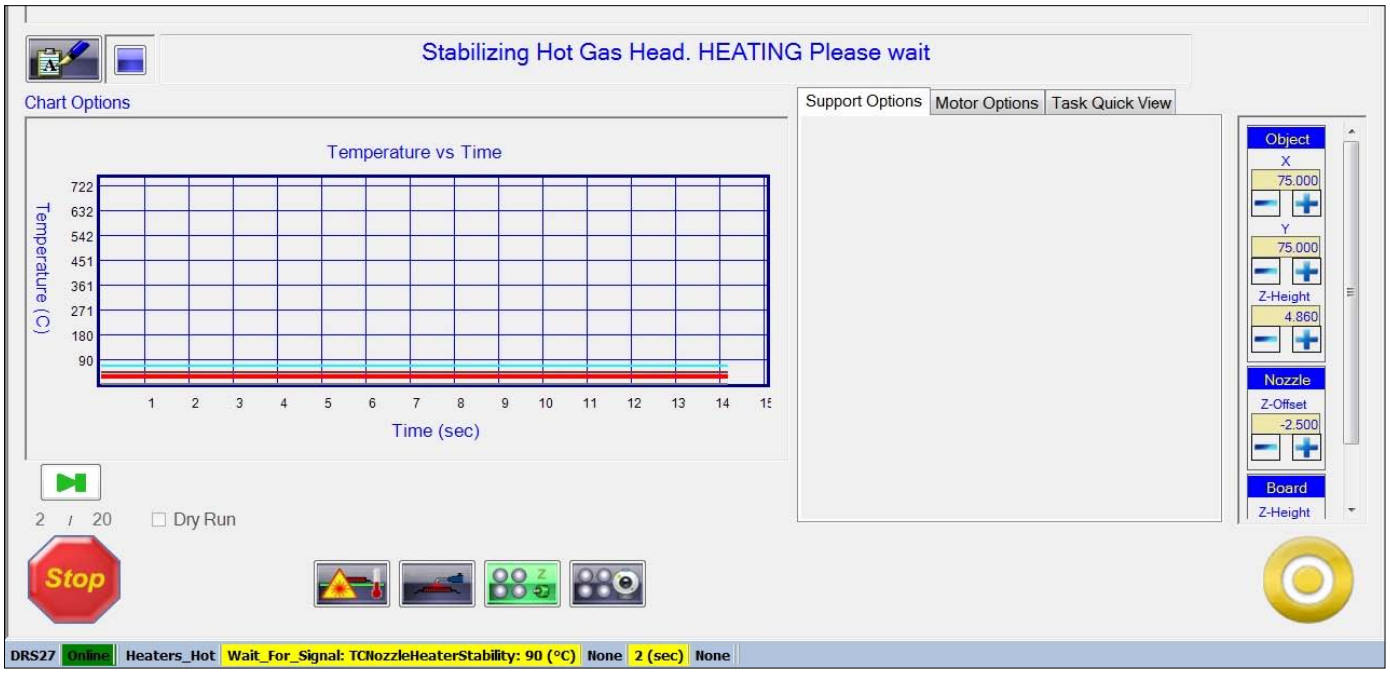
**CAUTION**

NOZZLE AND/OR MACHINE MAY BE HOT.



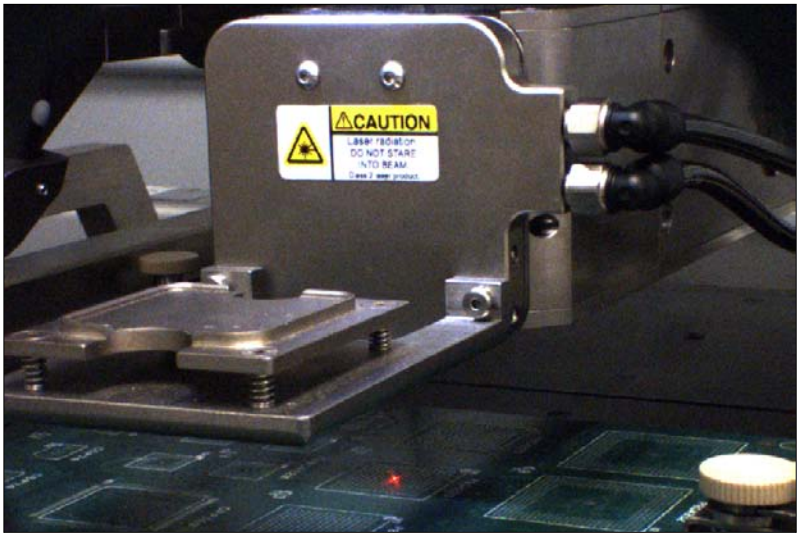
### Event #2: Stabilize Hot Gas Head

The hot gas head will be heated up to 90˚C if the machine is cold or cooled to 110˚C if the machine is hot.



**Event #3: Teach Site Center Position. Locate Target Site Using Laser Pointer.**

This is a footswitch based event. Position laser pointer over center of site.

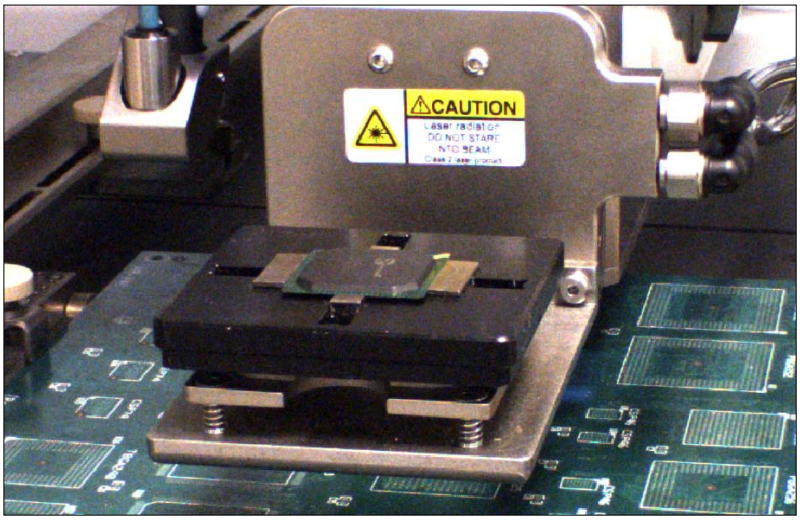



**Event #3: Position Temperature Sensor.**

The IR sensor is meant to read the board temperature. It is important to position the sensor, approximately 2-3 inches away from the component on an open area of the board.

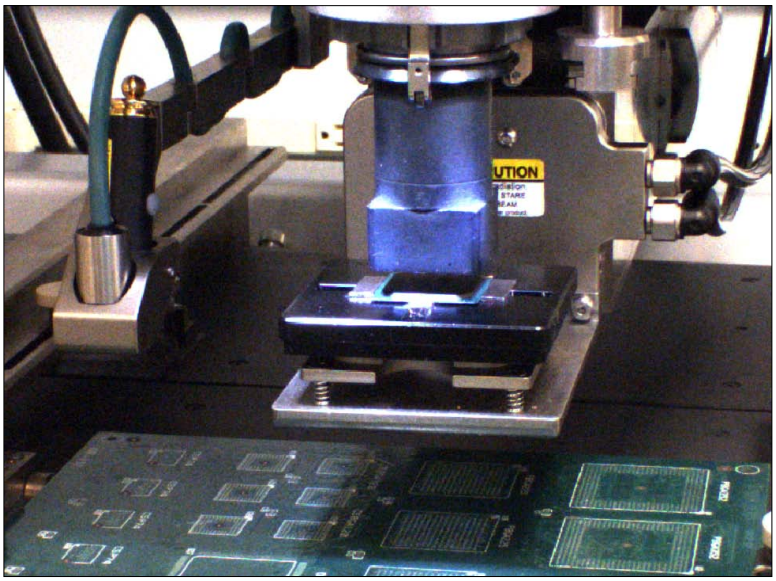
**Event #3: Align Component After Pick Up.**

Insert the new component into the Universal Insertion Tool and center the component.
Install the Insertion Tool into the Component Pick-Up Tray.
Footswitch to continue.

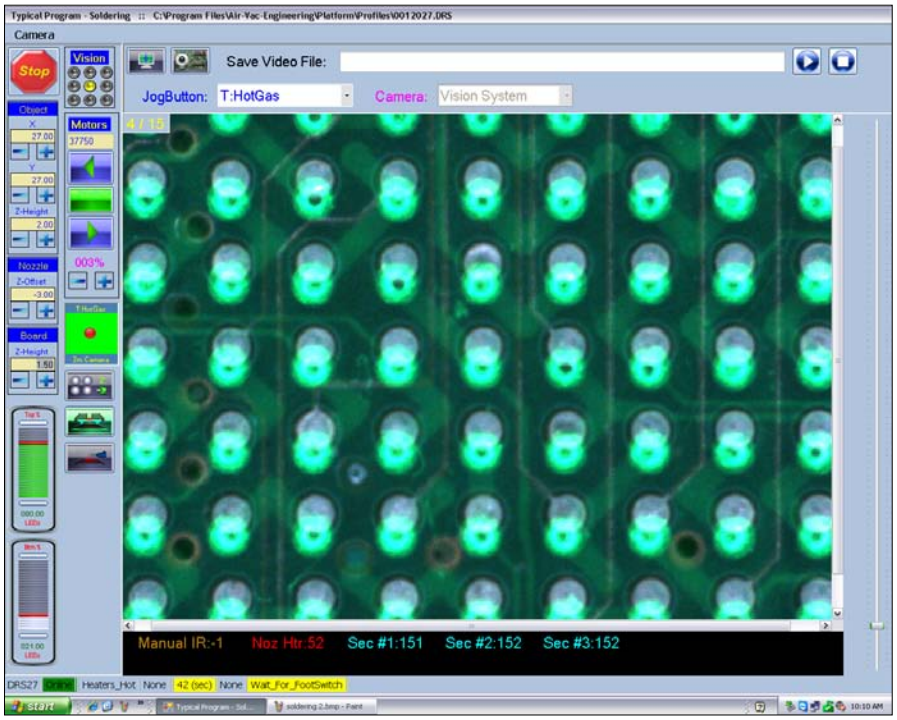


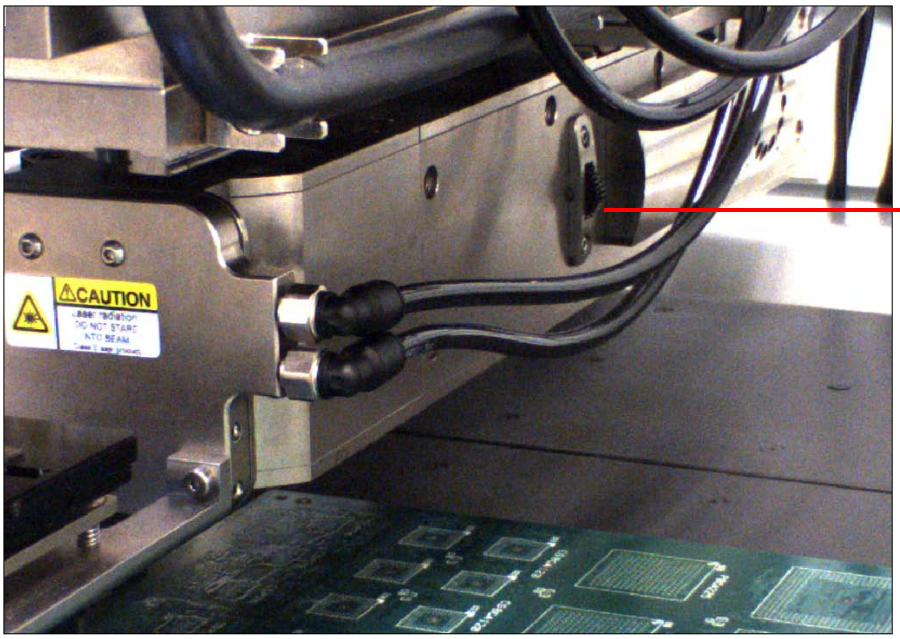

**IMPORTANT!: Component orientation (polarity) must be correct.**

The nozzle picks up the component from the pick up tray. The nozzle and component retract. The vision alignment system is activated.

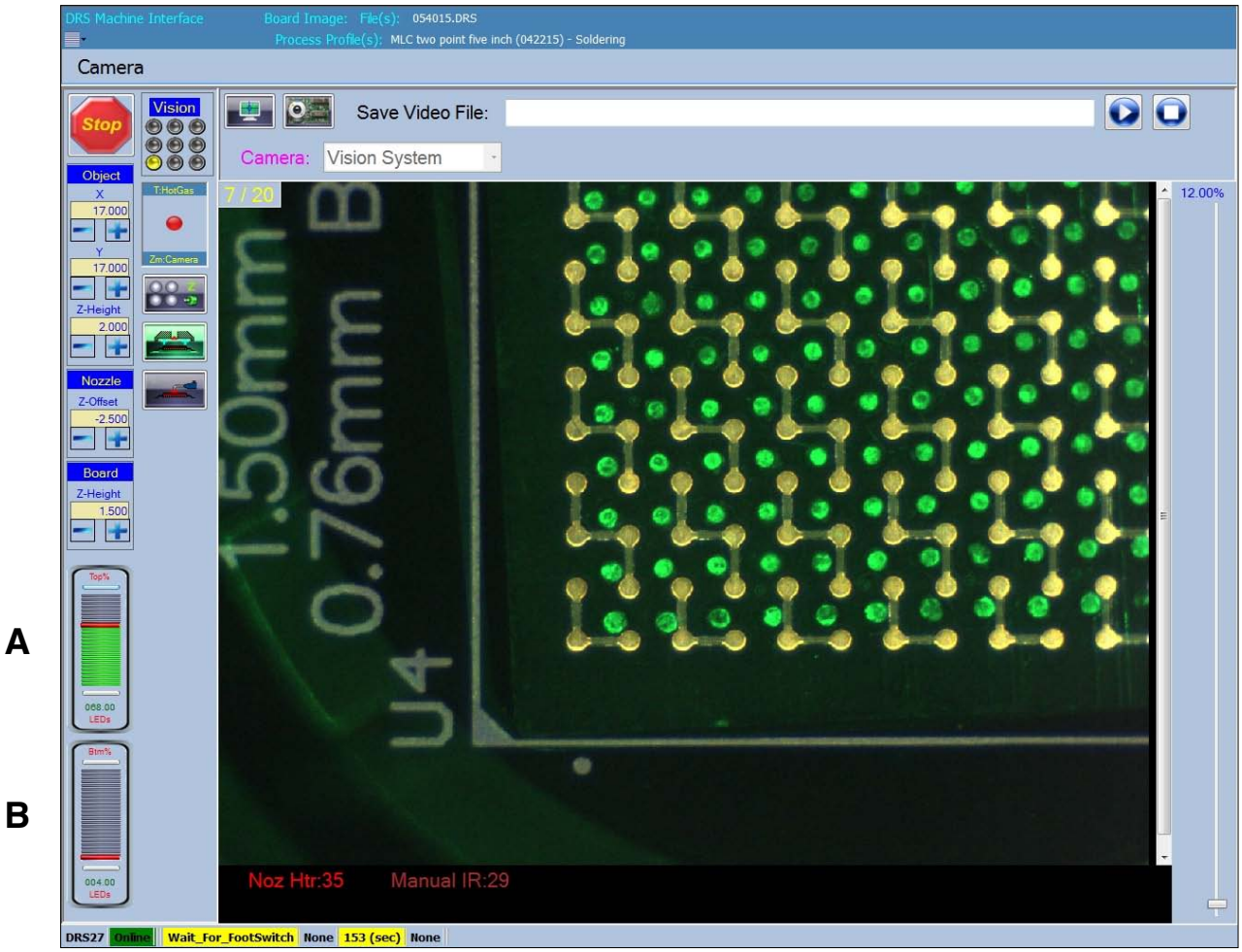


The vision system camera screen is activated. If pad and lead image is not clear, use focus adjustment **(A)** on side of vision system.



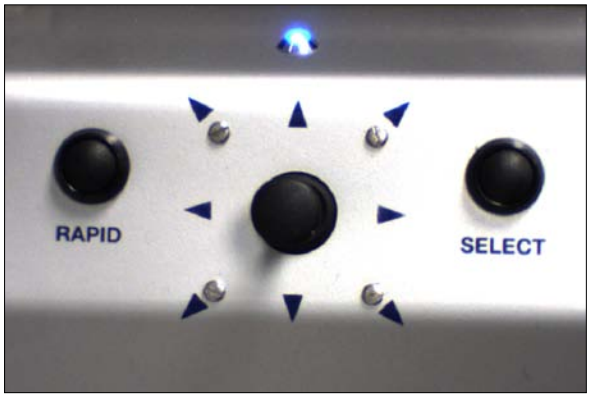
The green and white LED lighting may be adjusted to operator preference. Adjustment for lighting intensity of component **(A)** and lighting intensity of board **(B)** can be used.



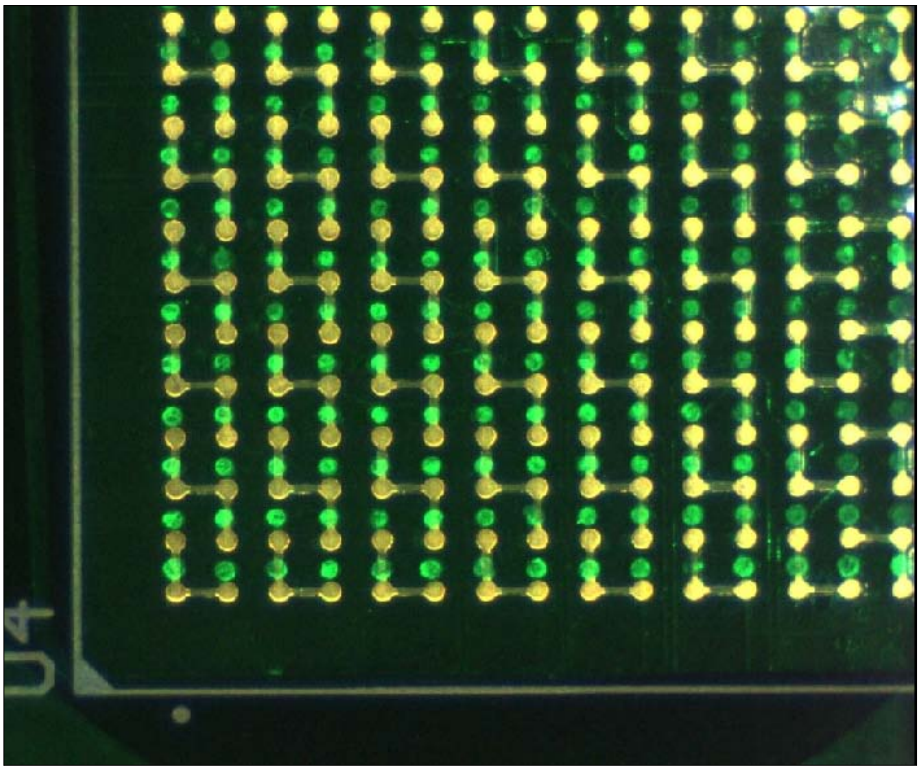

A

B

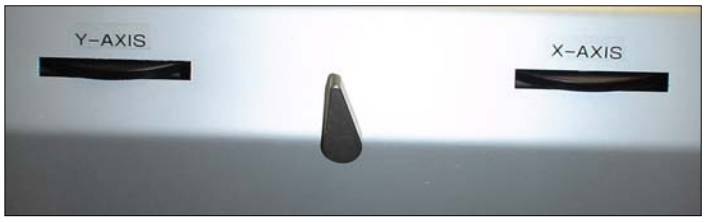
Most likely the component will be skewed. To correct for theta, use the joystick. The joystick has two functions available; theta and camera zoom. The joystick also has two speeds; slow and rapid. Pressing the rapid button sets the joystick functions in the fast mode. To correct for theta move the joystick left or right. To change the magnification, move the joystick up or down.

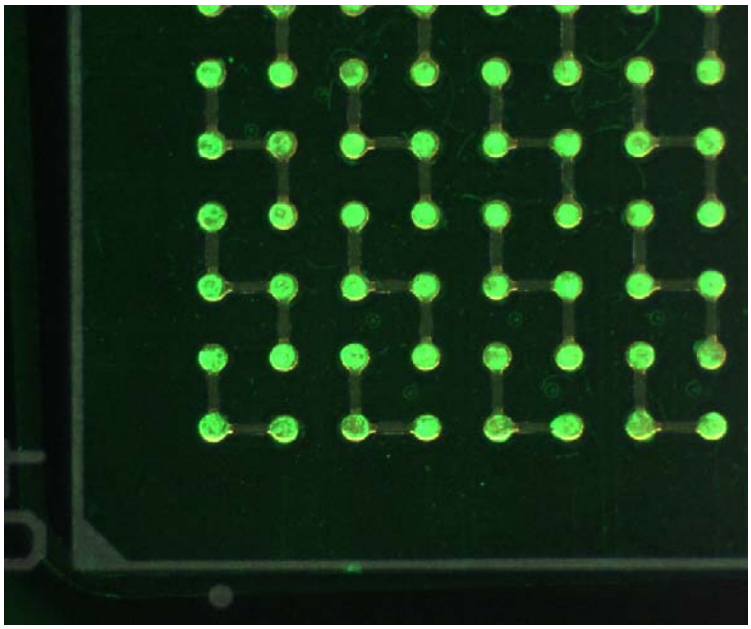



To make a theta adjustment, rotate the component until it is parallel to the pads and off in the y direction as shown below..

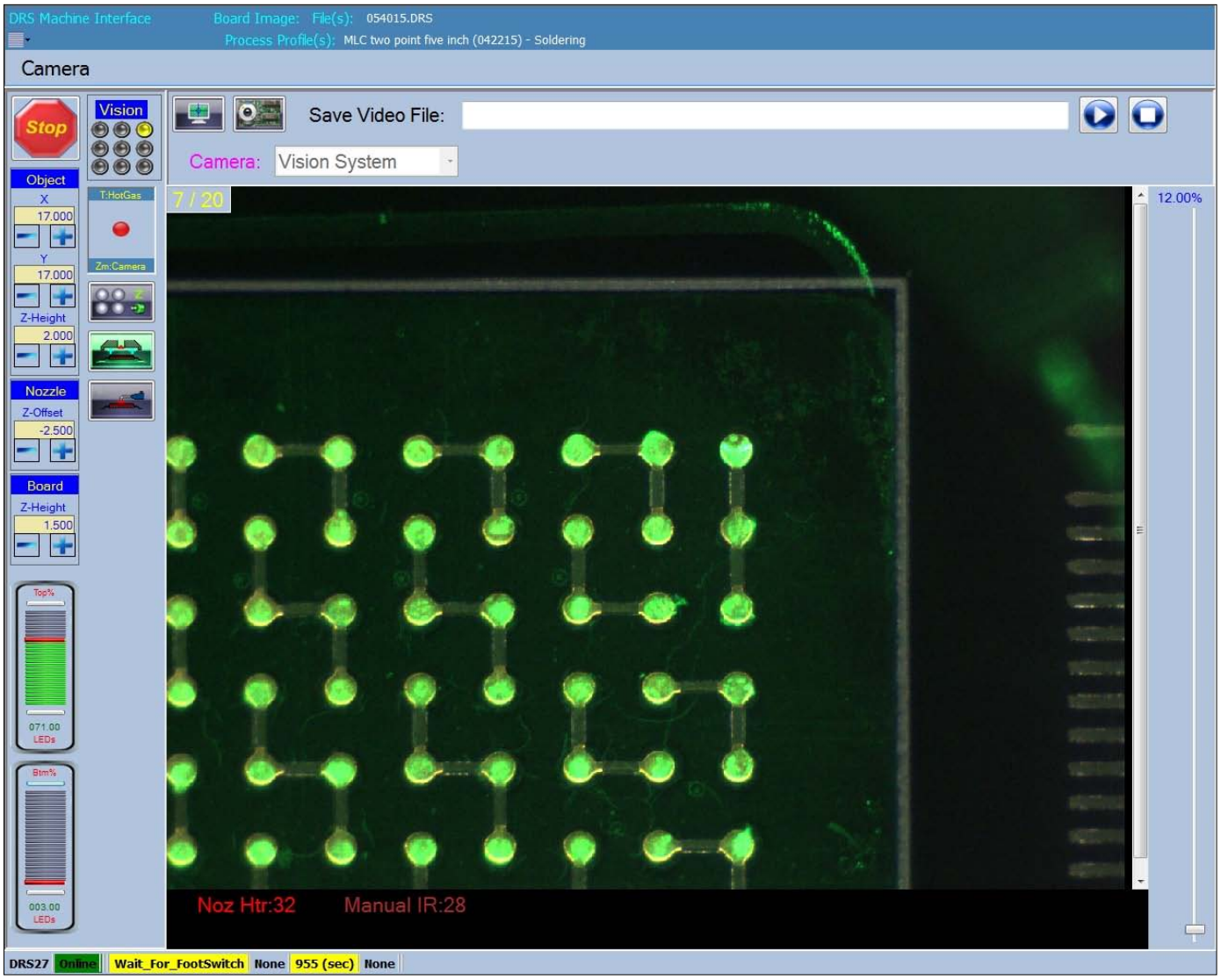


Move the x-axis wheel to align leads and pads in x direction and the y-axis wheel to align in y direction. Increase magnification with the joystick to enhance alignment accuracy. One corner of the BGA is now aligned



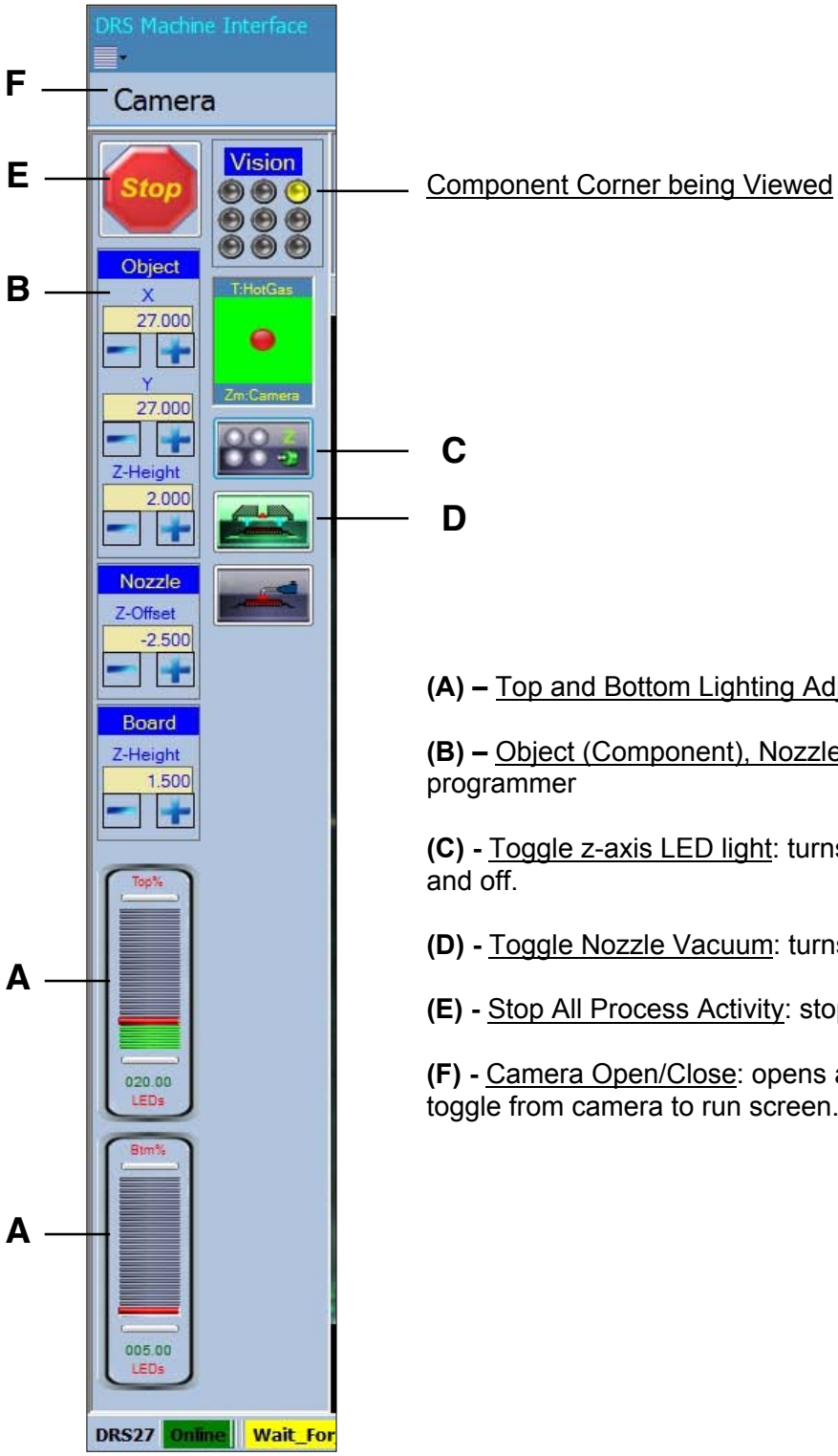



View the opposite corner by clicking on the opposite corner light under Vision. The light will turn green and the opposite corner will be shown. If the opposite corner is aligned, check the other two corners and center.


If the opposite corner is off in theta, make a 50% theta adjustment and then finalize X/Y. Check the opposite corner and reiterate until both corners are aligned.

**Miscellaneous Camera: Vision Systems Icons:**




**(A) –** Top and Bottom Lighting Adjustments:

**(B) –** Object (Component), Nozzle, Board Dimensions: set by programmer

**(C) -** Toggle z-axis LED light: turns lights over the nozzle on and off.

**(D) -** Toggle Nozzle Vacuum: turns nozzle vacuum on and off.

**(E) -** Stop All Process Activity: stops all movement and heating.

**(F) -** Camera Open/Close: opens and closes camera screen to toggle from camera to run screen.

### Event #5: Flux Site and Position Direct View Camera

Operator is instructed to apply tacky flux to site and to position the DV Camera on the site to observe placement.

### Event #6: Please Do Not Touch Machine (Component Placement)

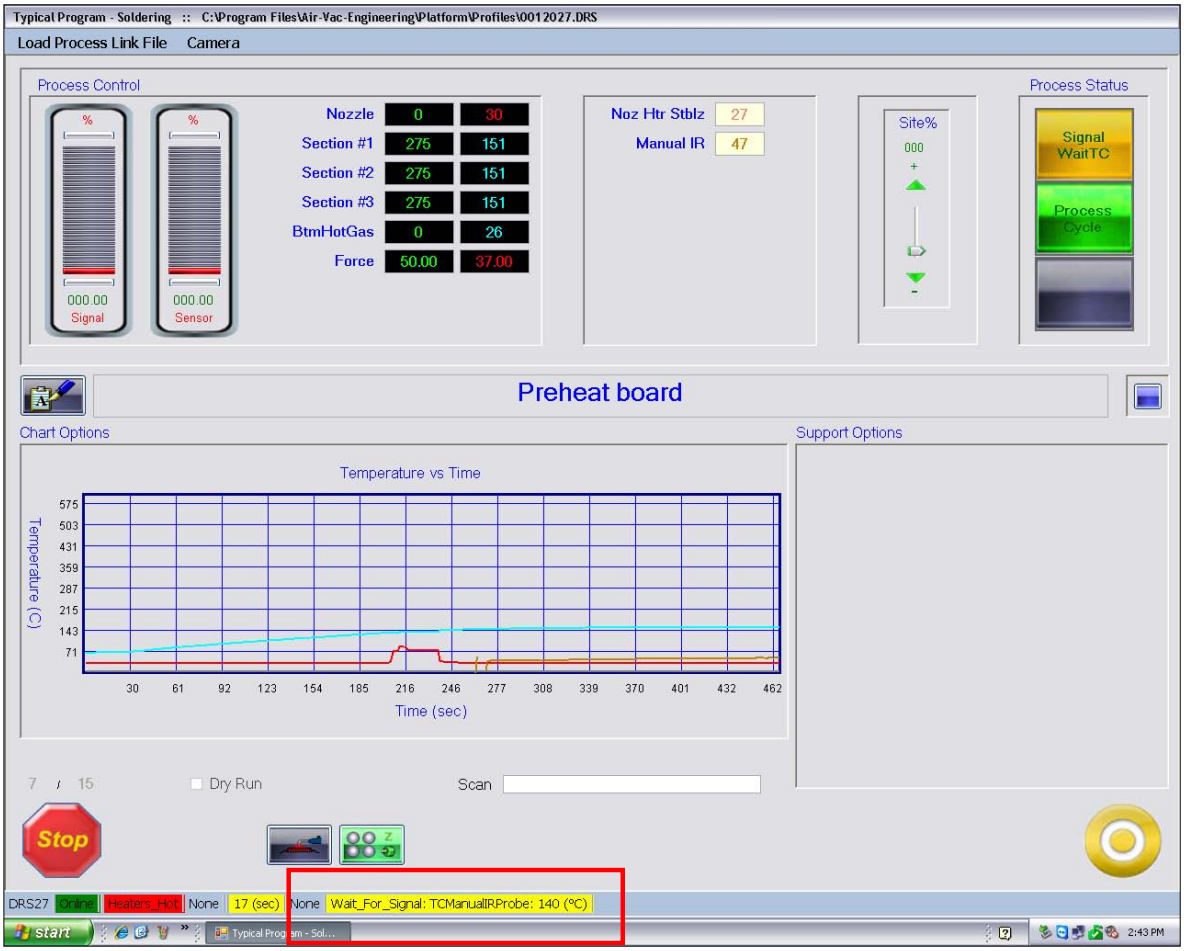
No operator involvement. BGA will be lowered to board using force placement system of machine. Nozzle vacuum is turned off. Slight pressure through the nozzle is applied. The nozzle retracts the programmed distance.

**NOTE:**

OPERATOR MUST NOT TOUCH MACHINE. IF MACHINE SENSES PRESSURE ON THE BOARD CARRIER, IT WILL AUTOMATICALLY GO TO THE NEXT EVENT. THE NOZZLE VACUUM WILL BE TURNED OFF AND THE COMPONENT WILL BE DROPPED (OUT OF ALIGNMENT).

### Event #7: Preheat Board

There is no operator involvement during this event. This is a temperature based event.



The IR sensor will monitor the board temperature. It is displayed under Thermocouple System. The bottom heater is displayed and will heat the board until the set/programmed temperature is reached.

**NOTE:**

BOARD PREHEATING TIME WILL VARY DEPENDING ON THE INITIAL TEMPERATURE OF THE BOTTOM HEATER, BOARD AND MACHINE. THE BOARD PREHEATING TEMPERATURE TARGET MAY BE PROGRAMMED DIFFERENTLY FOR VARIOUS ASSEMBLIES

### Events #8-11: Presoak, Soak, Ramp, Reflow 1

There is no operator involvement during these events. The programmed heating of the BGA is automatic. These are timed events. The total time is displayed at the bottom left of the Run screen.

### Event #12: Reflow 2

There is no operator involvement during this event. The heating events are finished. Cool air will be controlled through the nozzle and the board cooling system. This is a timed event based on the programmer.

### Event #13: Heaters Off

There is no operator involvement during this event. The preheater and upper heater are turned off.

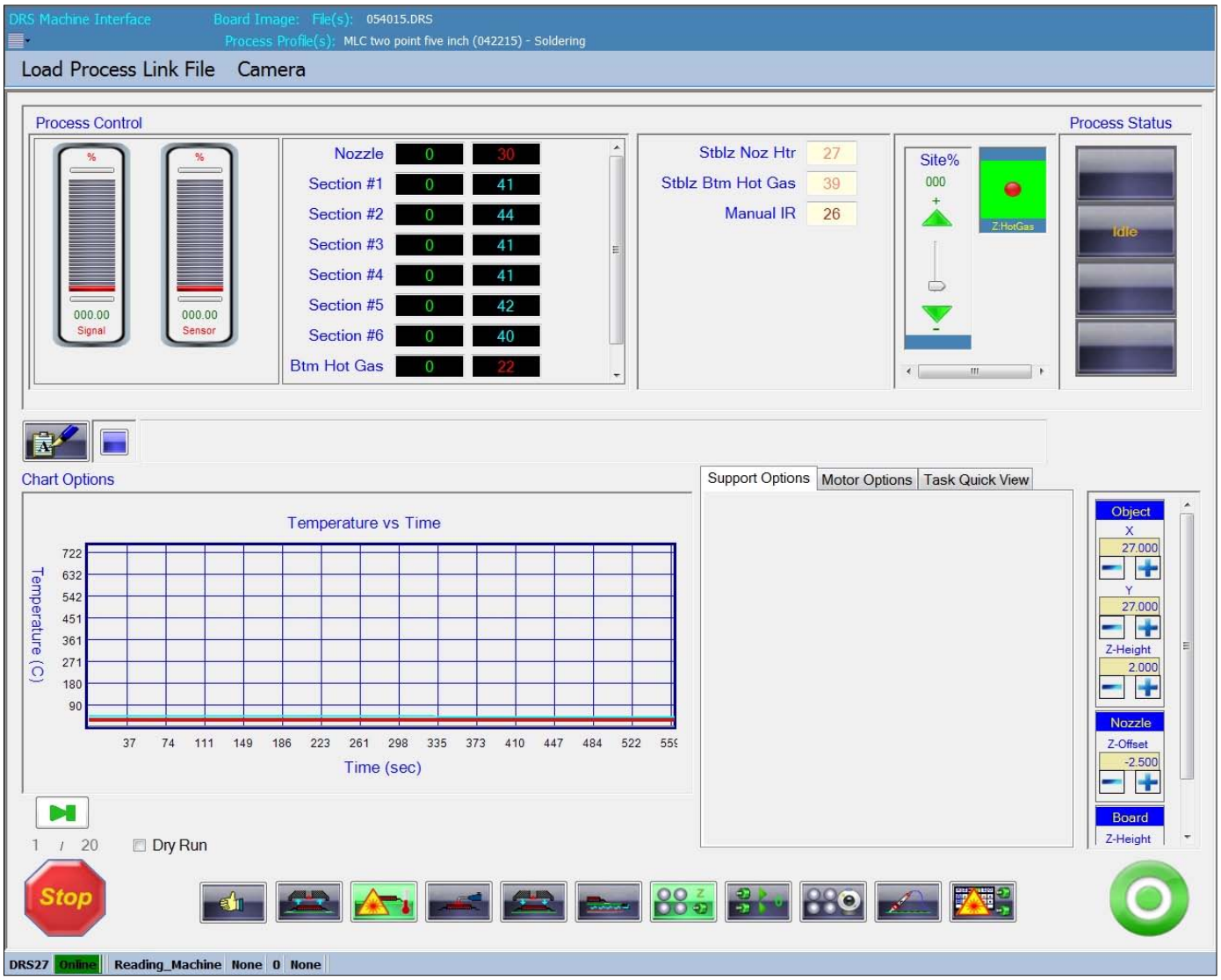
### Event #14: Machine and Board Cooldown

There is no operator involvement during this event. This is a timed event for 50 seconds. The nozzle moves up. The board cooling system air flow is set to high flow. The upper heater is set to low temperature/high flow.

### Event #15: Remove Board (Process Complete)

This is a timed event for 5 seconds. The nozzle retracts to its top position. The board carrier cooling system is turned off. The upper heater is turned off. At the end of the process the operator has three options:

## 7.8 Reference: Run Screen - Operator Controls




**Laser Pointer Teach Position**

**Start Cycle**


**Stop Cycle**

**Ok/Exit Screen**

**Nozzle Vacuum:** On/off vacuum for nozzle

**Component Probe Vacuum:** On/off vacuum for vacuum probe port

**Blow Off Air:** On/off pressure for nozzle vacuum, used to gently blow the part away from nozzle.

**Board Carrier Cooling Flow:** Allows upper heater and bottom heater to perform rapid cooldown. The nozzle cooldown involves a bypass operation to deliver cool air directly into the nozzle chamber (does not cool down the heating element).

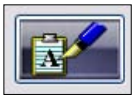
**LED Light:** On/Off machine lights

**Home Vision Systems Motors:** Brings nozzle (top position) and vision system (rear position) to home position.

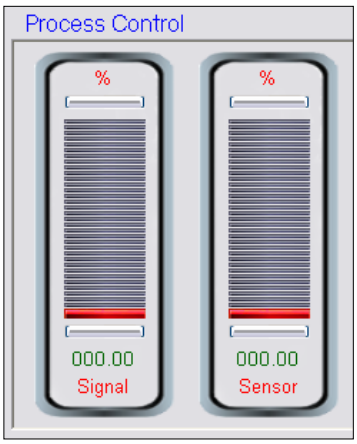
**Direct View Camera Lights:** On/Off

**Site Cleaning Vacuum:** On/Off

**IR Probe Laser Pointer:** On/Off light

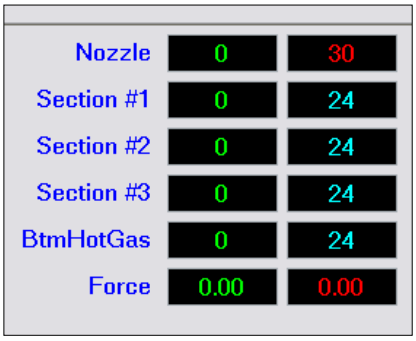


**Application Notes:** Allows the operator to review profile notes prior to running the program. It may be useful to open when a linked profile is opened.




**Process Control - % Signal:** Indicates flow to nozzle (set).

**Process Control - % Sensor:** Indicates flow to nozzle (actual).

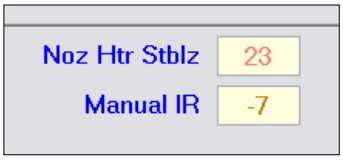



**Nozzle:** Left side – indicates set temperature to upper heater. Right side – indicates actual temperature to upper heater.

**Section #1 - #3:** Indicates set and actual temperature of preheat panels (#1 front, #2 middle, #3 rear).

**Bottom Hot Gas Spot Heater:** Indicates set and actual temperature of spot heater.

**Force:** Indicates force and actual setting of force system.




**Noz Htr Stblz:** Indicates temperature of thermocouple attached to hot gas head.

**Manual IR/Thermocouples:** Indicates temperature of IR temperature sensor.

**Dry Run:** When activated runs program without heat parameters applied.


**Scan:** Allows bar scanner to be used for history file. Information can be entered manually without scanner.

**Wait For Footswitch:** In footswitch events, the operator can advance the program to the next event by clicking on "Wait For Footswitch" or by depressing the footswitch under the machine.

# 8: Maintenance

8.0 MAINTENANCE ..... 3
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8.2 PREVENTATIVE MAINTENANCE SCHEDULE ..... 4
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8.4 FILTER ELEMENT REPLACEMENT ..... 6
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8.6 ASSEMBLY DIAGRAMS ..... 11

## 8.0 Maintenance

- As a basic rule, disconnect the main 220 Vac power before servicing the machine or when the machine is taken off line.
- Only use the tools for their defined purpose.
- Never remove or disable any DRS27 safety features or software.
- Make sure that all electrical devices are leakage current protected and are stored and used in dry, dust-free surroundings.
- The machine contains static sensitive devices. Use caution to avoid static discharge when handling DRS27 machine parts.
- Use original spare parts only.

## 8.1 General Cautions

- The customer is responsible for the safety of their operations and the actions of their employees.
- The customer's employees are responsible for understanding and following all safety instructions outlined by the customer's process specification and safety policies.
- These employees should also be trained in electrical safety, and should be familiar with all hazards associated with Air-Vac Engineering systems. If toxic gases or chemicals are used with the equipment, the personnel working with these materials must also be familiar with related MSDSs and associated safety requirements. In addition, personnel working with Air-Vac Engineering equipment should observe to the following guidelines:
- Maintenance should be performed by qualified personnel only.
- Standard cautions should be observed when working on the machine
- If tasks do not require power, perform proper Lockout Tagout procedures to ensure machine is safe to work on. Note: heaters may still be hot for some time after removing power.
- If machine is required to be powered for maintenance tasks, use caution. Removal of covers exposes high voltage areas. Provide warnings to others in the area of exposed hazards.
- Moving axis produce a pinch point hazard. Be careful of Z and vision axis motion.
- Heaters can reach high temperatures that can burn skin on contact. If heater operation is required, do not touch surfaces or place anything on heater surfaces (fire hazard).
- Only use the tools for their defined purpose.
- Never remove or disable any DRS27 safety features or software.
- Make sure that all electrical devices are leakage current protected and are stored and used in dry, dust-free surroundings.
- The machine contains static sensitive devices. Use caution to avoid static discharge when handling DRS27 machine parts.
- Use original spare parts only.
- DO NOT smoke, eat, or drink while operating or servicing the system.
- Always work with a partner when conducting service and maintenance functions involving hazardous-voltage conditions: one person to monitor the system status; the other, to carry out the maintenance or service.

- Always wear appropriate protective clothing when working around the equipment. Consult your in-house safety coordinator for specific requirements.
- Avoid inhaling cleaning fluid vapors while cleaning the system components. Whenever using cleaning fluids or lubricants, follow all warnings and cautions contained on the labels.

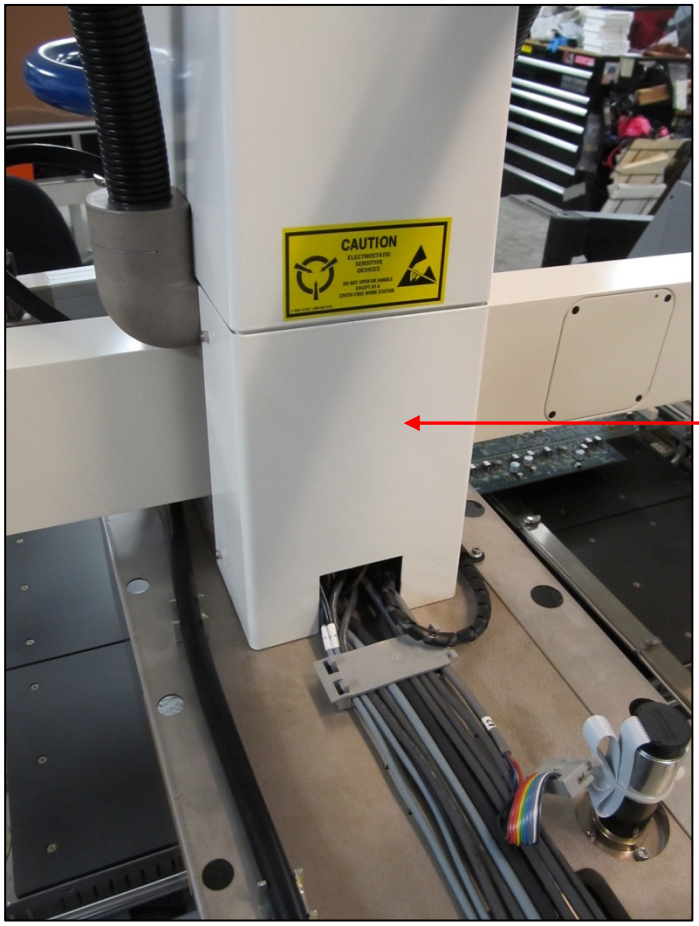
## 8.2 Preventative Maintenance Schedule

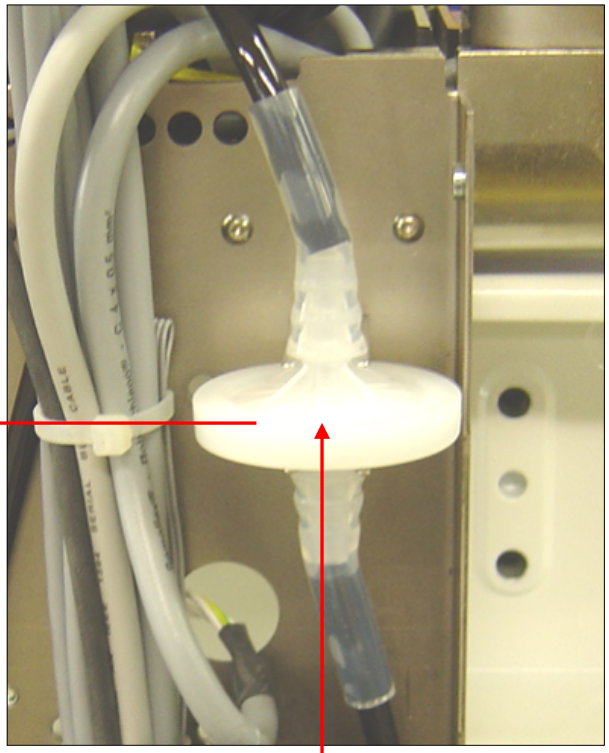
| ***Machine Component*** | ***Maintenance Activity*** | ***Notes*** | ***Frequency*** | | |
|---|---|---|---|---|---|
| | | | *Daily* | *Weekly* | *Monthly* |
| Data Backup | Profiles and part types must be written to an off-machine storage media (network server, memory stick, cd, etc.) | Off-machine data back-up is the most critical maintenance task. Air-Vac is not responsible for lost data. | | X | |
| Nozzles | Clean nozzles of flux and inspect o-rings and vacuum cups | | | X | |
| Site Clean Tool (option) | Install the SC nozzle and activate the SC vacuum to verify that a strong vacuum exists. Inspect tip collector and blue vacuum cup for wear. | Vacuum cup should be replaced after 8 hrs. of use | X | X | |
| Machine Frame | Clean the machine frame and the machine covers<br>Make sure there are no flux- or dispense media spoiled on the machine | Dry lint-free cloth, in case of flux, use flux remover | | | X |
| Vision Unit | Clean the protective cover glass on the lower and on the upper side of the vision unit | Kimwipes® Denatured Alcohol | | | X |
| Pneumatic Unit | Inspect and drain the air regulator filters of any water or oil as required (verify the air pressure is 0.55 mba) | | X | | |
| Vacuum Filter | Replace vacuum filter if vacuum is insufficient to hold component. | See instructions in Maintenance Section | | | X |
| X-Y-Z Axis Bearings | Clean all the linear bearing rails carefully.<br>Lubricate the bearing rails afterwards slightly with oil | Benzine, dry lint-free cloth<br>3 in 1 oil | | | X |
| Z-axis Lead Screw | Clean the lead screw<br>Lubricate the lead screw afterwards slightly with oil | Benzine, soft brush<br>3 in 1 oil | | | X |
| Computer/Machine | Hard Boot | | 8-10 hrs per shift | | |
| Nozzle | Temperature Calibration | See instructions in Maintenance Section | | | X |
| Site Clean Jar | Filter Change | Changing filter is dependent on usage | As required | | |

| ***Machine Component*** | ***Maintenance Activity*** | ***Notes*** | ***Frequency*** | | |
|---|---|---|---|---|---|
| | | | *Daily* | *Weekly* | *Monthly* |
| Test Emergency Off | | With machine on start any profile and press EMO - everything should stop and axis should be depowered. | weekly | | |
| Machine | Machine Verification (Chapter 3) | | Every 3-4 months | | |

## 8.3 Vacuum Filter

The assembly head vacuum uses an inline filter. The filter is located under the back cover of the head. If the process includes heavy evaporating flux, then the filter must be replaced on a regular base.

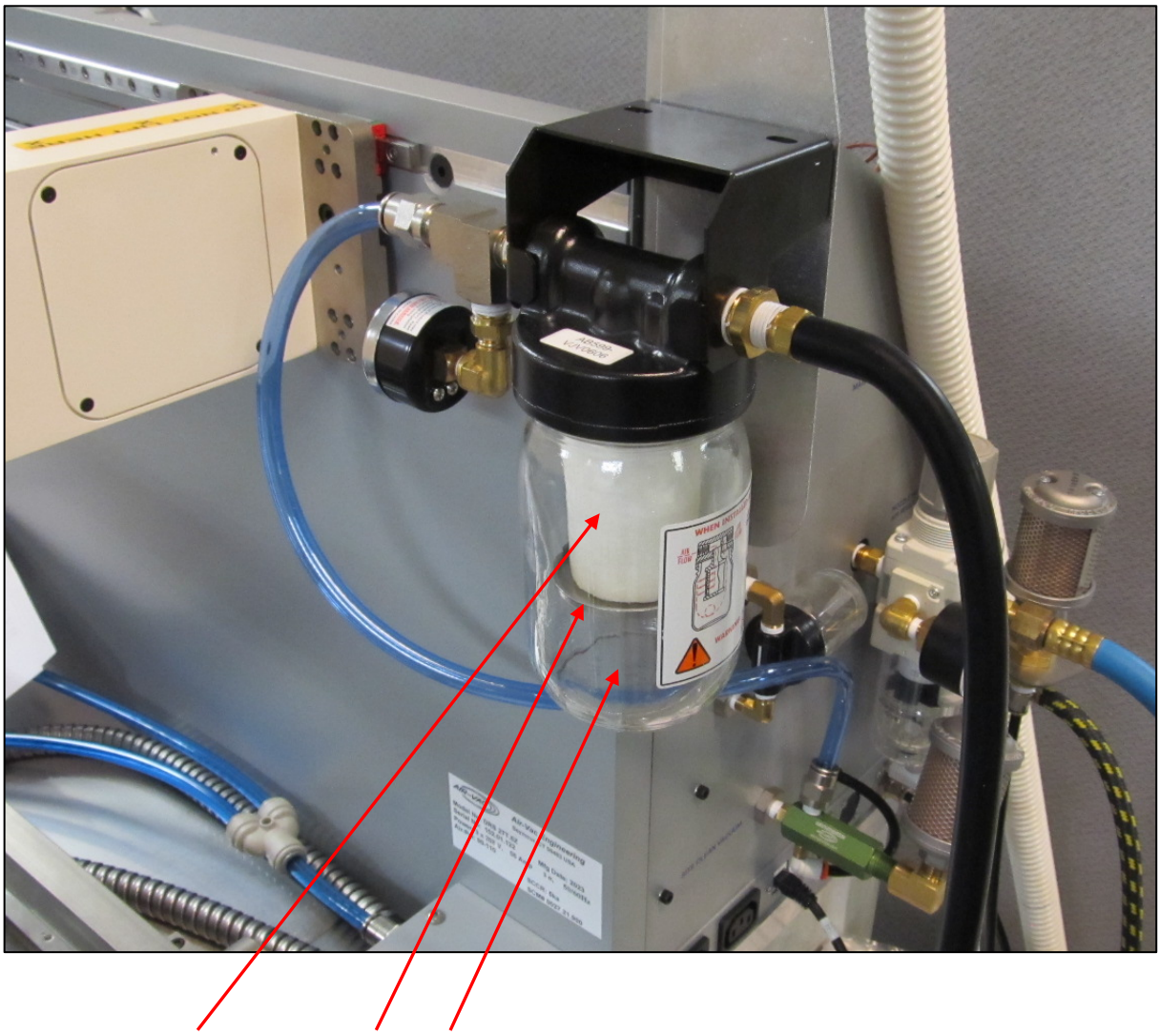


Filter

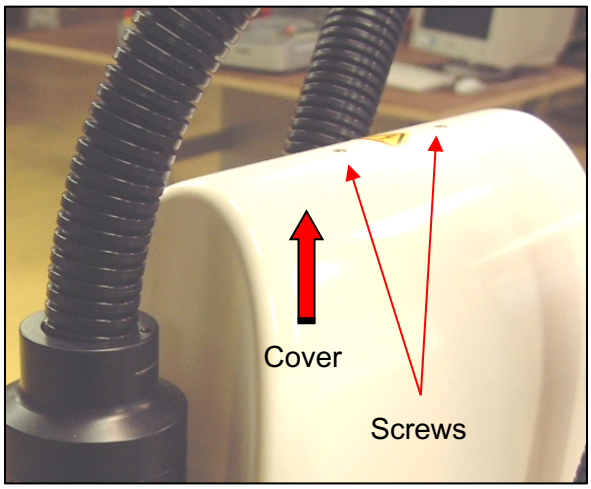
## 8.4 Filter Element Replacement

- Un-screw jar.
- Un-screw retaining flange.
- Replace filter.

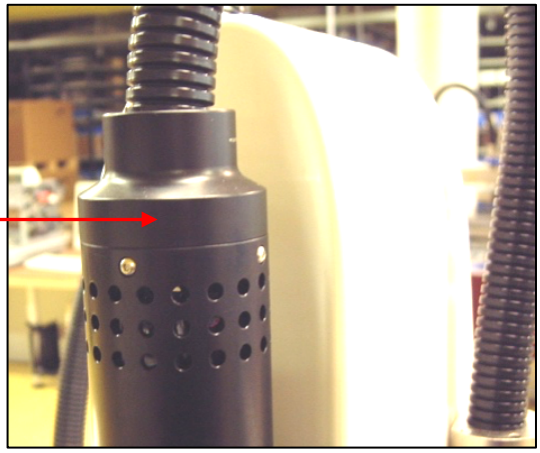


## 8.5 Upper Heating Element Replacement (Note: photos may vary)

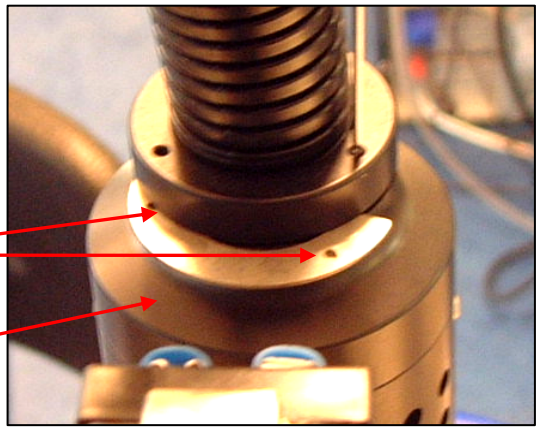
**1.** Take off the white Top Cover.



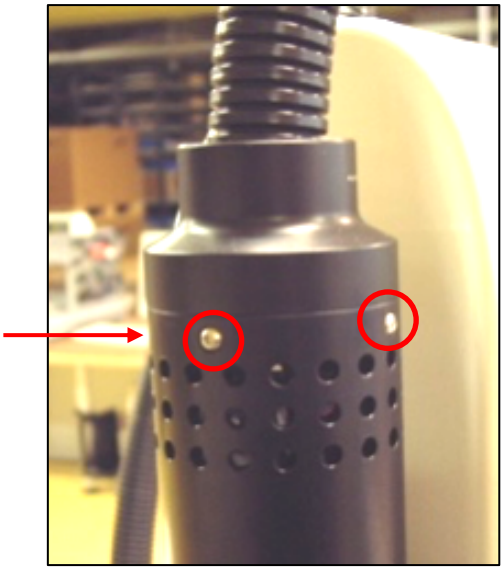

**2.** Take off the Top Cover by…



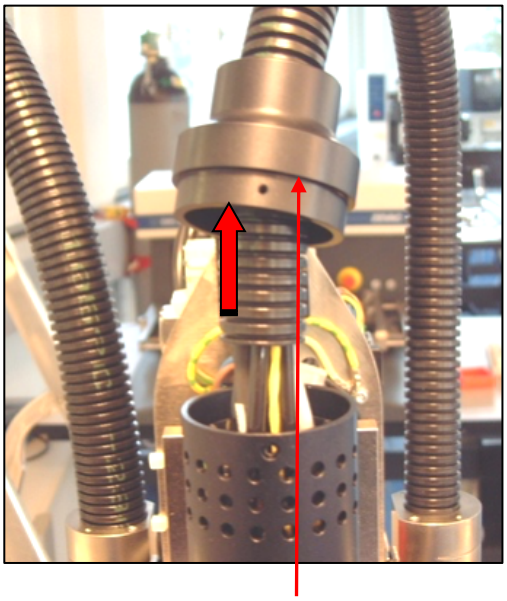

**3.** Loosening the two set Screws and take off the Plate.



**4.** Loosen the three Screws and slide the top Cover through the Tube.

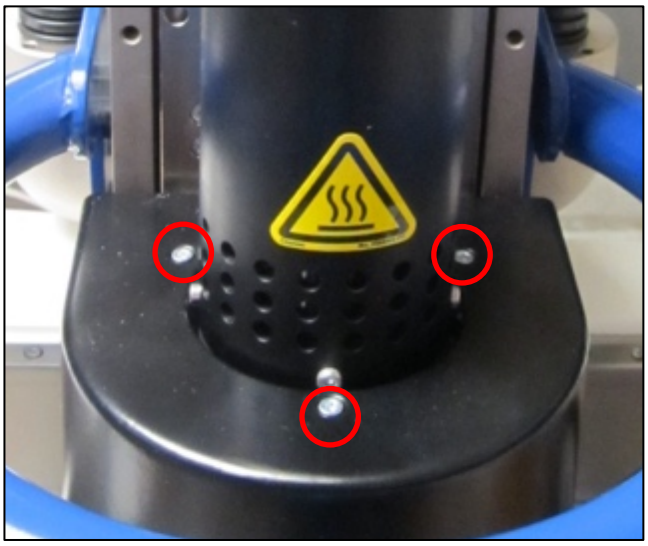


Screws

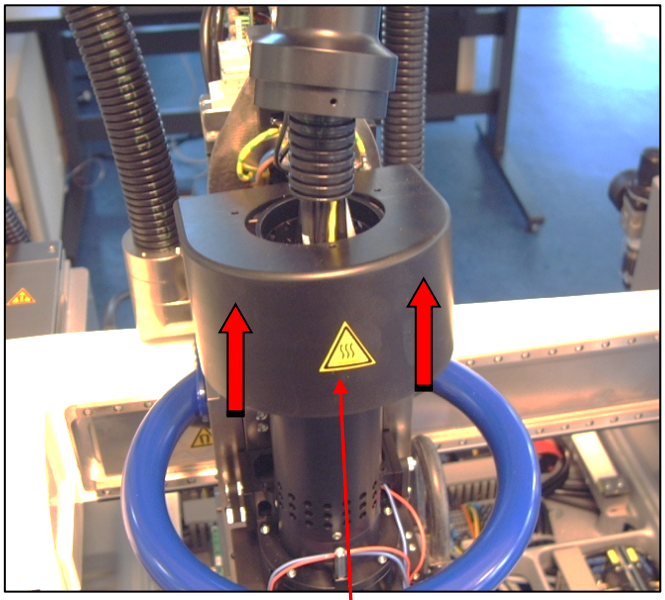


Top Cover

**5.** Take off the three Screws and lift up the Cover.

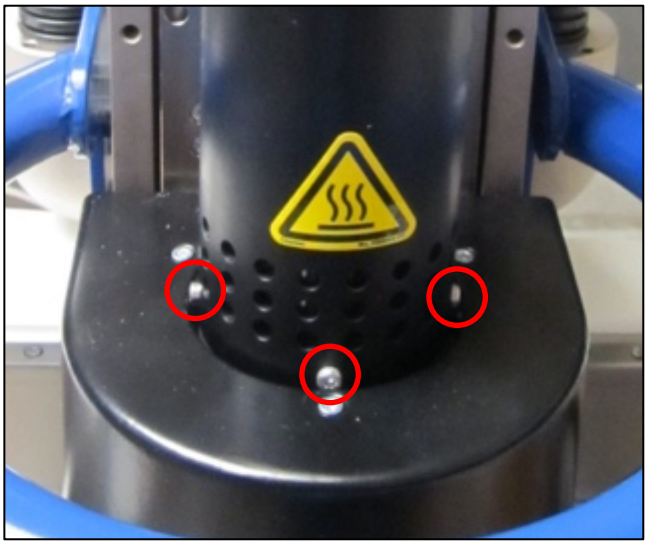


Screws

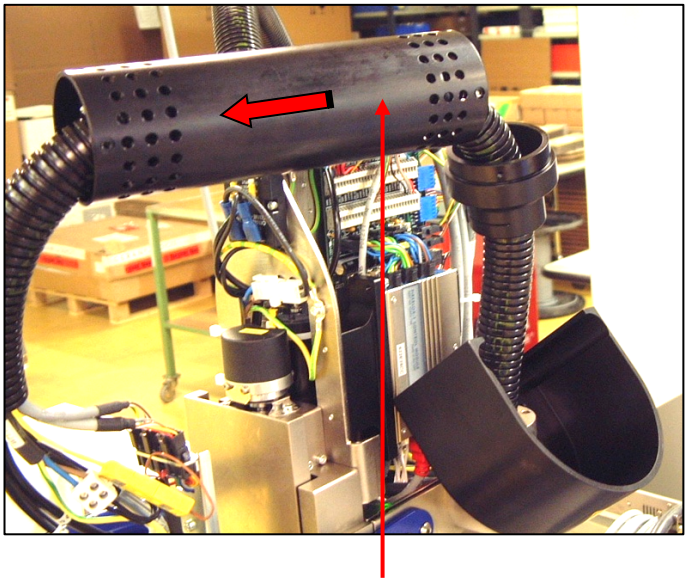


Cover

**6.** Take off the three Screws and slide the Pipe through the Tube.

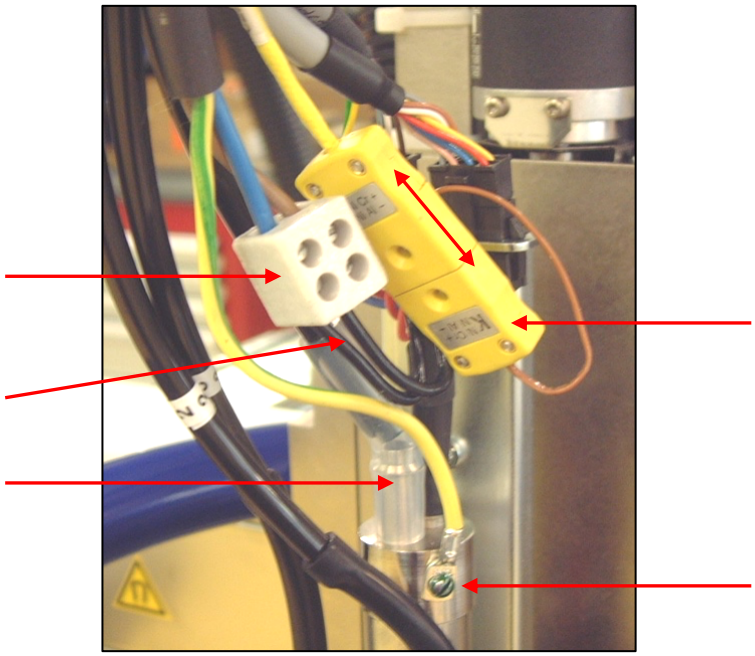


Screws



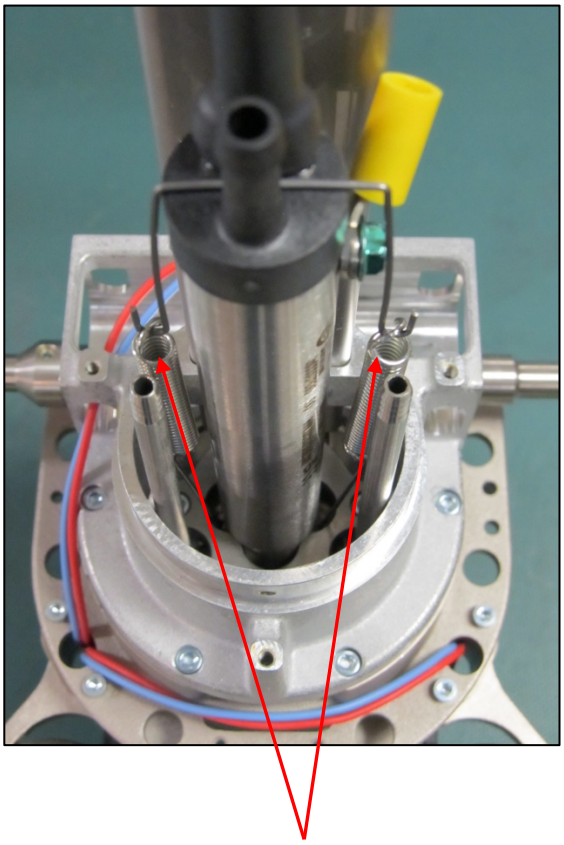
Pipe

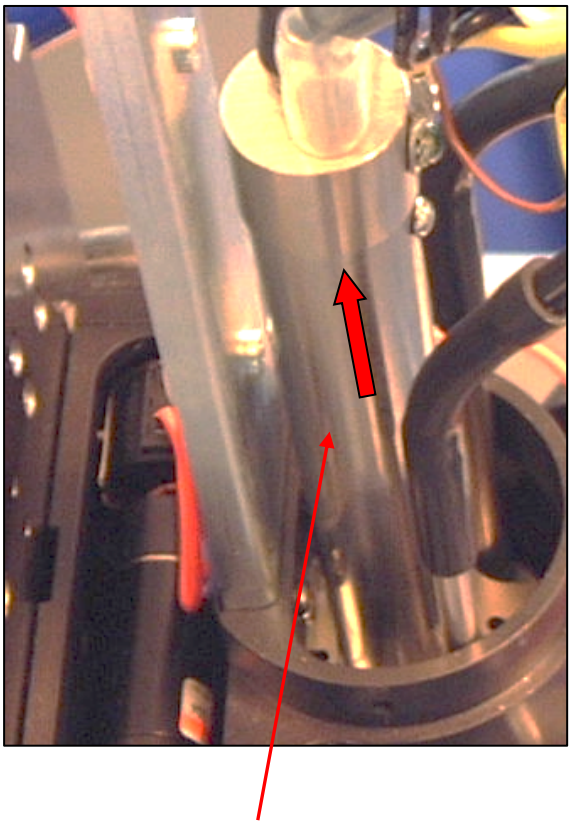
**7.** Remove the two black Heater Wires from the ceramic Terminal Block.
**8.** Remove the Ground Wire from the Heater.
**9.** Remove the Air Tube from the Heater.
**10.** Disconnect the T/C Plugs.



**11.** Remove the Spring Pack that holds the Heater in place.

**12.** Remove the Heater from Head assembly.



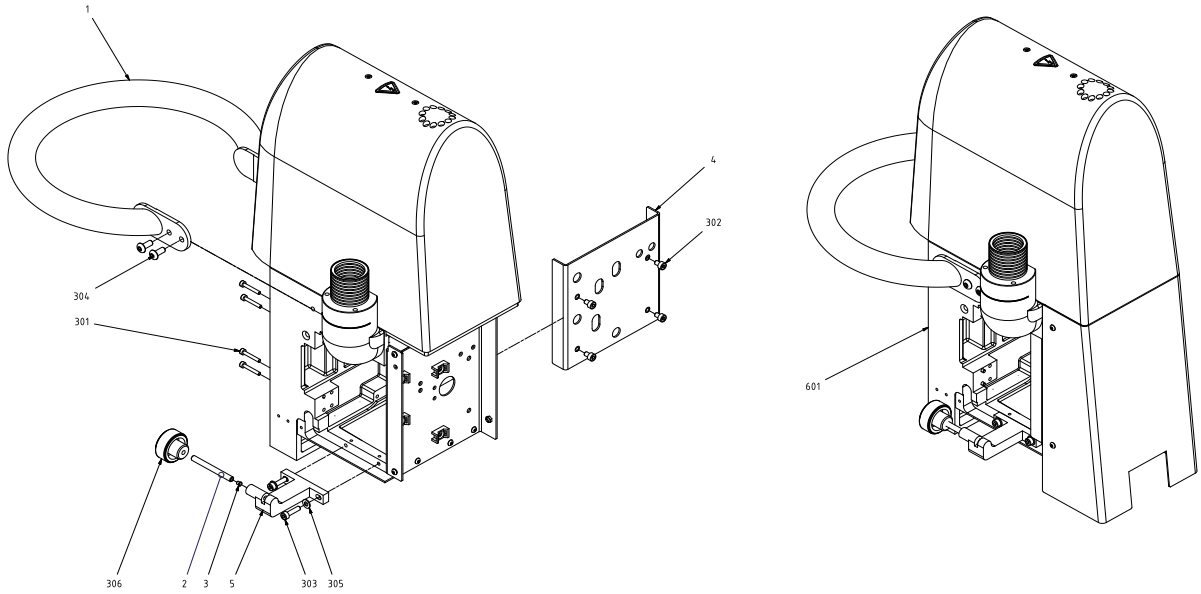


**Note**

To remount all removed parts, follow the same procedure in reverse.

## 8.6 Assembly Diagrams

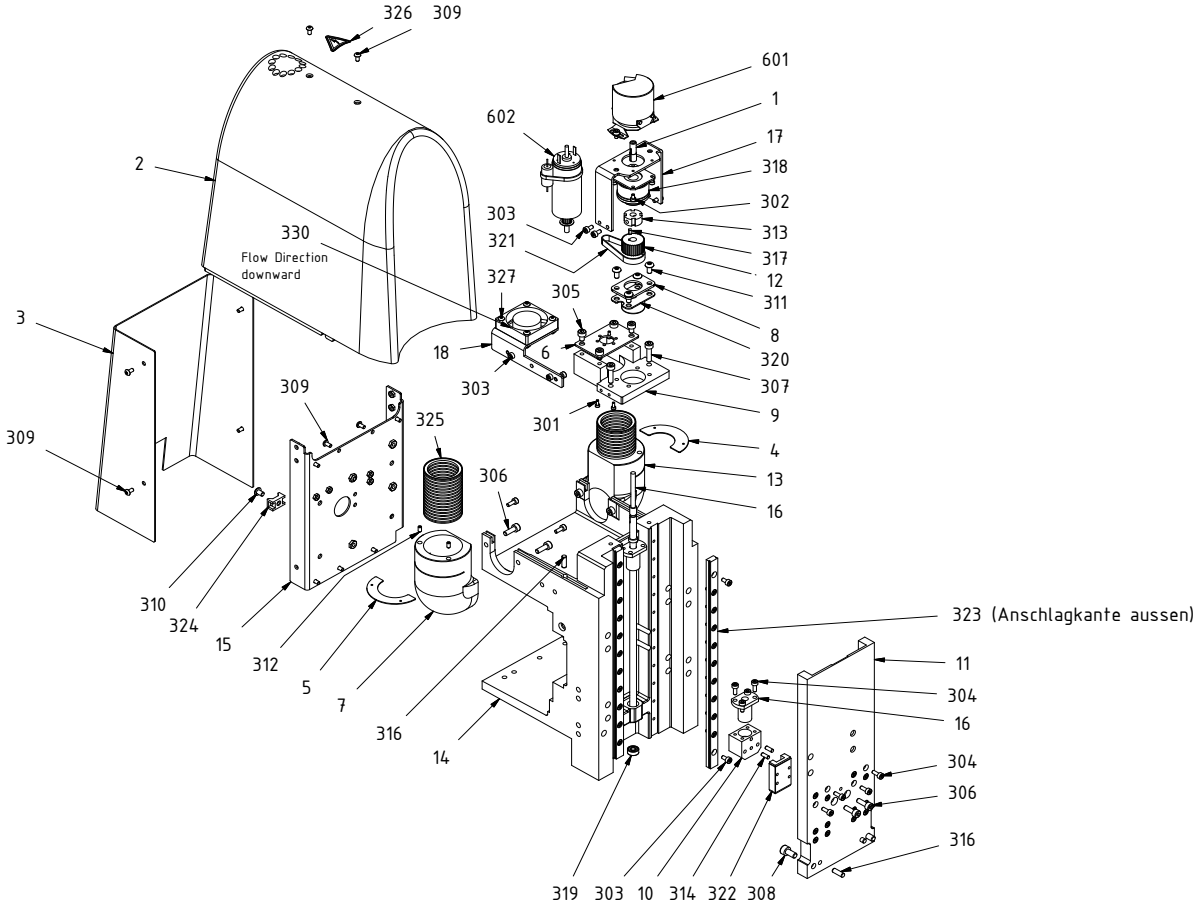
# 300.00.968 X-Z-Axis 150mm (OBC 30mm)




Initial date:14.02.2006/CL Change index:0 /19.09.2008/AG

| Pos. | Amount | Unit | Spare part class | Article number | Article description |
|---|---|---|---|---|---|
| 1 | 1 | pc. | - | 200.01.158 | Handle |
| 2 | 1 | pc. | - | 200.01.891 | Gewindestange |
| 3 | 1 | pc. | - | 200.01.892 | Druckstück |
| 4 | 1 | pc. | - | 200.01.923 | Anschlagblech |
| 5 | 1 | pc. | - | 200.02.107 | Halter |
| 301 | 16 | pc. | - | 100.00.021 | Cyl. Screw M3x20, BN3 |
| 302 | 4 | pc. | - | 100.00.027 | Cyl. screw M4x6, BN3 |
| 303 | 2 | pc. | - | 100.00.032 | Cyl. screw M4x16, BN3 |
| 304 | 4 | pc. | - | 100.00.166 | Lens head Screw M5x12, BN1593 |
| 305 | 2 | pc. | - | 100.04.002 | Washer M4, BN 726 |
| 306 | 1 | pc. | - | 101.26.003 | Turning knob M5x10, BN14176 |
| 307 | 0.6 | m | - | 109.19.032 | Conduit pipe PMARobot PCSG-23B.50 |
| 601 | 1 | pc. | - | 300.01.023 | X-Z-Axis 150mm base module (OBC 30mm) |

## 300.01.023 X-Z-Axis 150mm base module (OBC 30mm)

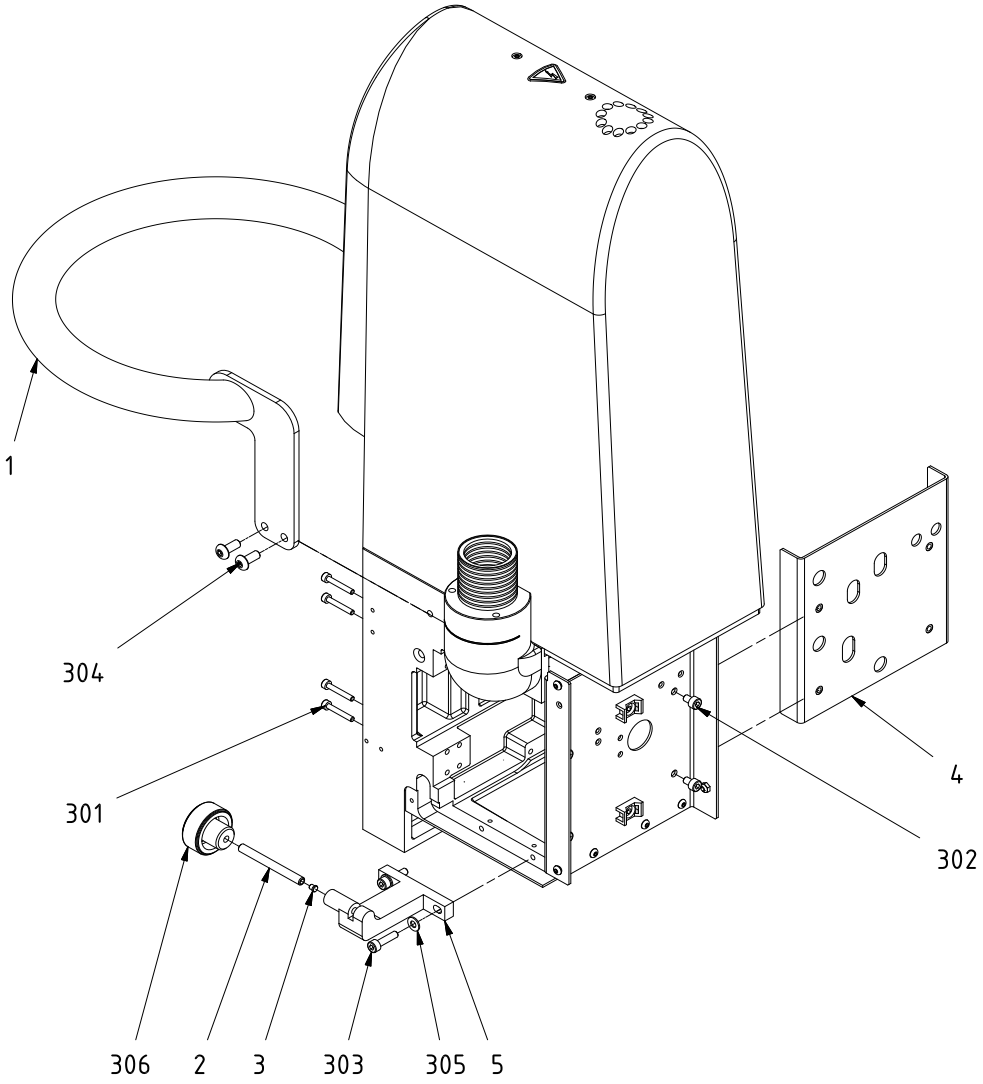



Initial date:09.05.2006/CL Change index:2 /23.12.2008/AG

| Pos. | Amount | Unit | Spare part class | Article number | Article description |
|---|---|---|---|---|---|
| 1 | 1 | pc. | - | 200.01.089 | Huelse Encoder |
| 2 | 1 | pc. | - | 200.03.390 | Cover z-axis |
| 3 | 1 | pc. | - | 200.01.155 | Abdeckung Rueckwand |
| 4 | 1 | pc. | - | 200.01.156 | Segment 23 |
| 5 | 1 | pc. | - | 200.01.157 | Segment 29 |
| 6 | 1 | pc. | - | 200.01.166 | Motorplatte Z |
| 7 | 1 | pc. | - | 200.01.408 | Wellrohranschluss 29 |
| 8 | 1 | pc. | - | 200.01.430 | Abschlussplatte |
| 9 | 1 | pc. | - | 200.01.432 | Attachment plate motor |
| 10 | 1 | pc. | - | 200.01.433 | Mutterflansch |
| 11 | 1 | pc. | - | 200.01.435 | Vertikalschlitten |
| 12 | 1 | pc. | - | 200.01.436 | Zahnscheibe Spindel |
| 13 | 1 | pc. | - | 200.01.438 | Wellrohranschluss 23 |
| 14 | 1 | pc. | - | 200.02.331 | Grundplatte Kasten kurz |
| 15 | 1 | pc. | - | 200.02.378 | Cabinet back wall |
| 16 | 1 | pc. | - | 200.02.418 | Z-Spindel 150mm |
| 17 | 1 | pc. | - | 200.02.419 | Bügel |
| 18 | 1 | pc. | - | 200.03.363 | Fun holder |

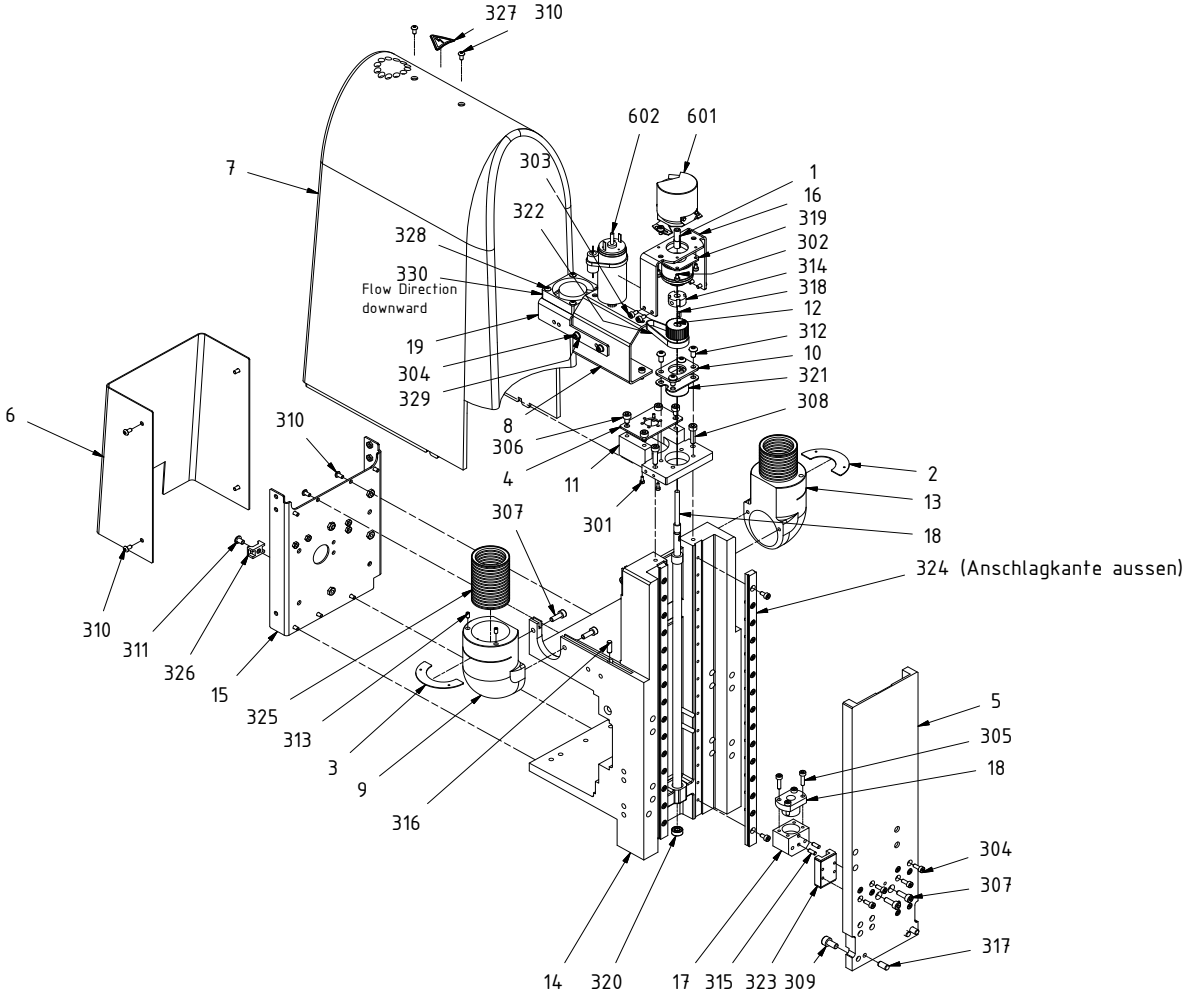
| Pos. | Amount | Unit | Spare part class | Article number | Article description |
|---|---|---|---|---|---|
| 301 | 3 | pc. | - | 100.00.003 | Cyl. Screw M2x6 BN 11 |
| 302 | 4 | pc. | - | 100.00.007 | Zyl. Schraube M2.5x4 BN 11 |
| 303 | 28 | pc. | - | 100.00.015 | Cyl. screw M3x6, BN3 |
| 304 | 24 | pc. | - | 100.00.016 | Cyl. screw M3x8, BN3 |
| 305 | 4 | pc. | - | 100.00.027 | Cyl. screw M4x6, BN3 |
| 306 | 6 | pc. | - | 100.00.030 | Cyl. screw M4x12, BN3 |
| 307 | 2 | pc. | - | 100.00.032 | Cyl. screw M4x16, BN3 |
| 308 | 2 | pc. | - | 100.00.044 | Cyl. screw M5x12 |
| 309 | 11 | pc. | - | 100.00.157 | Lens head screw M3x6, BN1593 |
| 310 | 4 | pc. | - | 100.00.208 | Lens head screw M4x6, BN1593 |
| 311 | 4 | pc. | - | 100.00.160 | Lens head screw M4x8, BN1593 |
| 312 | 4 | pc. | - | 100.00.206 | Threaded pin M3x6 with peak, BN29 |
| 313 | 1 | pc. | - | 100.02.019 | Stellmutter Kuso MRR M6x0.5 |
| 314 | 2 | pc. | - | 100.05.027 | Cyl. pin d 3-h6 x8 |
| 316 | 4 | pc. | - | 100.05.040 | Cyl. pin d 4-h6x12 BN 858 |
| 317 | 1 | pc. | - | 100.05.095 | Federkeil 2x2x6 BN 870 |
| 318 | 1 | pc. | 3 | 101.18.002 | Z-axis break 86621-03H00-24V |
| 319 | 1 | pc. | 3 | 101.22.007 | Ball bearing 4/10/4 |
| 320 | 1 | pc. | 3 | 101.22.033 | Axial bearing ZKLR 0624.2Z |
| 321 | 1 | pc. | 2 | 101.28.006 | Power grip belt GT 2MR-112, 6m |
| 322 | 4 | pc. | 3 | 102.00.012 | Linear bearing MNN 9-G1 |
| 323 | 2 | pc. | - | 102.00.024 | Linearfuehrung Schiene MN 9-233-G1-V1 |
| 324 | 4 | pc. | - | 109.19.027 | Attachment block TM-2S8 |
| 325 | 0.57 | m | - | 109.19.032 | Conduit pipe PMARobot PCSG-23B.50 |
| 326 | 1 | pc. | 2 | 109.51.005 | Warning label 25 x 25mm lightning |
| 327 | 4 | pc. | - | 100.00.273 | Lens head Screw M3x16 BN1593 |
| 330 | 1 | pc. | 3 | 109.08.003 | Fan 40x40x10 mm, 24 VDC |
| 331 | 2 | pc. | - | 100.00.014 | Cyl. screw M3x5, BN3 |
| 332 | 2 | pc. | - | 100.00.159 | Lens head screw M3x10, BN1593 |
| 601 | 1 | pc. | 2 | 300.00.038 | Z-Encoder complete |
| 602 | 1 | pc. | 3 | 9002.05.082 | Z-Motor complete |

## 300.01.034 X-Z-Axis 230mm (OBC 70mm)



| Pos. | Amount | Unit | Spare part class | Article number | Article description |
|---|---|---|---|---|---|
| 1 | 1 | pc. | - | 200.01.797 | Handle (Z 230mm) |
| 2 | 1 | pc. | - | 200.01.891 | Gewindestange |
| 3 | 1 | pc. | - | 200.01.892 | Druckstück |
| 4 | 1 | pc. | - | 200.01.923 | Anschlagblech |
| 5 | 1 | pc. | - | 200.02.107 | Halter |
| 301 | 8 | pc. | - | 100.00.022 | Cyl. Screw M3x22, BN 3 |
| 302 | 4 | pc. | - | 100.00.027 | Cyl. screw M4x6, BN3 |
| 303 | 2 | pc. | - | 100.00.032 | Cyl. screw M4x16, BN3 |
| 304 | 4 | pc. | - | 100.00.166 | Lens head Screw M5x12, BN1593 |
| 305 | 2 | pc. | - | 100.04.002 | Washer M4, BN 726 |
| 306 | 1 | pc. | - | 101.26.003 | Turning knob M5x10, BN14176 |
| 307 | 0.65 | m | - | 109.19.032 | Conduit pipe PMARobot PCSG-23B.50 |
| 601 | 1 | pc. | - | 300.01.025 | X-Z-Axis 230mm base module (OBC 70mm) |

## 300.01.025 X-Z-Axis 230mm base module (OBC 70mm)

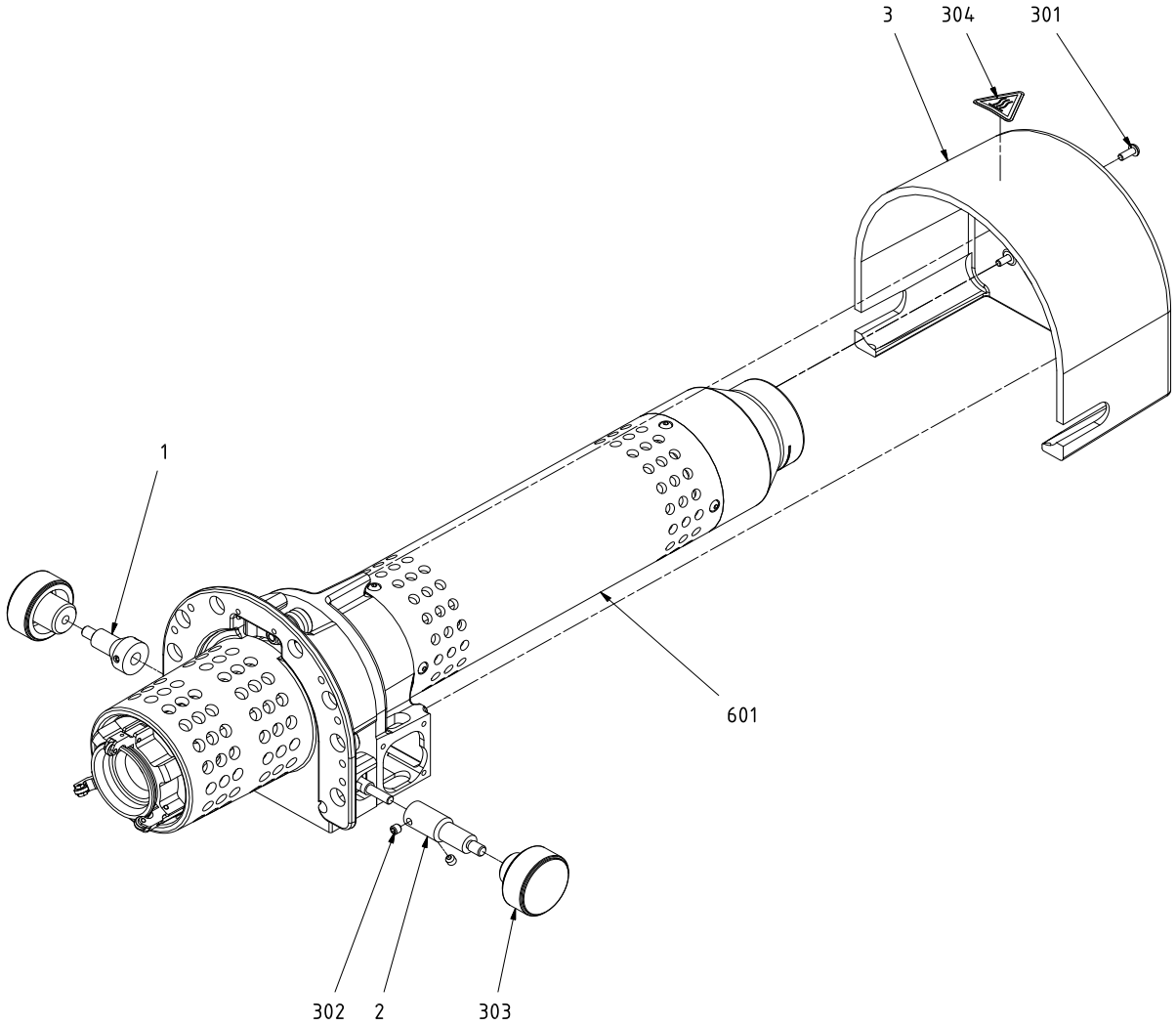



Initial date:10.05.2006/CL Change index:1 /05.02.2009/MH

| Pos. | Amount | Unit | Spare part class | Article number | Article description |
|---|---|---|---|---|---|
| 1 | 1 | pc. | - | 200.01.089 | Huelse Encoder |
| 2 | 1 | pc. | - | 200.01.156 | Segment 23 |
| 3 | 1 | pc. | - | 200.01.157 | Segment 29 |
| 4 | 1 | pc. | - | 200.01.166 | Motorplatte Z |
| 5 | 1 | pc. | - | 200.01.367 | Vertikalschlitten |
| 6 | 1 | pc. | - | 200.01.368 | Deckel Rueckwand |
| 7 | 1 | pc. | - | 200.03.391 | Haube Z-Achse hoch |
| 8 | 1 | pc. | - | 200.03.385 | Distance plate |
| 9 | 1 | pc. | - | 200.01.408 | Wellrohranschluss 29 |
| 10 | 1 | pc. | - | 200.01.430 | Abschlussplatte |
| 11 | 1 | pc. | - | 200.01.432 | Attachment plate motor |
| 12 | 1 | pc. | - | 200.01.436 | Zahnscheibe Spindel |
| 13 | 1 | pc. | - | 200.01.438 | Wellrohranschluss 23 |
| 14 | 1 | pc. | - | 200.02.332 | Grundplatte Kasten lang |
| 15 | 1 | pc. | - | 200.02.378 | Cabinet back wall |

| Pos. | Amount | Unit | Spare part class | Article number | Article description |
|---|---|---|---|---|---|
| 16 | 1 | pc. | - | 200.02.419 | Bügel |
| 17 | 1 | pc. | - | 200.02.585 | Mutterflansch |
| 18 | 1 | pc. | - | 200.02.586 | Z-Spindel 230mm |
| 19 | 1 | pc. | - | 200.03.363 | Fun holder |
| 301 | 3 | pc. | - | 100.00.003 | Cyl. Screw M2x6 BN 11 |
| 302 | 4 | pc. | - | 100.00.007 | Zyl. Schraube M2.5x4 BN 11 |
| 303 | 34 | pc. | - | 100.00.015 | Cyl. screw M3x6, BN3 |
| 304 | 24 | pc. | - | 100.00.016 | Cyl. screw M3x8, BN3 |
| 305 | 4 | pc. | - | 100.00.017 | Cyl. screw M3x10, BN3 |
| 306 | 4 | pc. | - | 100.00.027 | Cyl. screw M4x6, BN3 |
| 307 | 6 | pc. | - | 100.00.030 | Cyl. screw M4x12, BN3 |
| 308 | 2 | pc. | - | 100.00.032 | Cyl. screw M4x16, BN3 |
| 309 | 2 | pc. | - | 100.00.043 | Cyl. screw M5x10, BN3 |
| 310 | 11 | pc. | - | 100.00.157 | Lens head screw M3x6, BN1593 |
| 311 | 2 | pc. | - | 100.00.208 | Lens head screw M4x6, BN1593 |
| 312 | 4 | pc. | - | 100.00.160 | Lens head screw M4x8, BN1593 |
| 313 | 4 | pc. | - | 100.00.206 | Threaded pin M3x6 with peak, BN29 |
| 314 | 1 | pc. | - | 100.02.019 | Stellmutter Kuso MRR M6x0.5 |
| 315 | 2 | pc. | - | 100.05.027 | Cyl. pin d 3-h6 x8 |
| 316 | 2 | pc. | - | 100.05.040 | Cyl. pin d 4-h6x12 BN 858 |
| 317 | 2 | pc. | - | 100.05.039 | Cyl. pin d 4-h6 x10, BN 858 |
| 318 | 1 | pc. | - | 100.05.095 | Federkeil 2x2x6 BN 870 |
| 319 | 1 | pc. | 3 | 101.18.002 | Z-axis break 86621-03H00-24V |
| 320 | 1 | pc. | 3 | 101.22.007 | Ball bearing 4/10/4 |
| 321 | 1 | pc. | 3 | 101.22.033 | Axial bearing ZKLR 0624.2Z |
| 322 | 1 | pc. | 2 | 101.28.006 | Power grip belt GT 2MR-112, 6m |
| 323 | 4 | pc. | 3 | 102.00.012 | Linear bearing MNN 9-G1 |
| 324 | 2 | pc. | - | 102.00.025 | Linearfuehrung Schiene MN 9-313-G1-V1 |
| 325 | 1.2 | m | - | 109.19.024 | Wellrohr PCSG-29B |
| 326 | 4 | pc. | - | 109.19.027 | Attachment block TM-2S8 |
| 327 | 1 | pc. | 2 | 109.51.005 | Warning label 25 x 25mm lightning |
| 328 | 4 | pc. | - | 100.00.259 | Lens head Screw M3x16, BN1593 |
| 329 | 2 | pc. | - | 100.04.023 | Washer M3, BN 715 |
| 330 | 1 | pc. | 3 | 109.08.003 | Fan 40x40x10 mm, 24 VDC |
| 331 | 2 | pc. | - | 100.00.159 | Lens head screw M3x10, BN1593 |
| 601 | 1 | pc. | 2 | 300.00.038 | Z-Encoder complete |
| 602 | 1 | pc. | 3 | 9002.05.082 | Z-Motor complete |

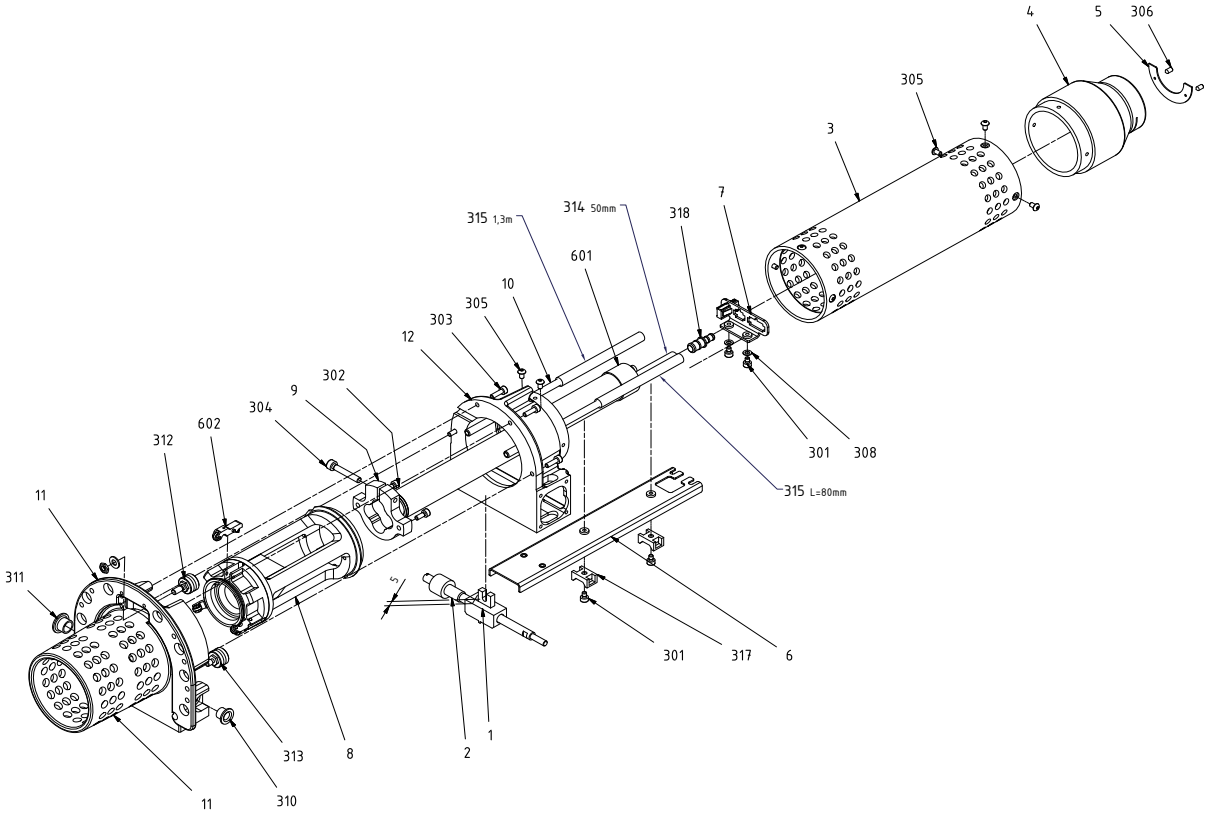
## 300.00.784 Advanced solder head




Initial date:13.02.2006/CL Change index:0 /23.12.2008/AG

| Pos. | Amount | Unit | Spare part class | Article number | Article description |
|---|---|---|---|---|---|
| 1 | 1 | pc. | - | 200.01.912 | Achsverlängerung links |
| 2 | 1 | pc. | - | 200.01.913 | Achsverlängerung rechts |
| 3 | 1 | pc. | - | 200.01.914 | Abdeckhaube Onyx 25 |
| 301 | 3 | pc. | - | 100.00.158 | Lens head screw M3x8, BN1593 |
| 302 | 4 | pc. | - | 100.00.180 | Threaded Pin M4x4, BN 28 |
| 303 | 2 | pc. | - | 101.26.003 | Turning knob M5x10, BN14176 |
| 304 | 1 | pc. | 2 | 109.51.006 | Warning label 25 x 25mm hot surface |
| 601 | 1 | pc. | - | 300.01.006 | Advanced solder head base |

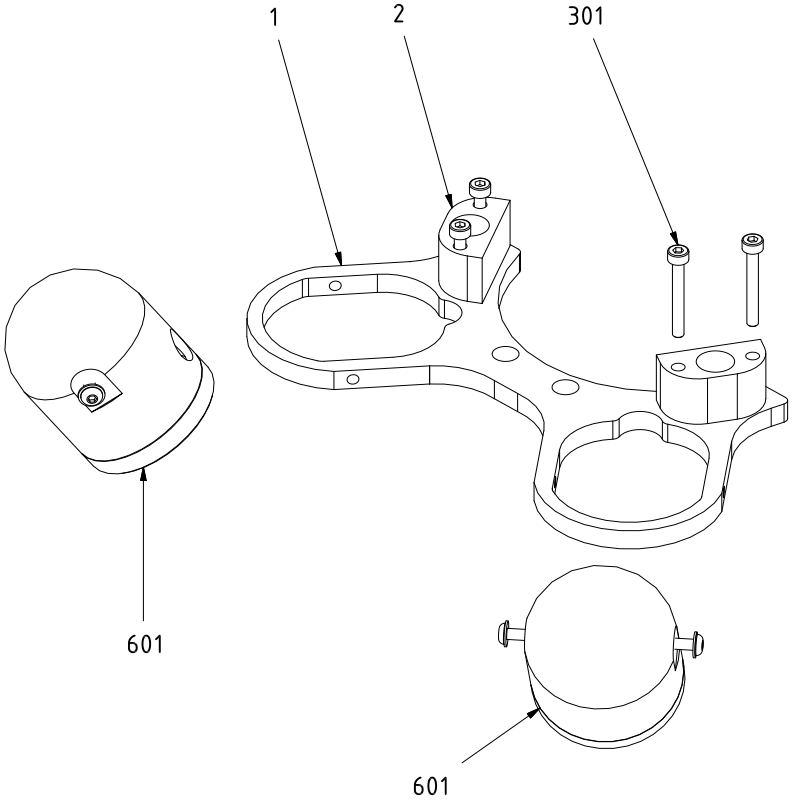
## 300.01.006 Advanced solder head base

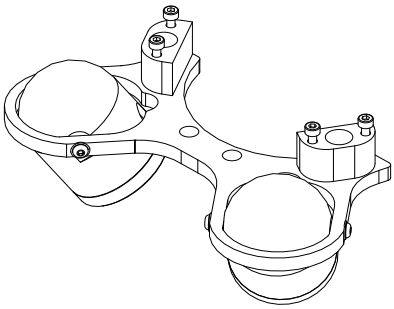



Initial date:24.04.2006/EG Change index:0 /14.01.2009/AG

| Pos. | Amount | Unit | Spare part class | Article number | Article description |
|---|---|---|---|---|---|
| 1 | 1 | pc. | - | 200.01.033 | Slider |
| 2 | 1 | pc. | - | 200.01.219 | Spindle |
| 3 | 1 | pc. | - | 200.01.220 | Schutzrohr |
| 4 | 1 | pc. | - | 200.01.221 | Abdeckkappe oben |
| 5 | 1 | pc. | - | 200.01.231 | Segment |
| 6 | 1 | pc. | - | 200.01.235 | Kabelhalter |
| 7 | 1 | pc. | - | 200.01.236 | Steckerhalter |
| 8 | 1 | pc. | - | 200.01.259 | Düsenkopf-Drehkörper |
| 9 | 1 | pc. | - | 200.01.260 | Klemmring |
| 10 | 2 | pc. | - | 200.01.261 | Luft-Vacuumrohr |
| 11 | 1 | pc. | - | 200.01.403 | Support head Z-axis |
| 12 | 1 | pc. | - | 200.01.404 | Motorflansch |
| 301 | 2 | pc. | - | 100.00.014 | Cyl. screw M3x5, BN3 |
| 302 | 2 | pc. | - | 100.00.017 | Cyl. screw M3x10, BN3 |
| 303 | 4 | pc. | - | 100.00.017 | Cyl. screw M3x10, BN3 |
| 304 | 1 | pc. | - | 100.00.035 | Cyl. Screw M4x25, BN 3 |
| 305 | 8 | pc. | - | 100.00.156 | Lens head screw M3x5, BN 1593 |
| 306 | 2 | pc. | - | 100.00.206 | Threaded pin M3x6 with peak, BN29 |
| 308 | 1 | pc. | - | 100.04.023 | Washer M3, BN 715 |
| 310 | 1 | pc. | 3 | 101.22.026 | Rotational spacer 6x8x12x7 |
| 311 | 1 | pc. | 3 | 101.22.027 | Rotational spacer 8x10x15x7.5 |

# 300.01.423 Field Illumination (adjustable)

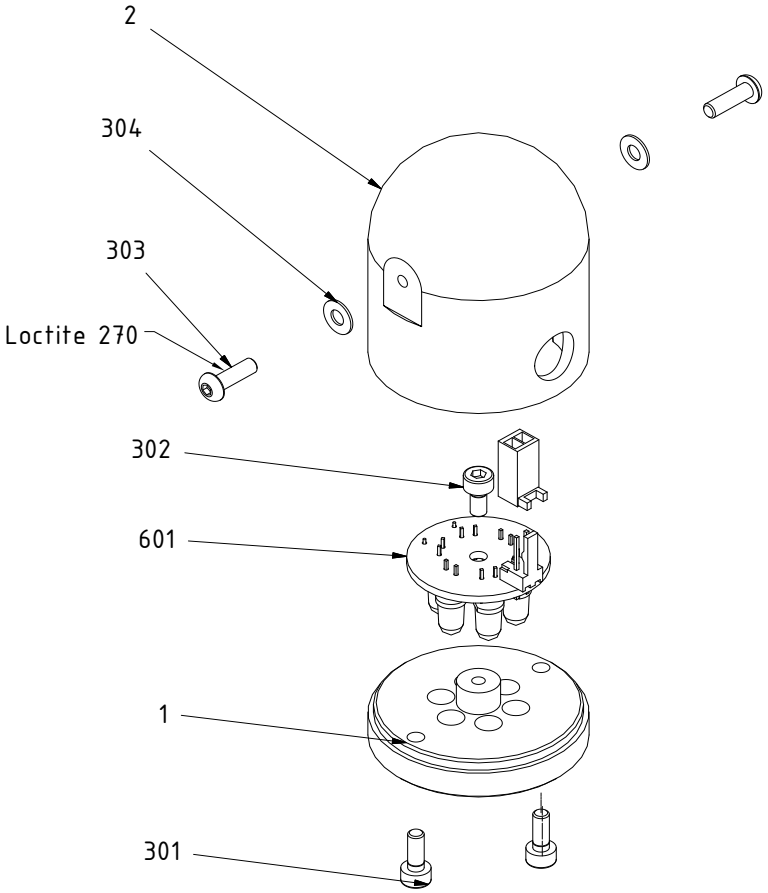


Initial date:21.03.2007/EG Change index:0 /29.01.2009/AG

| Pos. | Amount | Unit | Spare part class | Article number | Article description |
|---|---|---|---|---|---|
| 1 | 1 | pc. | - | 200.03.256 | Lampenhalter |
| 2 | 2 | pc. | - | 200.03.328 | Unterlage |
| 301 | 4 | pc. | - | 100.00.023 | Cyl. Screw M3x25, BN 3 |
| 601 | 2 | pc. | - | 300.01.422 | Lamp (adjustable) |
| 602 | 1 | pc. | - | 300.01.479 | Y-Cable field illumination |
| 603 | 1 | pc. | - | 300.00.910 | Cable field illumination |

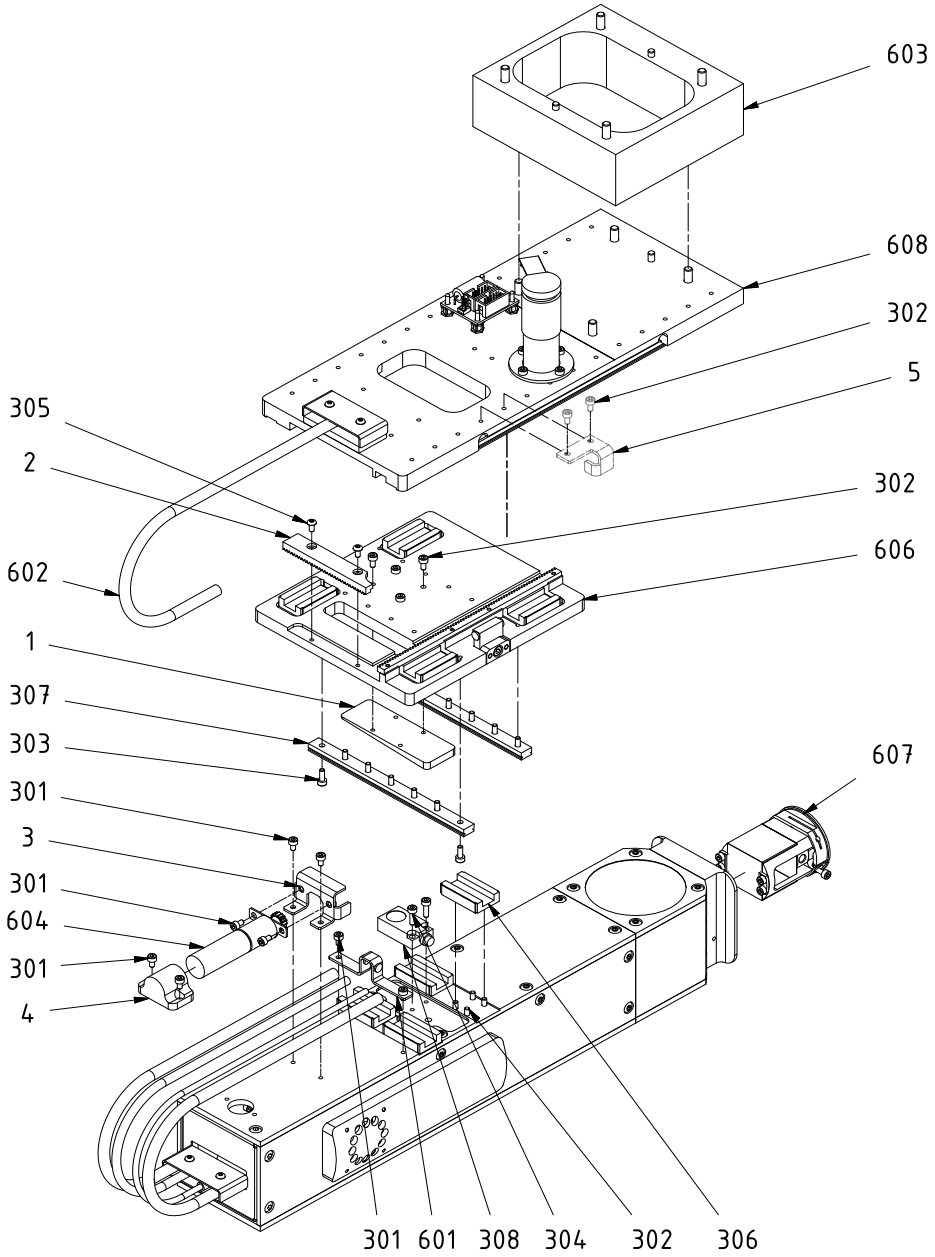
## 300.01.422 Lamp (adjustable)




Initial date:21.03.2007/EG Change index:0 /04.02.2009/MH

| Pos. | Amount | Unit | Spare part class | Article number | Article description |
|---|---|---|---|---|---|
| 1 | 1 | pc. | - | 200.01.228 | LED-Gehaeuse |
| 2 | 1 | pc. | - | 200.03.263 | Lampengehäuse |
| 301 | 2 | pc. | - | 100.00.016 | Cyl. screw M3x8, BN3 |
| 302 | 1 | pc. | - | 100.00.015 | Cyl. screw M3x6, BN3 |
| 303 | 2 | pc. | - | 100.00.159 | Lens head screw M3x10, BN1593 |
| 304 | 2 | pc. | - | 100.09.004 | U-Scheibe 3.2/7x0.5 BN670 rostfrei |
| 305 | 0.2 | ml | - | 115.14.012 | Loctite 270 10ml, Gew.-Sich. hochfest |
| 601 | 1 | pc. | 3 | 300.00.433 | Illumination board field illumination |

# 300.01.419 Vision system with MFOV extension

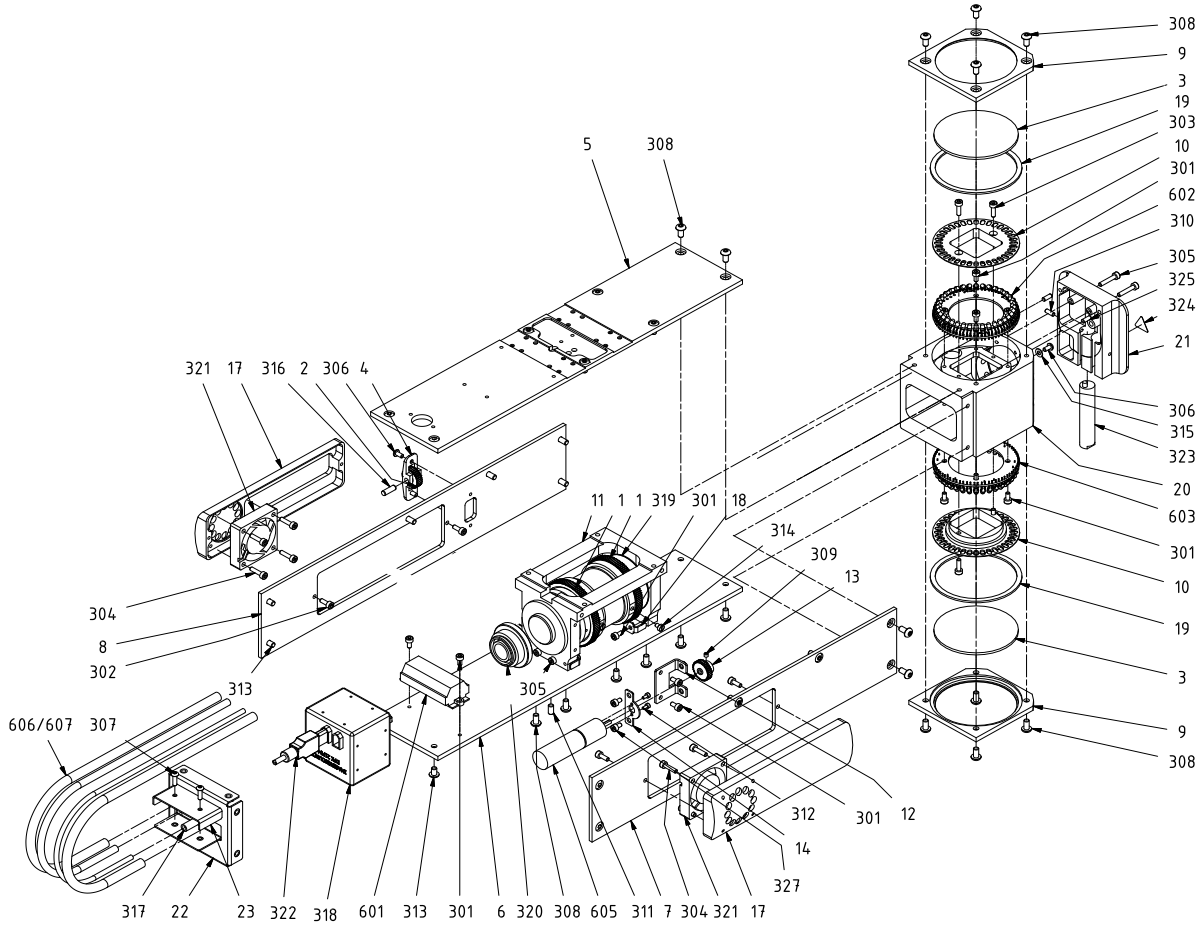



Initial date:20.02.2007/WB Change index:0 /04.02.2009/MH

| Pos. | Amount | Unit | Spare part class | Article number | Article description |
|---|---|---|---|---|---|
| 1 | 1 | pc. | - | 200.01.179 | Keil |
| 2 | 1 | pc. | - | 200.01.180 | Zahnstange X |
| 3 | 1 | pc. | - | 200.01.200 | Haltewinkel X-Motor |
| 4 | 1 | pc. | - | 200.01.202 | Motorstuetze X |
| 5 | 1 | pc. | 3 | 200.02.490 | Transport safety lock Vision Y |
| 301 | 8 | pc. | - | 100.00.014 | Cyl. screw M3x5, BN3 |

| Pos. | Amount | Unit | Spare part class | Article number | Article description |
|---|---|---|---|---|---|
| 302 | 6 | pc. | - | 100.00.015 | Cyl. screw M3x6, BN3 |
| 303 | 14 | pc. | - | 100.00.016 | Cyl. screw M3x8, BN3 |
| 304 | 2 | pc. | - | 100.00.017 | Cyl. screw M3x10, BN3 |
| 305 | 2 | pc. | - | 100.00.157 | Lens head screw M3x6, BN1593 |
| 306 | 4 | pc. | 3 | 102.00.012 | Linear bearing MNN 9-G1 |
| 307 | 2 | pc. | - | 102.00.017 | Linearfuehrung Schiene MN 9-135-G1-V1 |
| 308 | 1 | pc. | 3 | 109.04.028 | Inductive sensor IWFM 18U7504/S35A |
| 309 | 1 | pc. | - | 109.04.029 | Kabeldose ESG 32AH0200 4Pol |
| 310 | 16 | pc. | - | 100.00.013 | Cyl. Screw M3x4 BN 3 |
| 601 | 1 | pc. | - | 300.00.454 | Mechanical stop X complete |
| 602 | 1 | pc. | - | 300.00.501 | Robotic cable vision motors |
| 603 | 1 | pc. | - | 300.00.564 | Distance block vision system |
| 604 | 1 | pc. | 3 | 9002.15.011 | Gear motor Vision X |
| 605 | 1 | pc. | - | 300.01.416 | Vision unit base module |
| 606 | 1 | pc. | - | 300.01.049 | Y-carriage vision |
| 607 | 1 | pc. | - | 300.01.052 | Prism attachment adjustable |
| 608 | 1 | pc. | - | 300.01.072 | Vision Y-guiding plate |

## 300.01.416 Vision unit base module

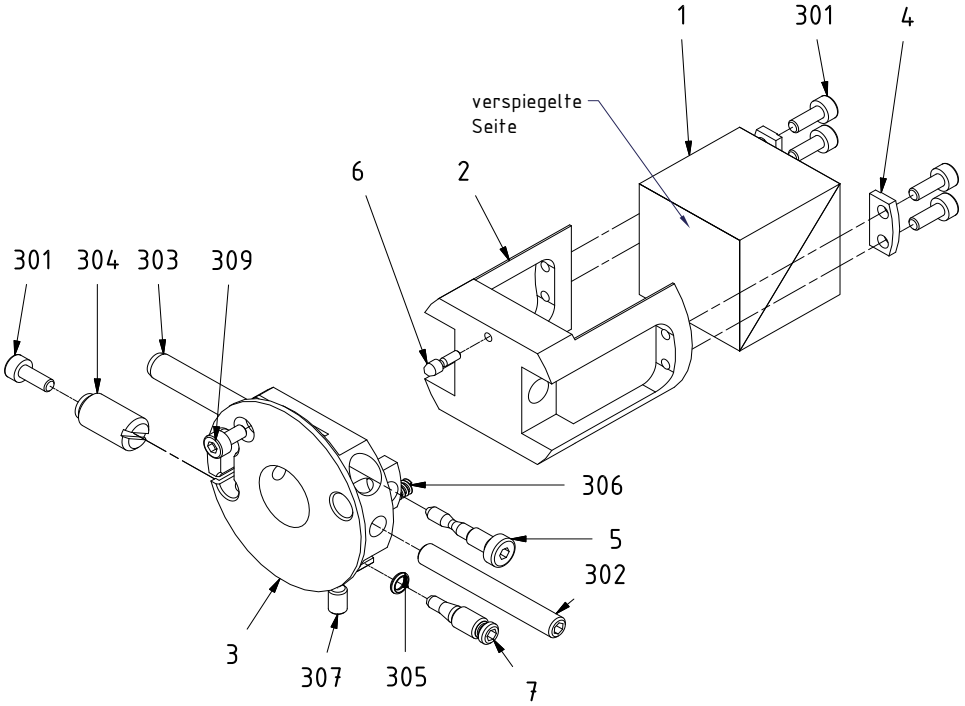



Initial date:19.02.2007/WB Change index:0 /23.12.2008/AG

| Pos. | Amount | Unit | Spare part class | Article number | Article description |
|---|---|---|---|---|---|
| 1 | 2 | pc. | - | 200.01.023 | Drive Ring |
| 2 | 1 | pc. | - | 200.01.025 | Handrad Objektiv |
| 3 | 2 | pc. | 3 | 200.01.131 | Protection glass |
| 4 | 1 | pc. | - | 200.01.184 | Zahnradgehaeuse |
| 5 | 1 | pc. | - | 200.01.186 | Grundplatte Vision |
| 6 | 1 | pc. | - | 200.01.187 | Bodenplatte |
| 7 | 1 | pc. | - | 200.01.188 | Seitenplatte links |
| 8 | 1 | pc. | - | 200.01.189 | Seitenplatte rechts |
| 9 | 2 | pc. | - | 200.01.190 | Frame protection glass |
| 10 | 2 | pc. | - | 200.01.191 | LED-Abdeckring |
| 11 | 1 | pc. | - | 200.01.193 | Objektivgehaeuse |
| 12 | 1 | pc. | - | 0027.17.102 | Grundplatte Zoomantrieb |
| 13 | 1 | pc. | - | 200.01.195 | Toothed Gear |
| 14 | 1 | pc. | - | 0027.17.103 | Motor Plate |
| 17 | 2 | pc. | - | 200.01.199 | Cover motor |
| | | | | | |
| | | | | | |

| Pos. | Amount | Unit | Spare part class | Article number | Article description |
|---|---|---|---|---|---|
| 18 | 2 | pc. | - | 200.01.204 | Kabellasche |
| 19 | 2 | pc. | - | 200.01.282 | Disc |
| 20 | 1 | pc. | - | 200.01.927 | Prismagehaeuse |
| 21 | 1 | pc. | - | 0027.10.104 | Laserpointergehaeuse |
| 22 | 1 | pc. | - | 200.02.449 | Rahmen Vision |
| 23 | 1 | pc. | - | 200.02.450 | Kabelbride |
| | | | | | |
| | | | | | |
| 301 | 18 | pc. | - | 100.00.015 | Cyl. screw M3x6, BN3 |
| 302 | 4 | pc. | - | 100.00.016 | Cyl. screw M3x8, BN3 |
| 303 | 4 | pc. | - | 100.00.017 | Cyl. screw M3x10, BN3 |
| 304 | 8 | pc. | - | 100.00.018 | Cyl. screw M3x12, BN3 |
| 305 | 4 | pc. | - | 100.00.020 | Cyl. screw M3x16, BN3 |
| 306 | 4 | pc. | - | 100.00.157 | Lens head screw M3x6, BN1593 |
| 307 | 2 | pc. | - | 100.00.018 | Cyl. screw M3x12, BN3 |
| 308 | 28 | pc. | - | 100.00.160 | Lens head screw M4x8, BN1593 |
| | | | | | |
| 310 | 1 | pc. | - | 100.00.179 | Gew.Stift M3x 8 BN 28 |
| 311 | 1 | pc. | - | 100.00.183 | Threaded pin M4x8, BN 28 |
| 312 | 2 | pc. | - | 100.00.197 | Cyl. Screw M2x4, BN 11 |
| 313 | 8 | pc. | - | 100.00.208 | Lens head screw M4x6, BN1593 |
| 314 | 2 | pc. | - | 100.03.014 | Zyl. Schraube mit Schlitz M3x4 BN 330 |
| 315 | 2 | pc. | - | 100.04.023 | Washer M3, BN 715 |
| 316 | 1 | pc. | - | 100.05.040 | Cyl. pin d 4-h6x12 BN 858 |
| 317 | 0.025 | m | 3 | 106.17.002 | Polyurethane tube d=6mm, black |
| 318 | 1 | pc. | 3 | 108.00.013 | FireWire camera DFK 21F04 |
| 319 | 1 | pc. | 3 | 108.01.004 | Macro zoom objective Computar MLH-10X |
| 320 | 1 | pc. | 3 | 108.06.010 | Tele converter 2x with C-mount |
| 321 | 2 | pc. | 3 | 109.08.003 | Fan 40x40x10 mm, 24 VDC |
| 322 | 1 | pc. | 3 | 109.16.095 | Cable Firewire 6pin/6pin, Length 3m |
| 323 | 1 | pc. | 3 | 109.24.027 | Dioden Pointer |
| 324 | 1 | pc. | 2 | 109.51.058 | Warning label 15 x 15mm Laser beam |
| 325 | 2 | pc. | - | 100.05.027 | Cyl. pin d 3-h6 x8 |
| | | | | | |
| 327 | 2 | pc. | - | 100.00.014 | Cyl. screw M3x5, BN3 |
| 601 | 1 | pc. | - | 300.00.439 | Terminal strip |
| 602 | 1 | pc. | 3 | 300.01.214 | Upper illumination board (LED green) |
| 603 | 1 | pc. | 3 | 300.00.458 | Lower illumination board |
| | | | | | axis |
| 605 | 1 | pc. | 3 | 9002.15.011 | Gear motor vision |
| 606 | 1 | pc. | - | 300.00.501 | Robotic cable vision motors |
| 607 | 1 | pc. | - | 300.00.526 | Robotic cable IO-Signal vision |
| 608 | 1 | pc. | - | 300.00.908 | LED-Vision light cable |

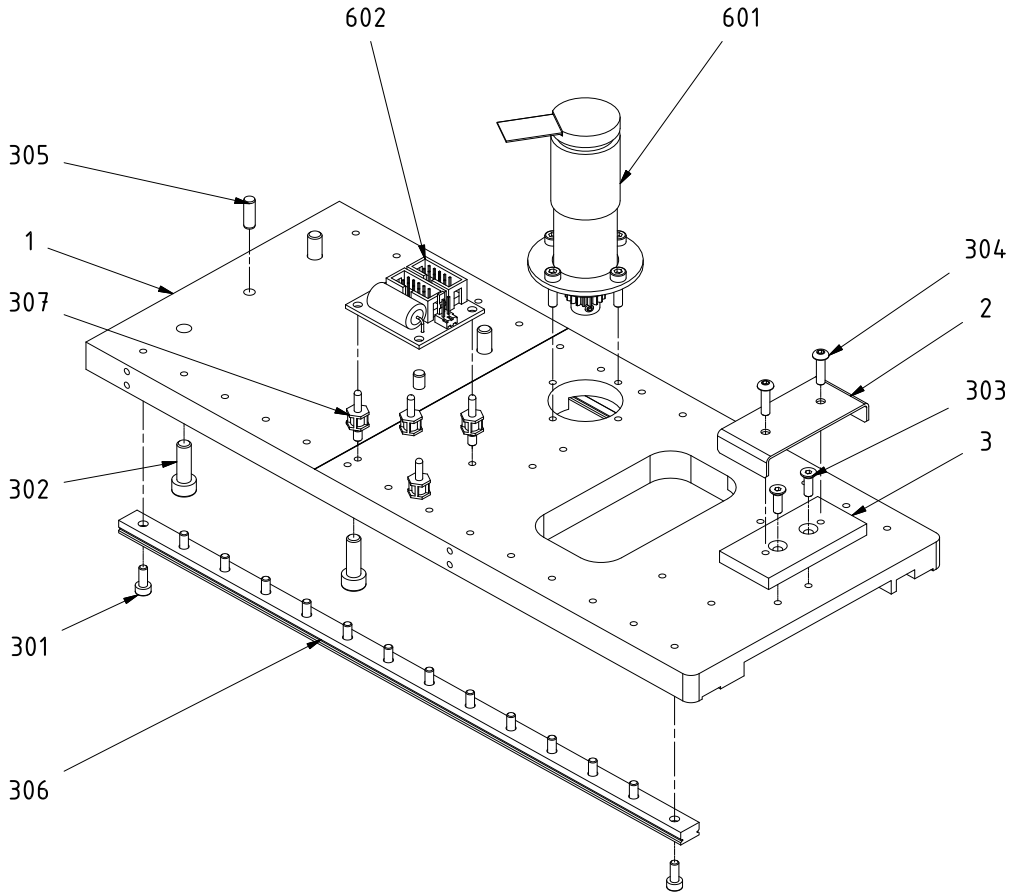
## 300.01.052 Prism attachment adjustable




Initial date:12.06.2006/CL Change index:0 /04.02.2009/MH

| Pos. | Amount | Unit | Spare part class | Article number | Article description |
|---|---|---|---|---|---|
| 1 | 1 | pc. | 3 | 200.01.123 | Beam splitter prism 30mm |
| 2 | 1 | pc. | - | 200.01.929 | Fassung Prisma |
| 3 | 1 | pc. | - | 200.01.930 | Drehlager |
| 4 | 2 | pc. | - | 200.01.931 | Klemmplatte Prisma |
| 5 | 1 | pc. | - | 200.01.932 | Justierschraube Y |
| 6 | 1 | pc. | - | 200.01.933 | Nocken |
| 7 | 1 | pc. | - | 200.01.934 | Justierschraube X |
| 301 | 5 | pc. | - | 100.00.016 | Cyl. screw M3x8, BN3 |
| 302 | 1 | pc. | - | 100.00.233 | Gew.Stift M5x40 BN28 |
| 303 | 1 | pc. | - | 100.05.070 | Zyl.Stift d 6-h6 x30 BN 858 |
| 304 | 1 | pc. | - | 100.12.016 | Druckstueck M8x16 BN 13364 |
| 305 | 1 | pc. | 2 | 101.20.024 | O-Ring di=3, s=1 Normatec |
| 306 | 1 | pc. | 3 | 101.27.021 | Spring D-090P |
| 307 | 1 | pc. | - | 100.00.182 | Threaded pin M4x6, BN28 |
| 308 | 4 | pc. | - | 100.10.001 | U-Scheibe d3.2/6x0.5 Messing |
| 309 | 1 | pc. | - | 100.00.015 | Cyl. screw M3x6, BN3 |

## 300.01.072 Vision Y-guiding plate



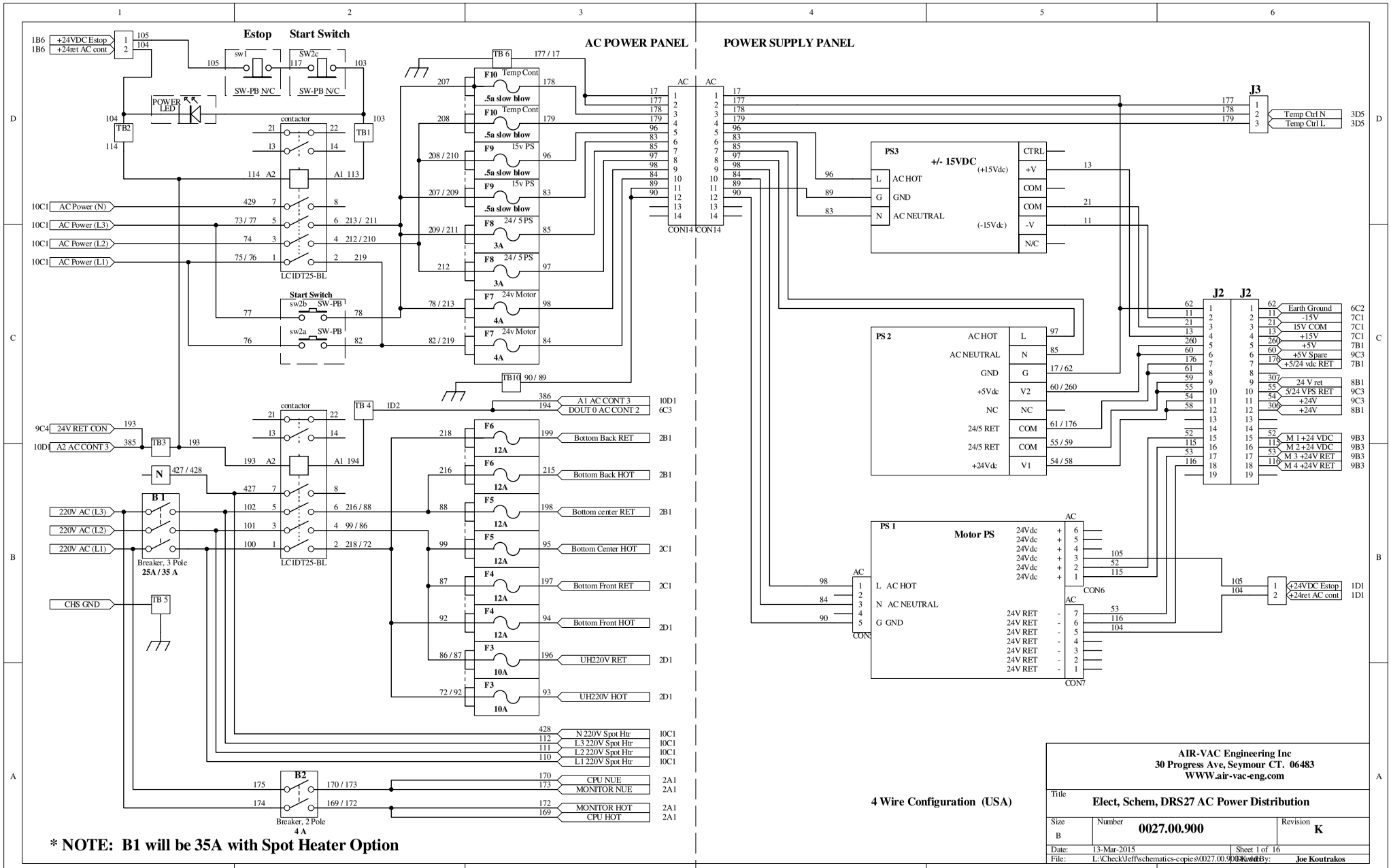

Initial date:09.06.2006/CL Change index:0 /23.12.2008/AG

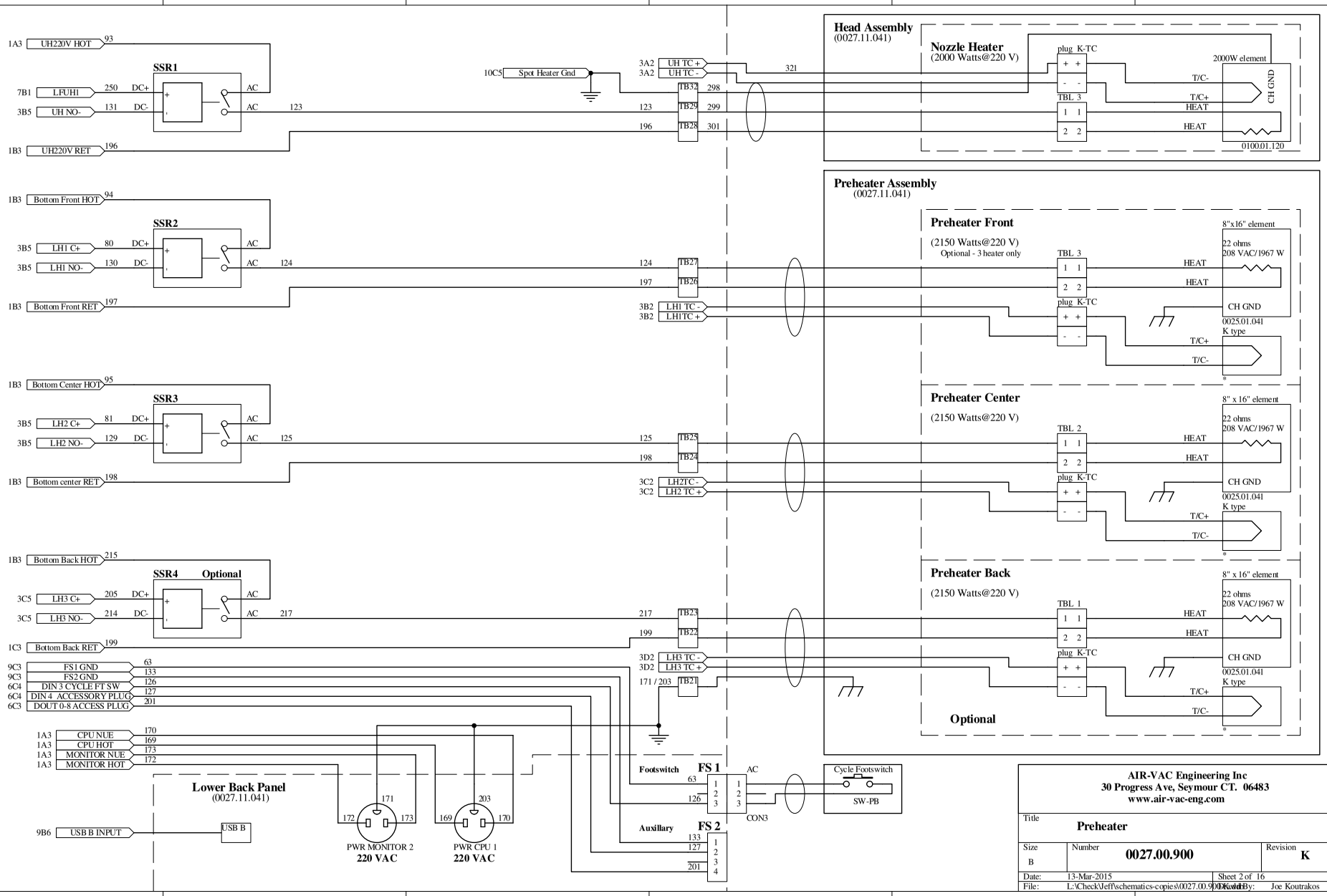
| Pos. | Amount | Unit | Spare part class | Article number | Article description |
|---|---|---|---|---|---|
| 1 | 1 | pc. | - | 200.01.170 | Grundplatte Y-Fuehrung |
| 2 | 1 | pc. | - | 200.02.450 | Kabelbride |
| 3 | 1 | pc. | - | 200.02.451 | Kabelbride Platte |
| 301 | 28 | pc. | - | 100.00.016 | Cyl. screw M3x8, BN3 |
| 302 | 4 | pc. | - | 100.00.046 | Cyl. screw M5x16, BN3 |
| 303 | 2 | pc. | - | 100.00.126 | Countersunk screw M3x10, BN21 |
| 304 | 2 | pc. | - | 100.00.017 | Cyl. screw M3x10, BN3 |
| 305 | 2 | pc. | - | 100.05.042 | Cyl. pin d 4-h6 x16 |
| 306 | 2 | pc. | - | 102.00.022 | Linear guiding rail MN 9-275-G1-V1 |
| 307 | 4 | pc. | - | 109.19.007 | Spacer M3, l = 6.35mm |
| 601 | 1 | pc. | 3 | 9002.05.083 | Motor vision Y-axis |
| 602 | 1 | pc. | 3 | 300.00.636 | Motor/Encoder Interface Card |
| 603 | 1 | pc. | - | 300.00.902 | Motor interface cable |
| 604 | 1 | pc. | - | 300.00.975 | Encoder cable vision Y |

# 9: Schematics

## #0027.00.900: DRS27 3-Zone Preheater

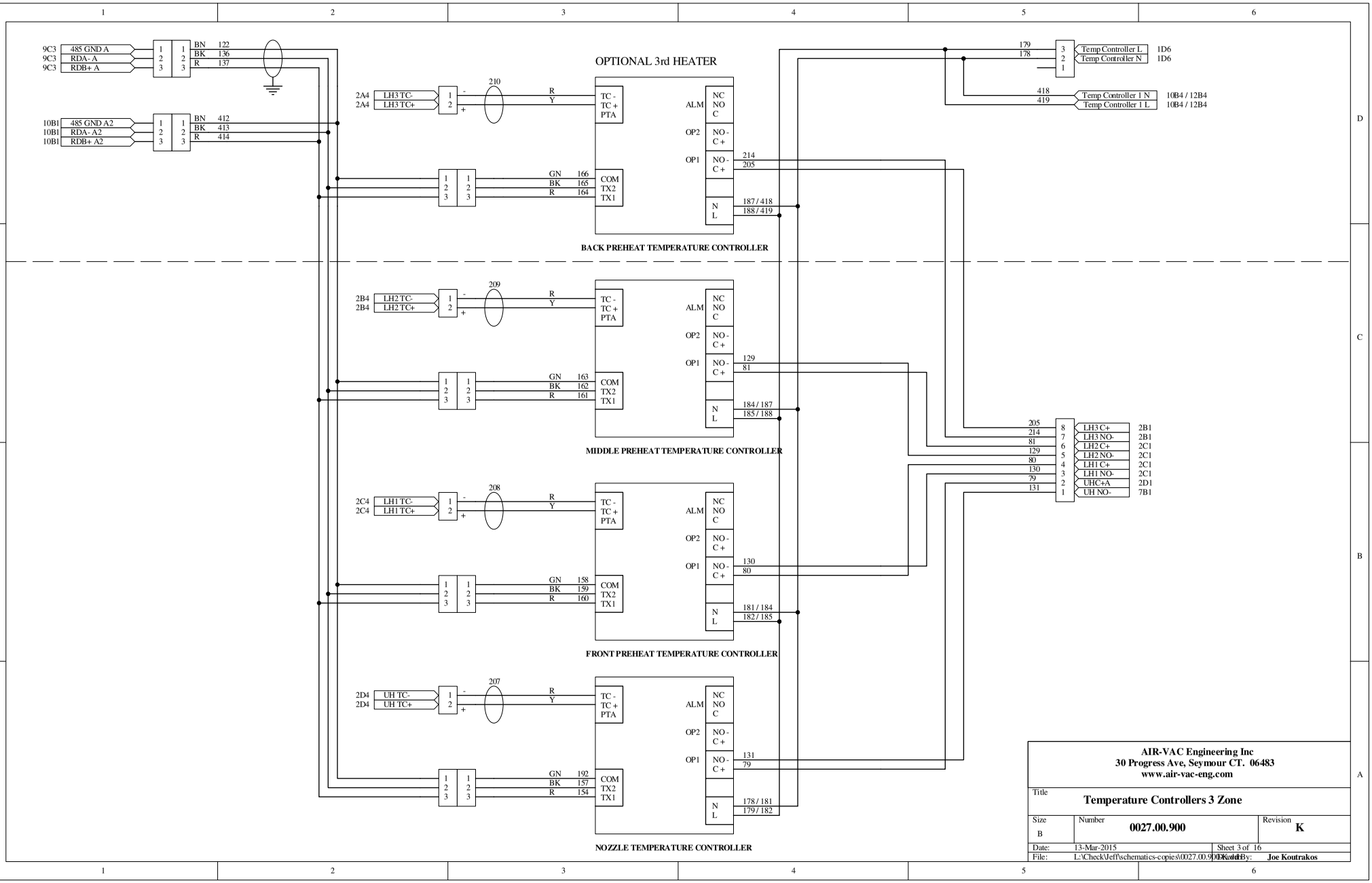
## #0027.21.900: DRS27 6-Zone Preheater

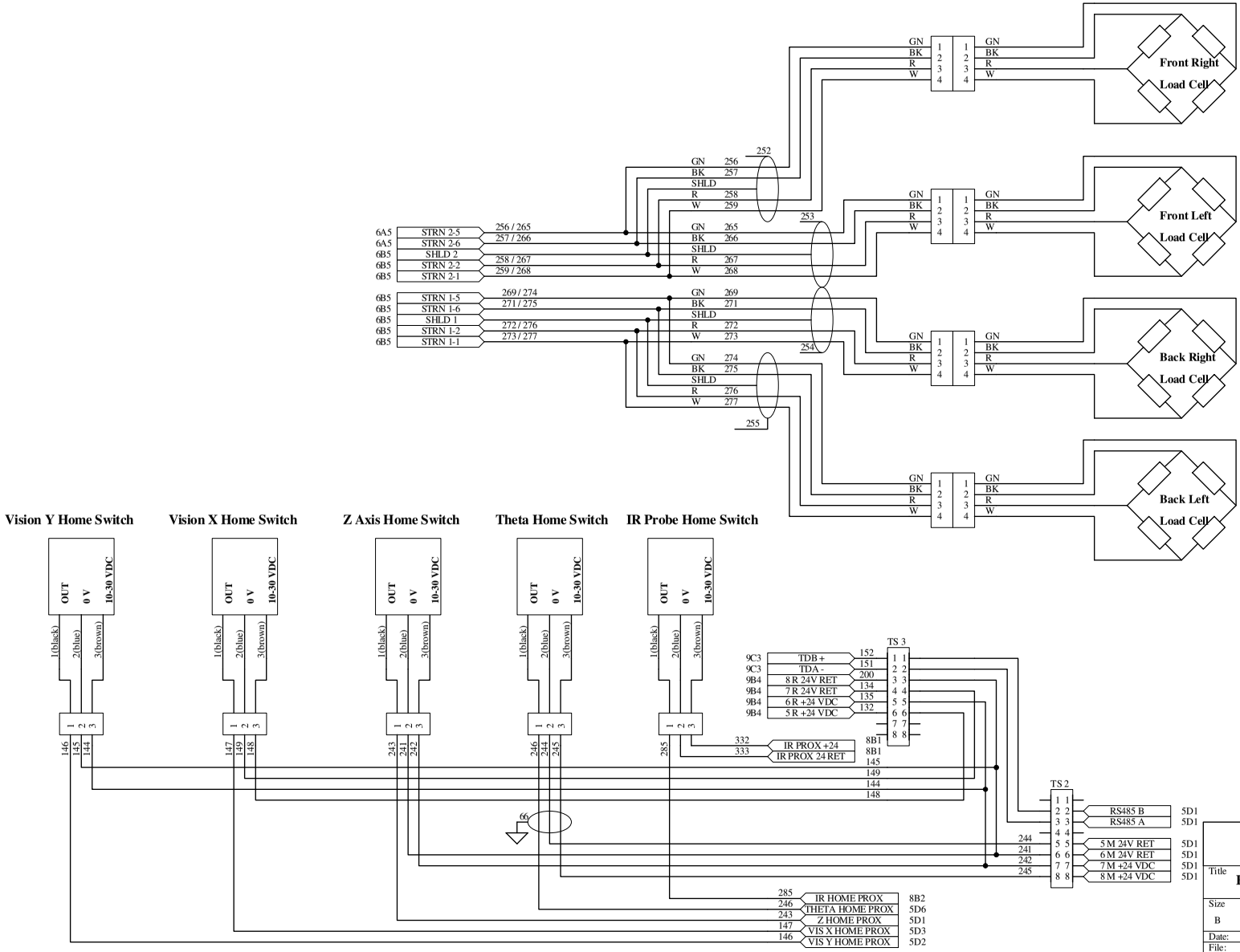

Estop
Start Switch
AC POWER PANEL
POWER SUPPLY PANEL
1B6 +24VDC Estop
1B6 +24ret AC cont
SW-PB N/C
POWER LED
contactor
LC1DT25-BL
Start Switch
10C1 AC Power (N)
10C1 AC Power (L3)
10C1 AC Power (L2)
10C1 AC Power (L1)
9C4 24V RET CON
10D1 A2 AC CONT 3
220V AC (L3)
220V AC (L2)
220V AC (L1)
Breaker, 3 Pole
25A / 35 A
CHS GND
Breaker, 2 Pole
4 A
F10 Temp Cont .5a slow blow
F9 15v PS .5a slow blow
F8 24 / 5 PS 3A
F7 24v Motor 4A
F6 12A
F5 12A
F4 12A
F3 10A
A1 AC CONT 3
DOUT 0 AC CONT 2
Bottom Back RET
Bottom Back HOT
Bottom center RET
Bottom Center HOT
Bottom Front RET
Bottom Front HOT
UH220V RET
UH220V HOT
N 220V Spot Htr
L3 220V Spot Htr
L2 220V Spot Htr
L1 220V Spot Htr
CPU NUE
MONITOR NUE
MONITOR HOT
CPU HOT
CON14
PS3 +/- 15VDC
AC HOT
GND
AC NEUTRAL
CTRL
+V
COM
-V
N/C
PS 2
+5Vdc
NC
24/5 RET
+24Vdc
PS 1 Motor PS
24Vdc
24V RET
CON6
CON7
J3
Temp Ctrl N
Temp Ctrl L
J2
Earth Ground
-15V
15V COM
+15V
+5V
+5V Spare
+5/24 vdc RET
24 V ret
5/24 VPS RET
+24V
M 1 +24 VDC
M 2 +24 VDC
M 3 +24V RET
M 4 +24V RET
+24VDC Estop
+24ret AC cont
4 Wire Configuration (USA)
* NOTE: B1 will be 35A with Spot Heater Option
AIR-VAC Engineering Inc
30 Progress Ave, Seymour CT. 06483
WWW.air-vac-eng.com
Title
Elect, Schem, DRS27 AC Power Distribution
Size
B
Number
0027.00.900
Revision
K
Date: 13-Mar-2015
Sheet 1 of 16
File: L:\Check\Jeff\schematics-copies\0027.00.900.dwg
Drawn By: Joe Koutrakos




**AIR-VAC Engineering Inc**
**30 Progress Ave, Seymour CT. 06483**
**www.air-vac-eng.com**

| | | | |
|---|---|---|---|
| Title | **Preheater** | | |
| Size B | Number **0027.00.900** | | Revision **K** |
| Date: 13-Mar-2015 | | Sheet 2 of 16 | |
| File: L:\Check\Jeff\schematics-copies\0027.00.900.dwg | | Drawn By: Joe Koutrakos | |


OPTIONAL 3rd HEATER
9C3 485 GND A
9C3 RDA- A
9C3 RDB+ A
BN 122
BK 136
R 137
10B1 485 GND A2
10B1 RDA- A2
10B1 RDB+ A2
BN 412
BK 413
R 414
2A4 LH3 TC-
2A4 LH3 TC+
210
R
Y
TC -
TC +
PTA
ALM
NC
NO
C
OP2
NO -
C +
OP1
NO -
C +
N
L
214
205
187 / 418
188 / 419
GN 166
BK 165
R 164
COM
TX2
TX1
BACK PREHEAT TEMPERATURE CONTROLLER
2B4 LH2 TC-
2B4 LH2 TC+
209
129
81
184 / 187
185 / 188
GN 163
BK 162
R 161
MIDDLE PREHEAT TEMPERATURE CONTROLLER
2C4 LH1 TC-
2C4 LH1 TC+
208
130
80
181 / 184
182 / 185
GN 158
BK 159
R 160
FRONT PREHEAT TEMPERATURE CONTROLLER
2D4 UH TC-
2D4 UH TC+
207
131
79
178 / 181
179 / 182
GN 192
BK 157
R 154
NOZZLE TEMPERATURE CONTROLLER
179
178
Temp Controller L 1D6
Temp Controller N 1D6
418
419
Temp Controller 1 N 10B4 / 12B4
Temp Controller 1 L 10B4 / 12B4
205 LH3 C+ 2B1
214 LH3 NO- 2B1
81 LH2 C+ 2C1
129 LH2 NO- 2C1
80 LH1 C+ 2C1
130 LH1 NO- 2C1
79 UHC+A 2D1
131 UH NO- 7B1
AIR-VAC Engineering Inc
30 Progress Ave, Seymour CT. 06483
www.air-vac-eng.com
Title
Temperature Controllers 3 Zone
Size B
Number 0027.00.900
Revision K
Date: 13-Mar-2015
Sheet 3 of 16
File: L:\Check\Jeff\schematics-copies\0027.00.900.dwg
Drawn By: Joe Koutrakos

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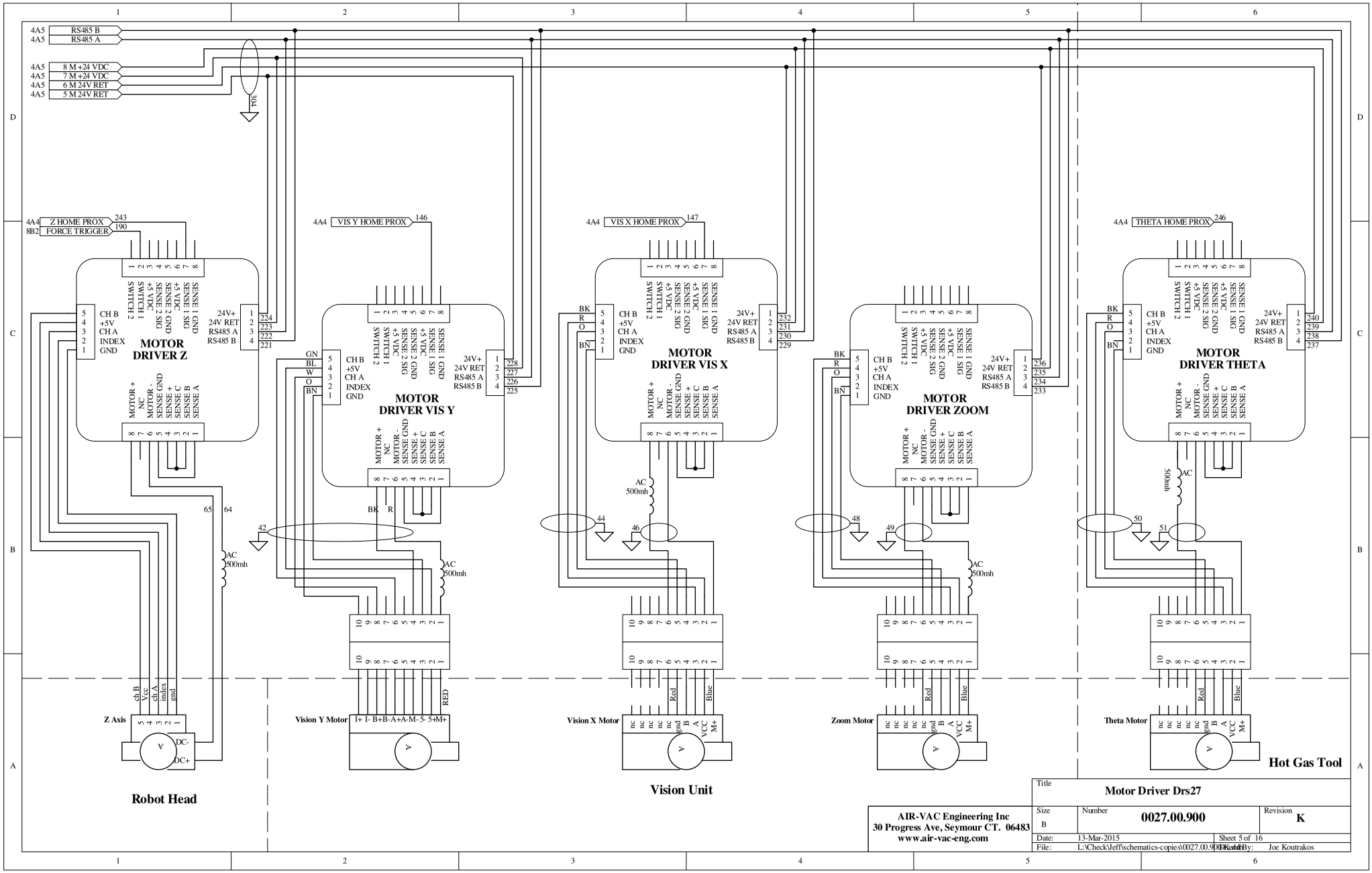
Title: **Force-Prox Sensors**

| Size | Number | Revision |
|---|---|---|
| B | **0027.00.900** | **K** |

Date: 13-Mar-2015 | Sheet 4 of 16
File: L:\Check\Jeff\schematics-copies\0027.00.900.dwg | Drawn By: Joe Koutrakos

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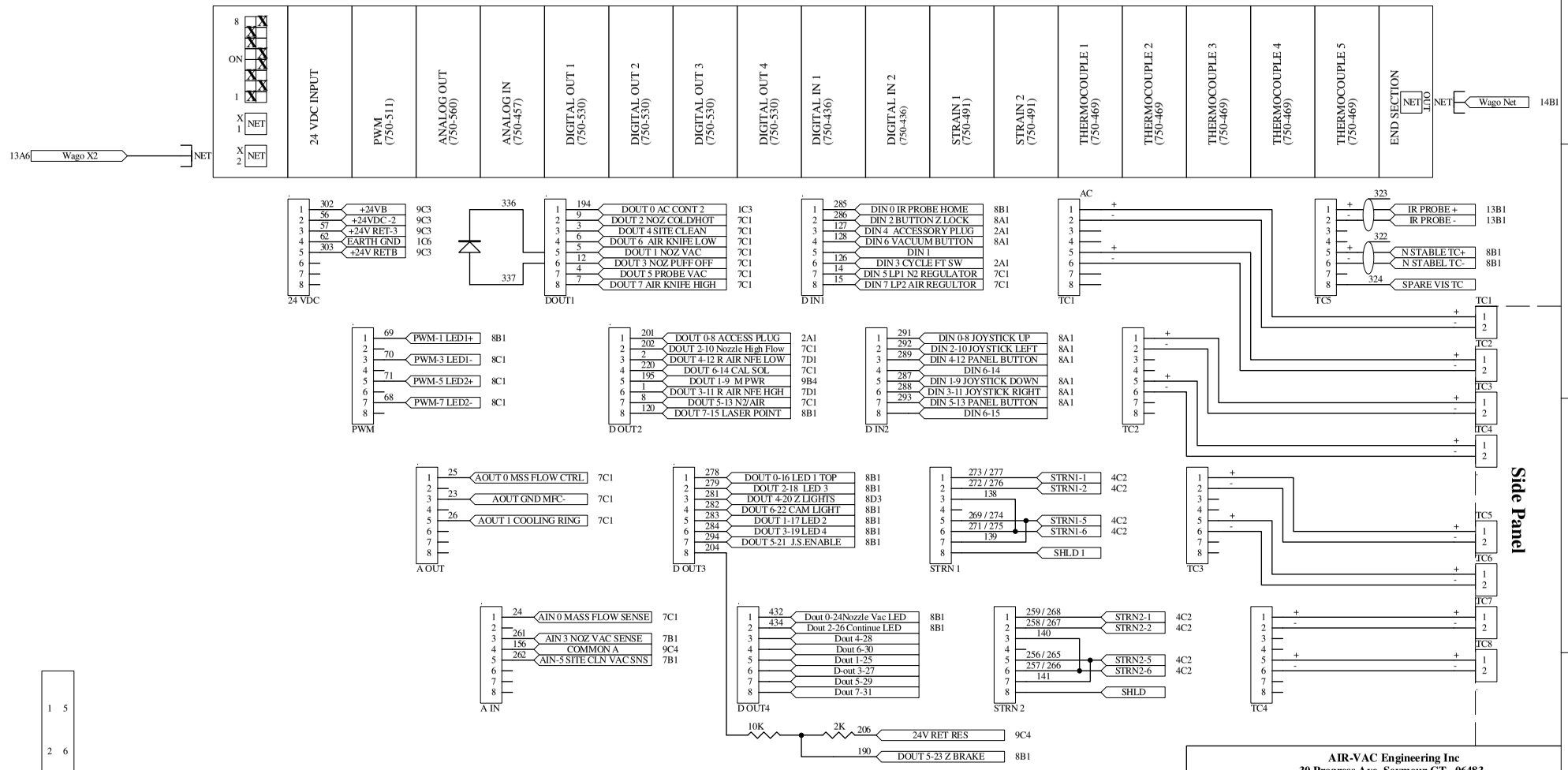
| | | | |
|---|---|---|---|
| Title | Motor Driver Drs27 | | |
| Size B | Number 0027.00.900 | | Revision K |
| Date: 13-Mar-2015 | | Sheet 5 of 16 | |
| File: L:\Check\Jeff\schematics-copies\0027.00.900.dwg | | Drawn By: Joe Koutrakos | |

# Wago Panel-1

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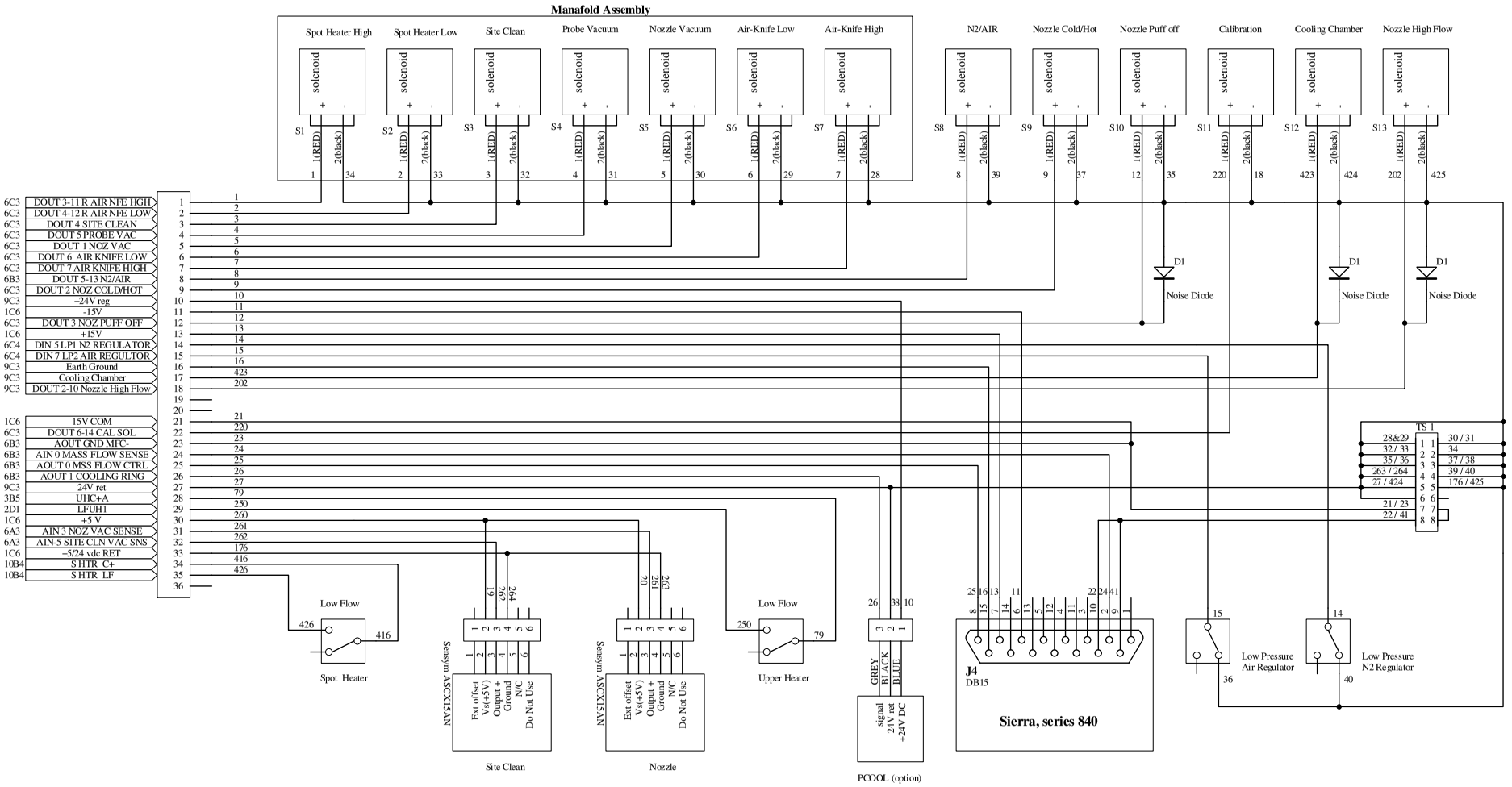
| | | | |
|---|---|---|---|
| Title | **WAGO DRS27** | | |
| Size B | Number **0027.00.900** | | Revision **K** |
| Date: 13-Mar-2015 | Sheet 6 of 16 | | |
| File: L:\Check\Jeff\schematics-copies\0027.00.900.dwg | | Drawn By: Joe Koutrakos | |




**AIR-VAC Engineering Inc**
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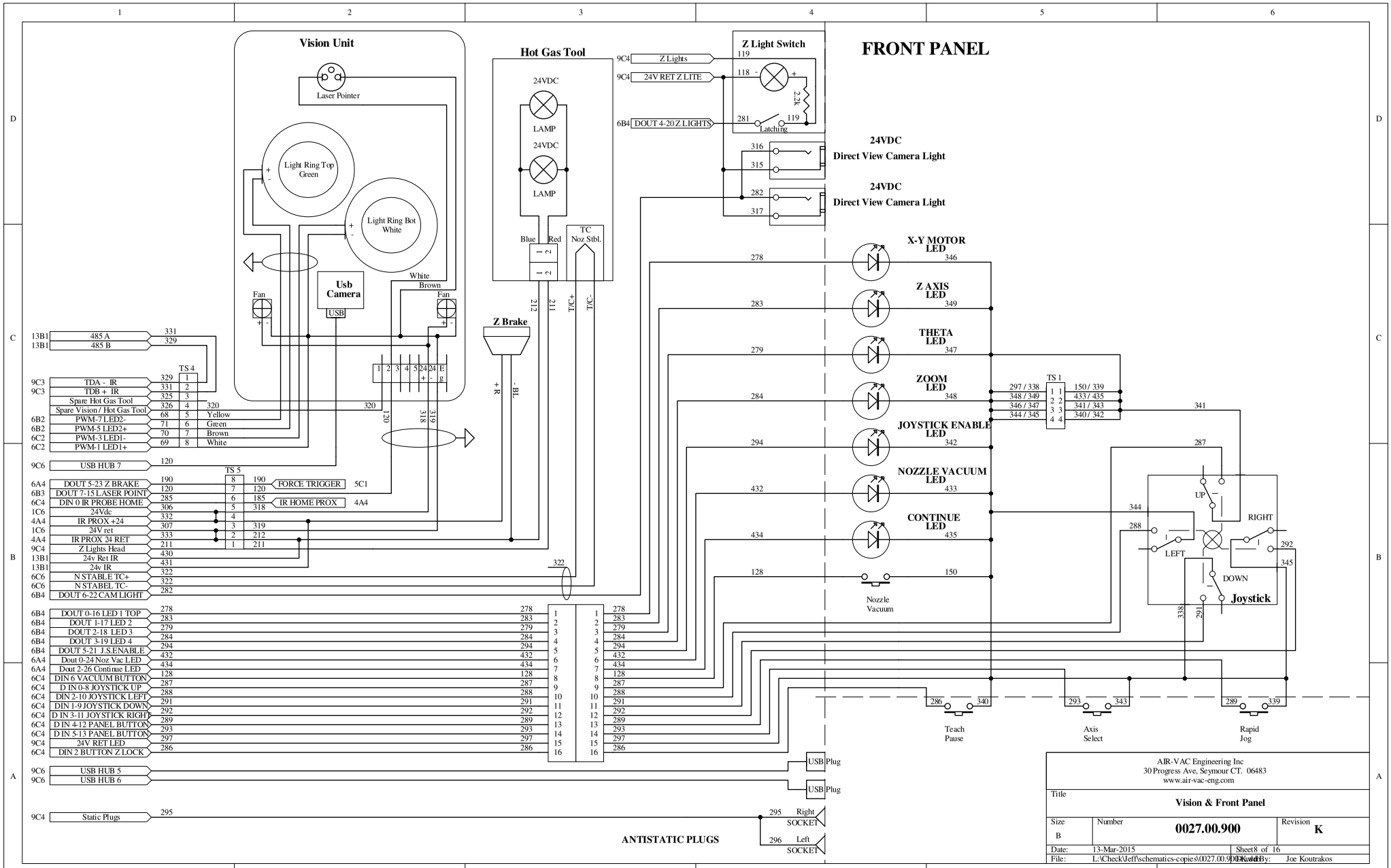
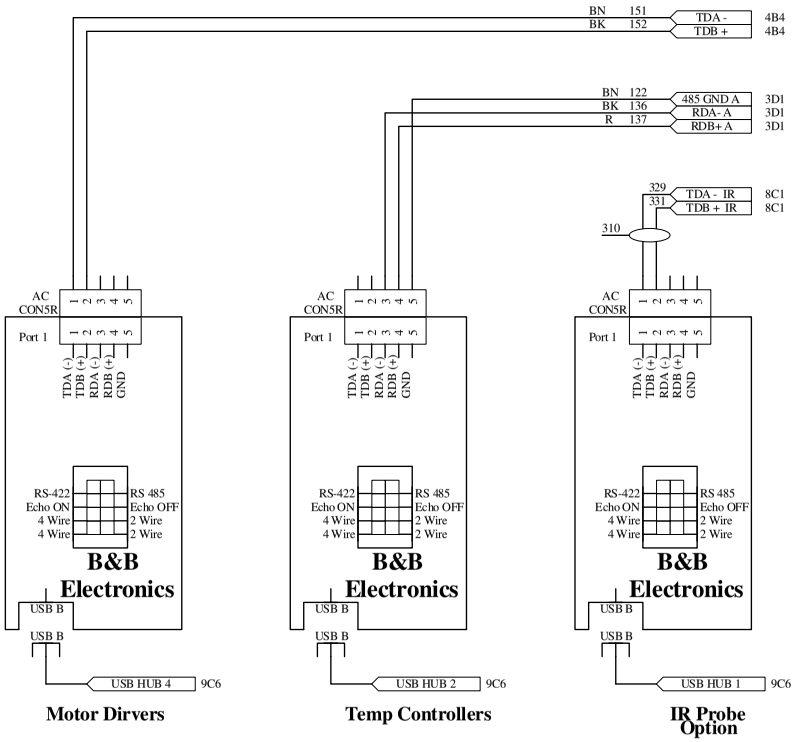
| | | | |
|---|---|---|---|
| Title | **Pneumatics** | | |
| Size B | Number **0027.00.900** | | Revision **K** |
| Date: 13-Mar-2015 | | Sheet 7 of 16 | |
| File: L:\Check\Jeff\schematics-copies\0027.00.900.dwg | | Drawn By: Joe Koutrakos | |


FRONT PANEL
Vision Unit
Laser Pointer
Light Ring Top Green
Light Ring Bot White
Usb Camera
USB
Fan
Hot Gas Tool
24VDC
LAMP
Blue
Red
TC Noz Stbl.
Z Brake
+ R
- BL
Z Light Switch
9C4 Z Lights
9C4 24V RET Z LITE
6B4 DOUT 4-20Z LIGHTS
Latching
2.2K
24VDC
Direct View Camera Light
X-Y MOTOR LED
Z AXIS LED
THETA LED
ZOOM LED
JOYSTICK ENABLE LED
NOZZLE VACUUM LED
CONTINUE LED
Nozzle Vacuum
Teach Pause
Axis Select
Rapid Jog
Joystick
UP
DOWN
LEFT
RIGHT
TS 1
TS 4
TS 5
FORCE TRIGGER
IR HOME PROX
USB Plug
ANTISTATIC PLUGS
Right SOCKET
Left SOCKET
AIR-VAC Engineering Inc
30 Progress Ave, Seymour CT. 06483
www.air-vac-eng.com
Title
Vision & Front Panel
Size
B
Number
0027.00.900
Revision
K
Date: 13-Mar-2015
Sheet 8 of 16
File: L:\Check\Jeff\schematics-copies\0027.00.900.Drawing
Drawn By: Joe Koutrakos

# Wago Panel-2

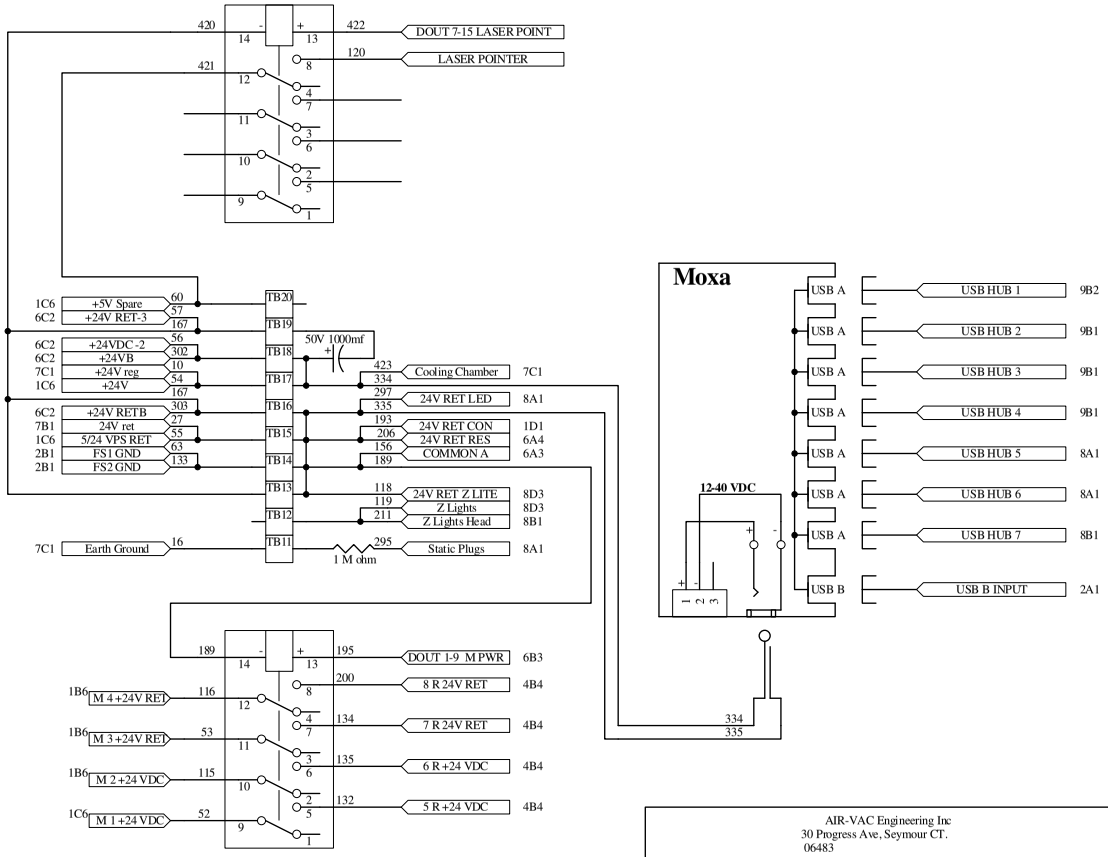
## Left Wall




**Motor Dirvers** **Temp Controllers** **IR Probe Option**

## Base

5 Vdc Laser Option (UL)




AIR-VAC Engineering Inc
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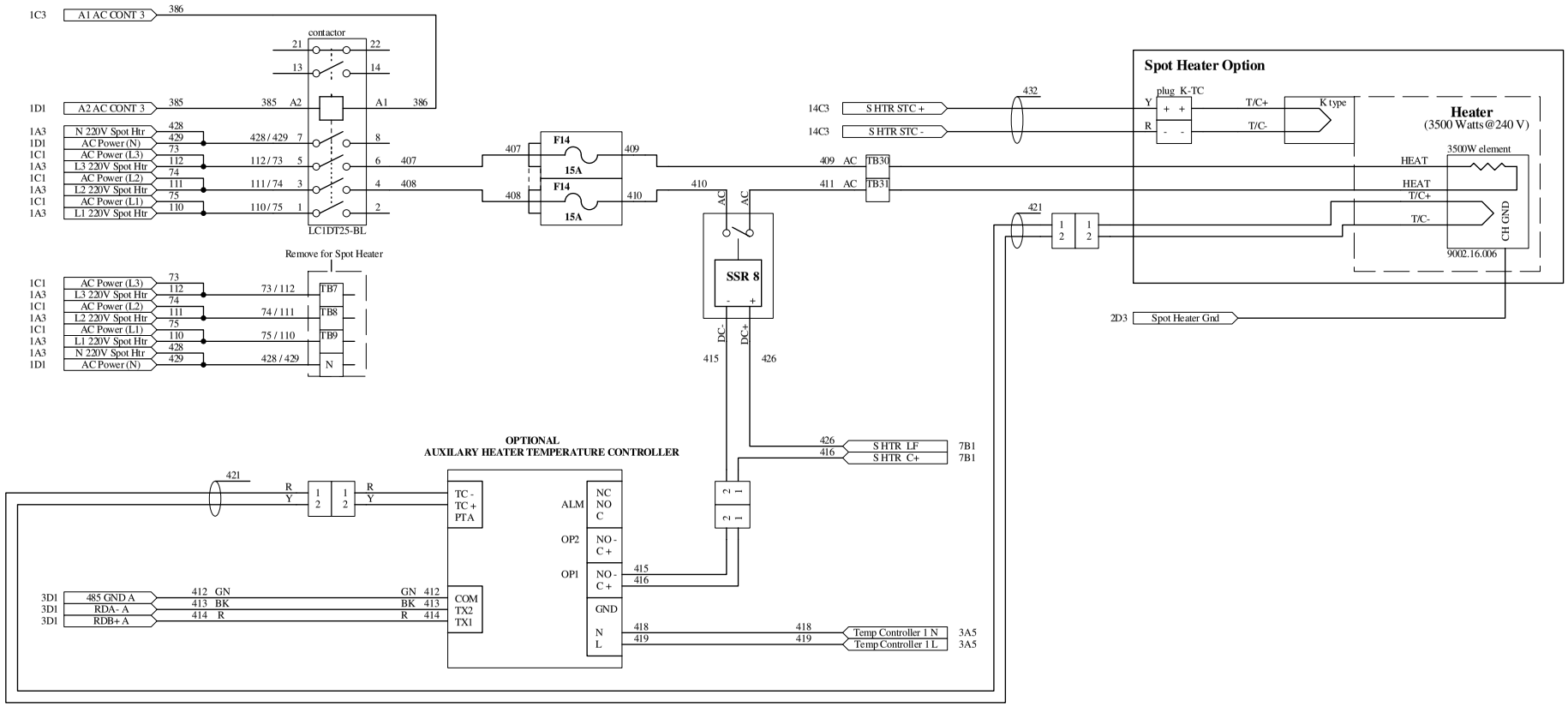
06483

| | | |
|---|---|---|
| Title: B&B / USB Hub | | |
| Size: B | Number: 0027.00.900 | Revision: K |
| Date: 13-Mar-2015 | Sheet 9 of 16 | |
| File: L:\Check\Jeff\schematics-copies\0027.00.900.dwg | Drawn By: Joe Koutrakos | |

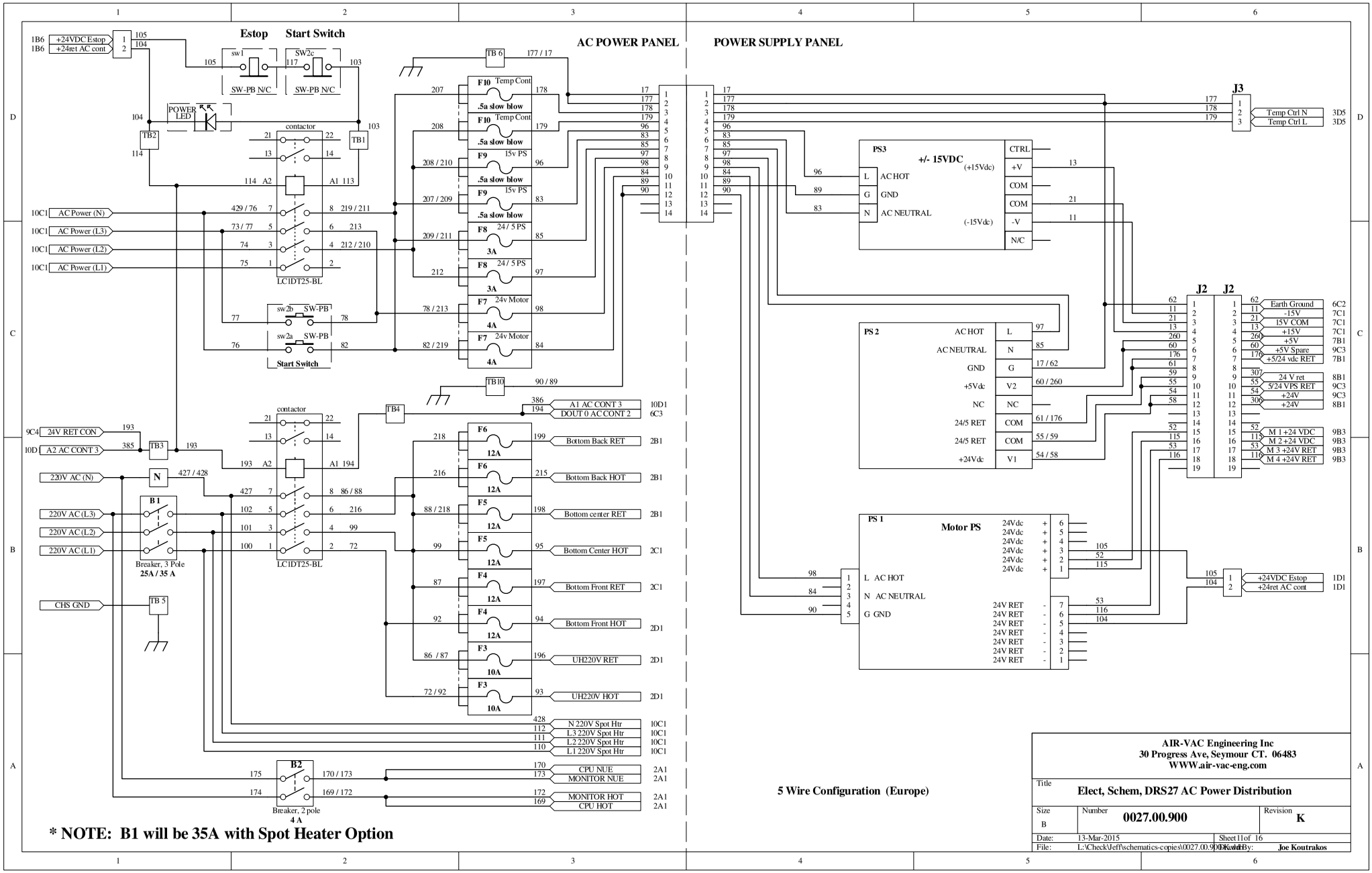
# Spot Heater



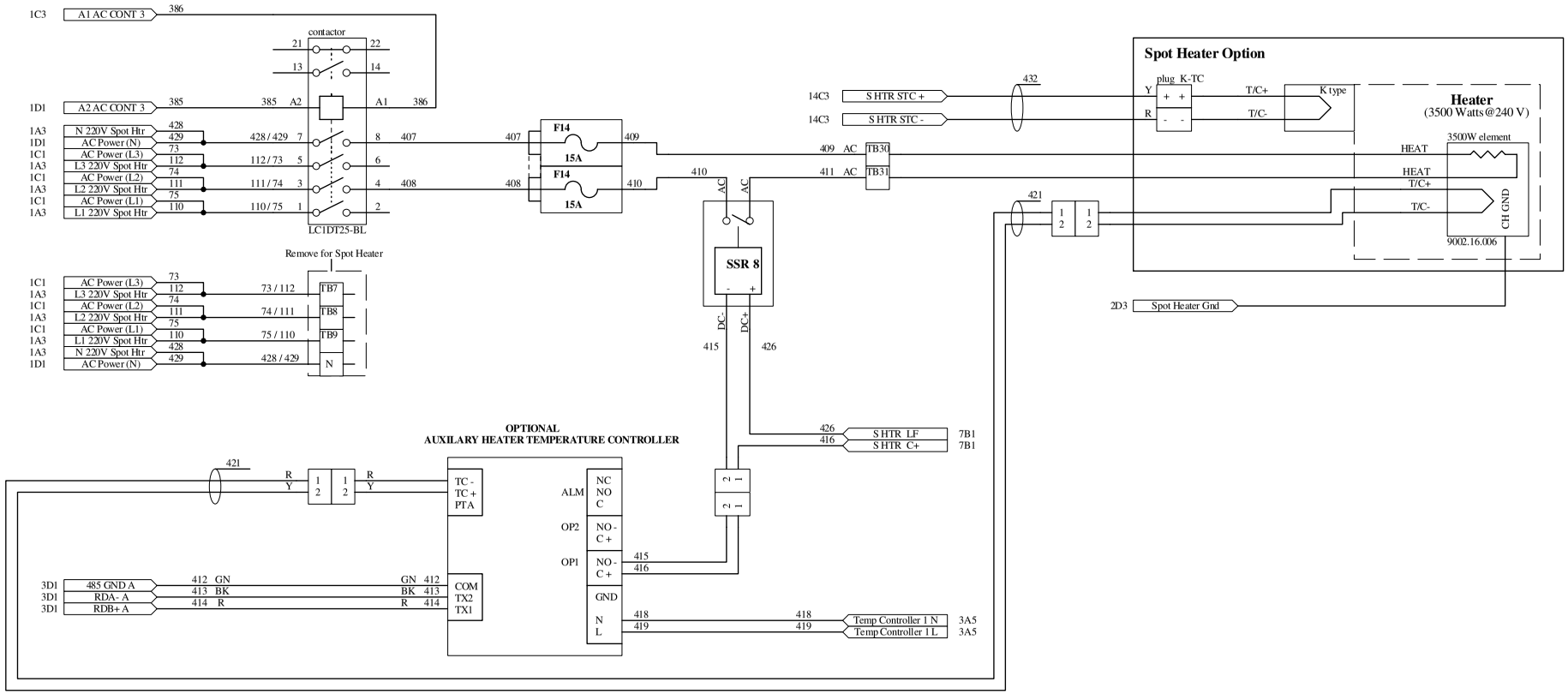

**4 Wire Configuration (USA)**

AIR-VAC Engineering Inc
30 Progress Ave, Seymour CT.
06483

| | | |
|---|---|---|
| Title | **Spot Heater** | |
| Size B | Number **0027.00.900** | Revision **K** |
| Date: 13-Mar-2015 | Sheet 10 of 16 | |
| File: L:\Check\Jeff\schematics-copies\0027.00.900.dwg | Drawn By: Joe Koutrakos | |


Estop
Start Switch
AC POWER PANEL
POWER SUPPLY PANEL
1B6 +24VDC Estop
1B6 +24ret AC cont
sw1
SW-PB N/C
SW2c
SW-PB N/C
POWER LED
TB2
TB1
contactor
LC1DT25-BL
10C1 AC Power (N)
10C1 AC Power (L3)
10C1 AC Power (L2)
10C1 AC Power (L1)
sw2b SW-PB
sw2a SW-PB
Start Switch
TB 6
TB10
F10 Temp Cont
.5a slow blow
F9 15v PS
F8 24 / 5 PS
3A
F7 24v Motor
4A
TB4
TB3
9C4 24V RET CON
10D A2 AC CONT 3
A1 AC CONT 3
DOUT 0 AC CONT 2
F6
12A
F5
F4
F3
10A
Bottom Back RET
Bottom Back HOT
Bottom center RET
Bottom Center HOT
Bottom Front RET
Bottom Front HOT
UH220V RET
UH220V HOT
220V AC (N)
220V AC (L3)
220V AC (L2)
220V AC (L1)
B 1
Breaker, 3 Pole
25A / 35 A
CHS GND
TB 5
N 220V Spot Htr
L3 220V Spot Htr
L2 220V Spot Htr
L1 220V Spot Htr
B2
Breaker, 2 pole
4 A
CPU NUE
MONITOR NUE
MONITOR HOT
CPU HOT
PS3
+/- 15VDC
(+15Vdc)
(-15Vdc)
L AC HOT
G GND
N AC NEUTRAL
CTRL
+V
COM
-V
N/C
PS 2
AC HOT
AC NEUTRAL
GND
+5Vdc
NC
24/5 RET
+24Vdc
PS 1
Motor PS
L AC HOT
N AC NEUTRAL
G GND
24Vdc
24V RET
J3
Temp Ctrl N
Temp Ctrl L
J2
Earth Ground
-15V
15V COM
+15V
+5V
+5V Spare
+5/24 vdc RET
24 V ret
5/24 VPS RET
+24V
+24V
M 1 +24 VDC
M 2 +24 VDC
M 3 +24V RET
M 4 +24V RET
+24VDC Estop
+24ret AC cont
* NOTE: B1 will be 35A with Spot Heater Option
5 Wire Configuration (Europe)
AIR-VAC Engineering Inc
30 Progress Ave, Seymour CT. 06483
WWW.air-vac-eng.com
Title
Elect, Schem, DRS27 AC Power Distribution
Size
B
Number
0027.00.900
Revision
K
Date: 13-Mar-2015
Sheet 11 of 16
File: L:\Check\Jeff\schematics-copies\0027.00.900.dwg
Drawn By: Joe Koutrakos

# Spot Heater

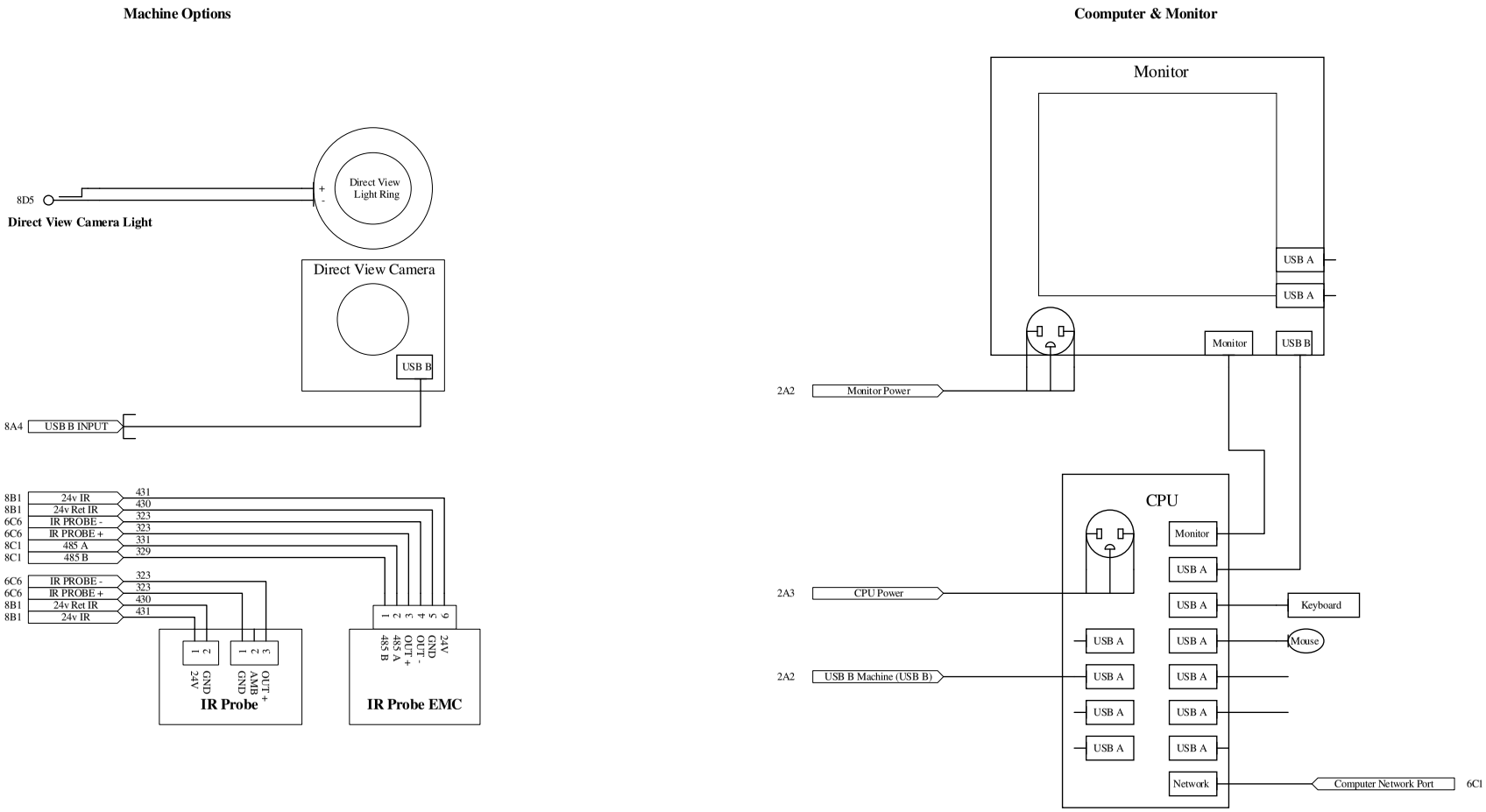



**5 Wire Configuration (Europe)**

AIR-VAC Engineering Inc
30 Progress Ave, Seymour CT.
06483

| | | |
|---|---|---|
| Title: **Spot Heater** | | |
| Size: B | Number: **0027.00.900** | Revision: **K** |
| Date: 13-Mar-2015 | Sheet 12 of 16 | |
| File: L:\Check\Jeff\schematics-copies\0027.00.900.dwg | Drawn By: Joe Koutrakos | |

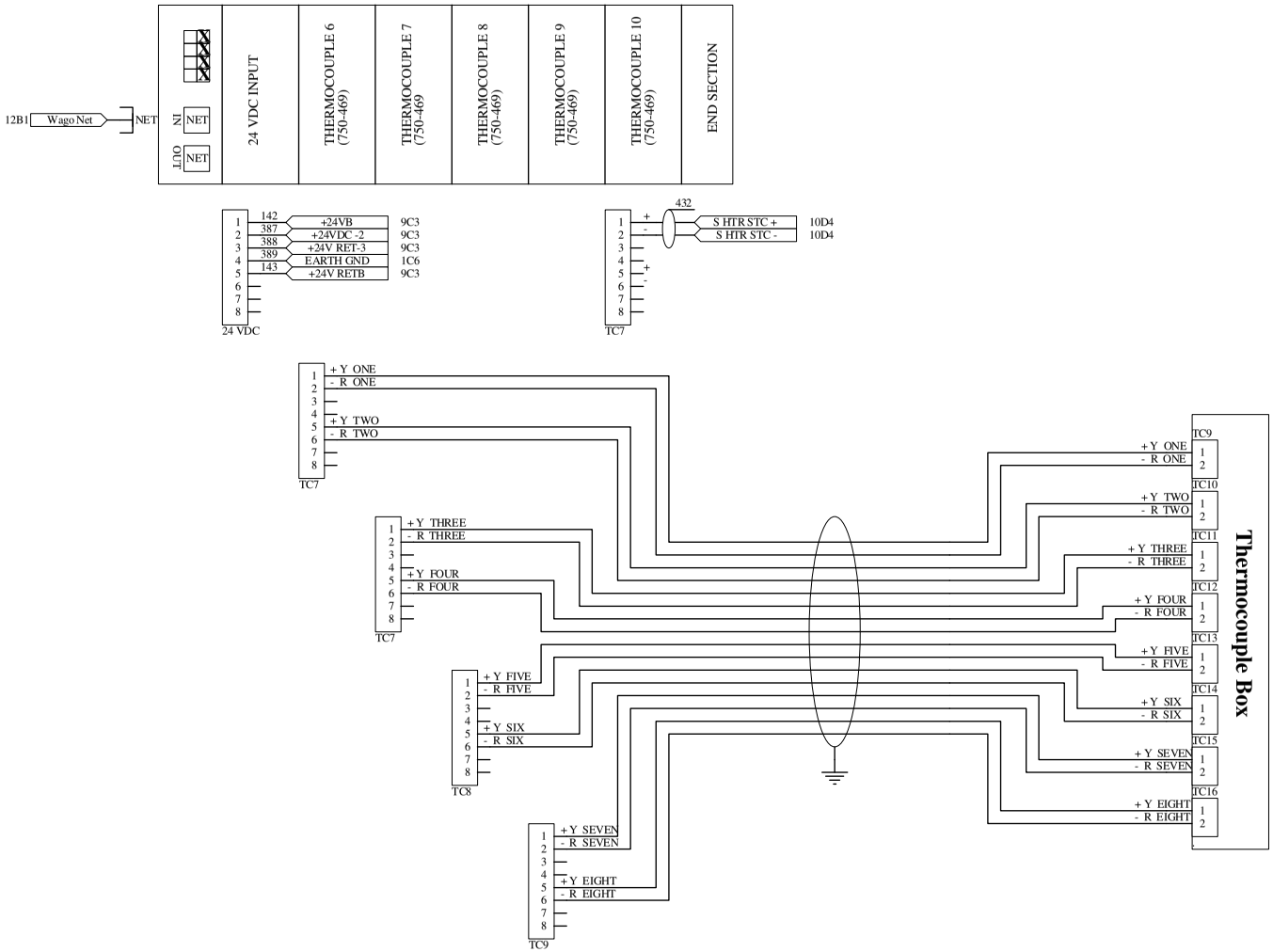
# Computer & Options




AIR-VAC Engineering Inc
30 Progress Ave, Seymour CT.
06483

| | | |
|---|---|---|
| Title: **Computer & Options** | | |
| Size: B | Number: **0027.00.900** | Revision: **K** |
| Date: 13-Mar-2015 | Sheet 13 of 16 | |
| File: L:\Check\Jeff\schematics-copies\0027.00.900.DSN | Drawn By: Joe Koutrakos | |

# Wago Panel-1

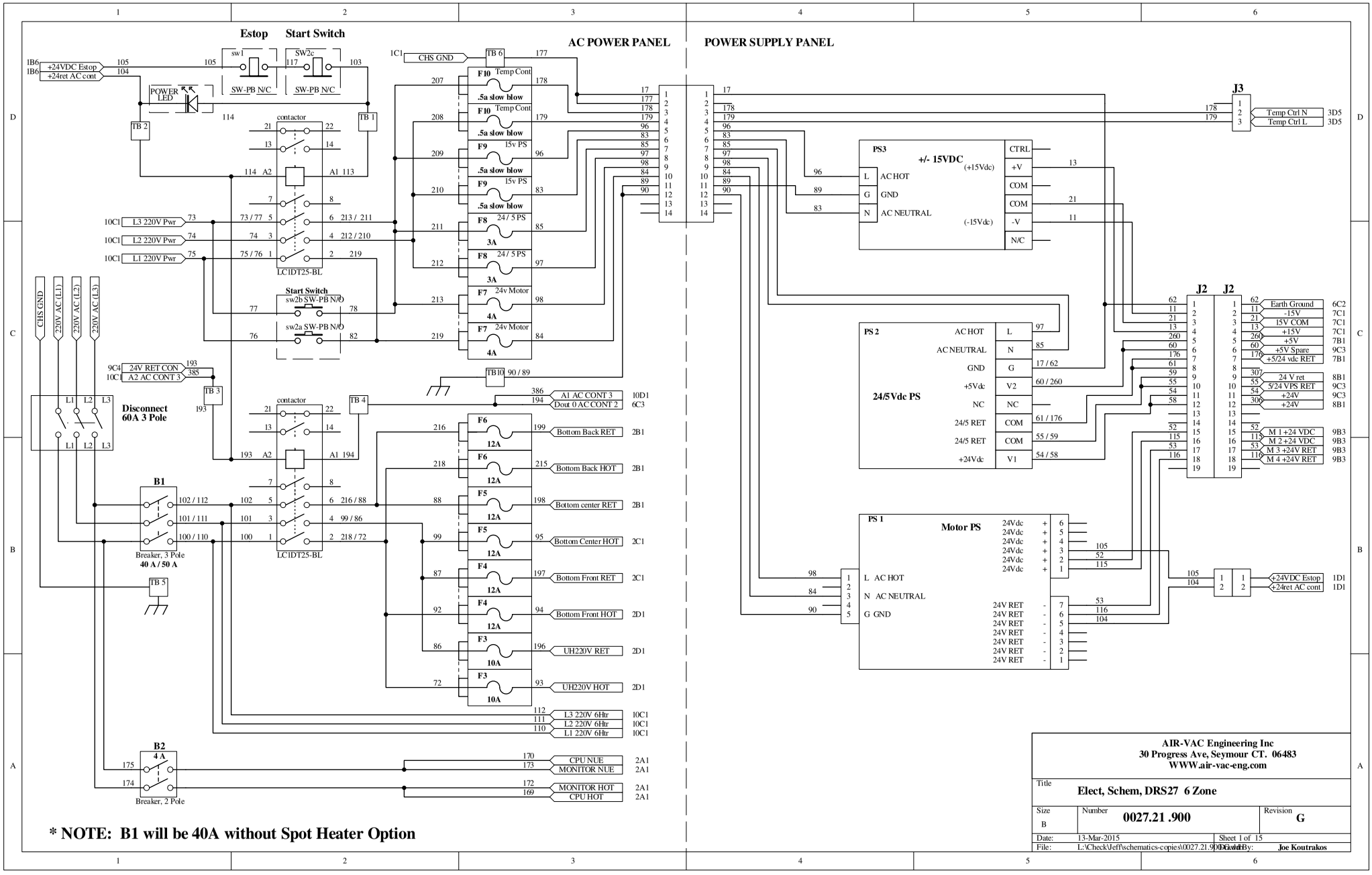


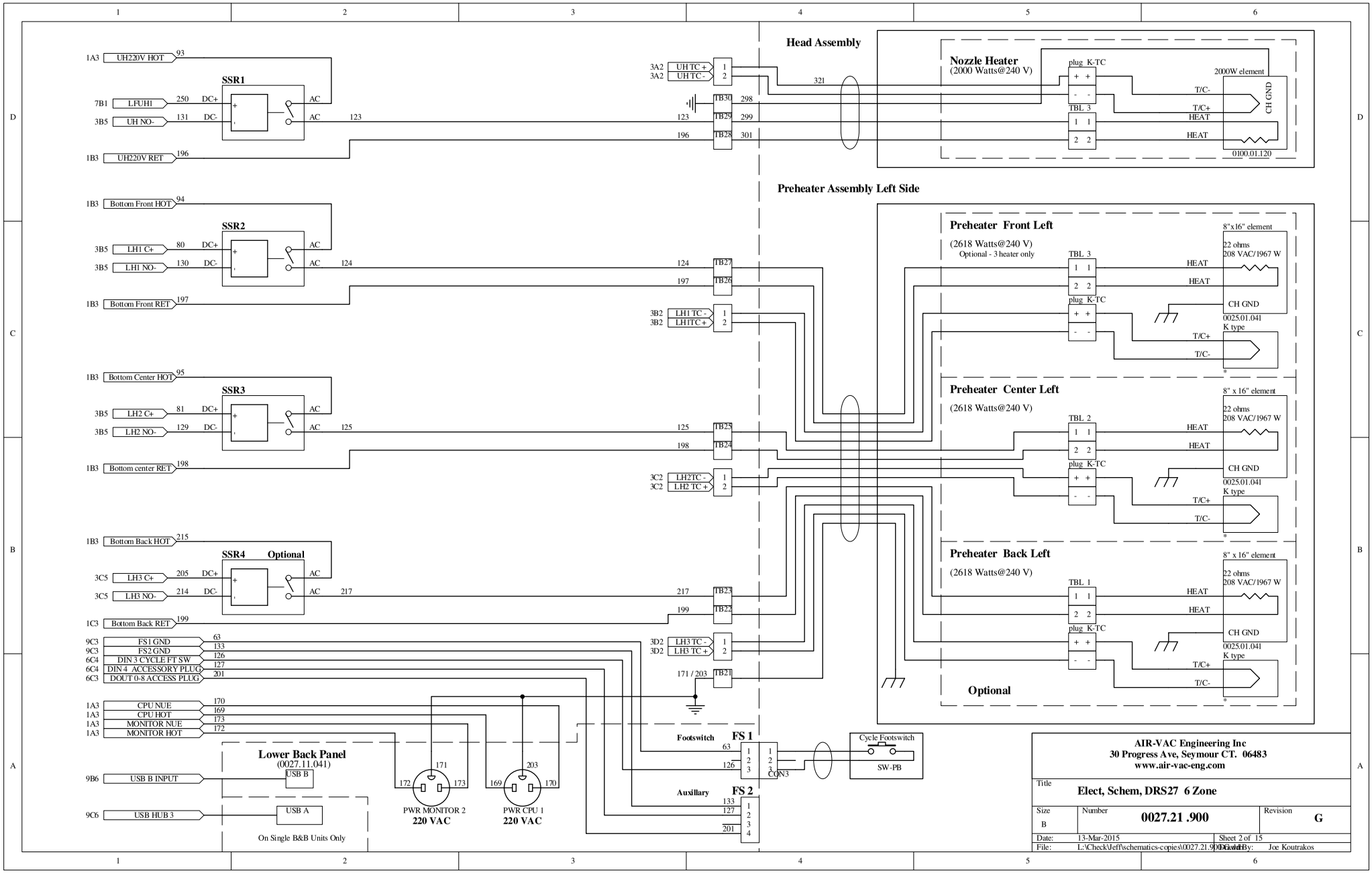

AIR-VAC Engineering Inc
30 Progress Ave, Seymour CT.
06483

Title: **Wago 2 Option**

| Size | Number | Revision |
|---|---|---|
| B | 0027.00.900 | K |

Date: 13-Mar-2015 Sheet 4 of 16
File: L:\Check\Jeff\schematics-copies\0027.00.900.DSN Drawn By: Joe Koutrakos


Estop
Start Switch
AC POWER PANEL
POWER SUPPLY PANEL
1B6 +24VDC Estop
1B6 +24ret AC cont
sw1
SW2c
SW-PB N/C
POWER LED
TB 2
TB 1
contactor
LC1DT25-BL
10C1 L3 220V Pwr
10C1 L2 220V Pwr
10C1 L1 220V Pwr
Start Switch
sw2b SW-PB N/O
sw2a SW-PB N/O
CHS GND
220V AC (L1)
220V AC (L2)
220V AC (L3)
9C4 24V RET CON
10C1 A2 AC CONT 3
TB 3
Disconnect
60A 3 Pole
B1
Breaker, 3 Pole
40 A / 50 A
TB 5
B2
4 A
Breaker, 2 Pole
1C1 CHS GND
TB 6
TB 10
TB 4
F10 Temp Cont .5a slow blow
F9 15v PS .5a slow blow
F8 24 / 5 PS 3A
F7 24v Motor 4A
F6 12A
F5 12A
F4 12A
F3 10A
A1 AC CONT 3 10D1
Dout 0 AC CONT 2 6C3
Bottom Back RET 2B1
Bottom Back HOT 2B1
Bottom center RET 2B1
Bottom Center HOT 2C1
Bottom Front RET 2C1
Bottom Front HOT 2D1
UH220V RET 2D1
UH220V HOT 2D1
L3 220V 6Htr 10C1
L2 220V 6Htr 10C1
L1 220V 6Htr 10C1
CPU NUE 2A1
MONITOR NUE 2A1
MONITOR HOT 2A1
CPU HOT 2A1
PS3 +/- 15VDC
L AC HOT
G GND
N AC NEUTRAL
CTRL
+V
COM
-V
N/C
PS 2 24/5Vdc PS
AC HOT
AC NEUTRAL
GND
+5Vdc
NC
24/5 RET
+24Vdc
PS 1 Motor PS
L AC HOT
N AC NEUTRAL
G GND
24Vdc
24V RET
J3
Temp Ctrl N 3D5
Temp Ctrl L 3D5
J2
Earth Ground 6C2
-15V 7C1
15V COM 7C1
+15V 7C1
+5V 7B1
+5V Spare 9C3
+5/24 vdc RET 7B1
24 V ret 8B1
5/24 VPS RET 9C3
+24V 9C3
+24V 8B1
M 1 +24 VDC 9B3
M 2 +24 VDC 9B3
M 3 +24V RET 9B3
M 4 +24V RET 9B3
+24VDC Estop 1D1
+24ret AC cont 1D1
* NOTE: B1 will be 40A without Spot Heater Option
AIR-VAC Engineering Inc
30 Progress Ave, Seymour CT. 06483
WWW.air-vac-eng.com
Title
Elect, Schem, DRS27 6 Zone
Size B
Number 0027.21 .900
Revision G
Date: 13-Mar-2015
Sheet 1 of 15
File: L:\Check\Jeff\schematics-copies\0027.21.900.dwg
Drawn By: Joe Koutrakos


Head Assembly
Nozzle Heater
(2000 Watts@240 V)
2000W element
plug K-TC
TBL 3
T/C-
T/C+
HEAT
HEAT
CH GND
0100.01.120
1A3 UH220V HOT 93
7B1 LFUH1 250 DC+
3B5 UH NO- 131 DC-
1B3 UH220V RET 196
SSR1
AC
AC
123
3A2 UH TC +
3A2 UH TC -
TB30 298
TB29 299
TB28 301
321
Preheater Assembly Left Side
1B3 Bottom Front HOT 94
3B5 LH1 C+ 80 DC+
3B5 LH1 NO- 130 DC-
1B3 Bottom Front RET 197
SSR2
124
TB27
TB26
197
3B2 LH1 TC -
3B2 LH1TC +
Preheater Front Left
(2618 Watts@240 V)
Optional - 3 heater only
8"x16" element
22 ohms
208 VAC/1967 W
0025.01.041
K type
1B3 Bottom Center HOT 95
3B5 LH2 C+ 81 DC+
3B5 LH2 NO- 129 DC-
1B3 Bottom center RET 198
SSR3
125
TB25
TB24
198
3C2 LH2TC -
3C2 LH2 TC +
Preheater Center Left
(2618 Watts@240 V)
8" x 16" element
1B3 Bottom Back HOT 215
3C5 LH3 C+ 205 DC+
3C5 LH3 NO- 214 DC-
1C3 Bottom Back RET 199
SSR4 Optional
217
TB23
TB22
199
3D2 LH3 TC -
3D2 LH3 TC +
Preheater Back Left
(2618 Watts@240 V)
Optional
9C3 FS1 GND 63
9C3 FS2 GND 133
6C4 DIN 3 CYCLE FT SW 126
6C4 DIN 4 ACCESSORY PLUG 127
6C3 DOUT 0-8 ACCESS PLUG 201
171 / 203 TB21
1A3 CPU NUE 170
1A3 CPU HOT 169
1A3 MONITOR NUE 173
1A3 MONITOR HOT 172
Footswitch FS 1
Auxillary FS 2
CON3
Cycle Footswitch
SW-PB
Lower Back Panel
(0027.11.041)
USB B
9B6 USB B INPUT
9C6 USB HUB 3
USB A
On Single B&B Units Only
PWR MONITOR 2
220 VAC
PWR CPU 1
220 VAC
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Title
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Size B
Number 0027.21 .900
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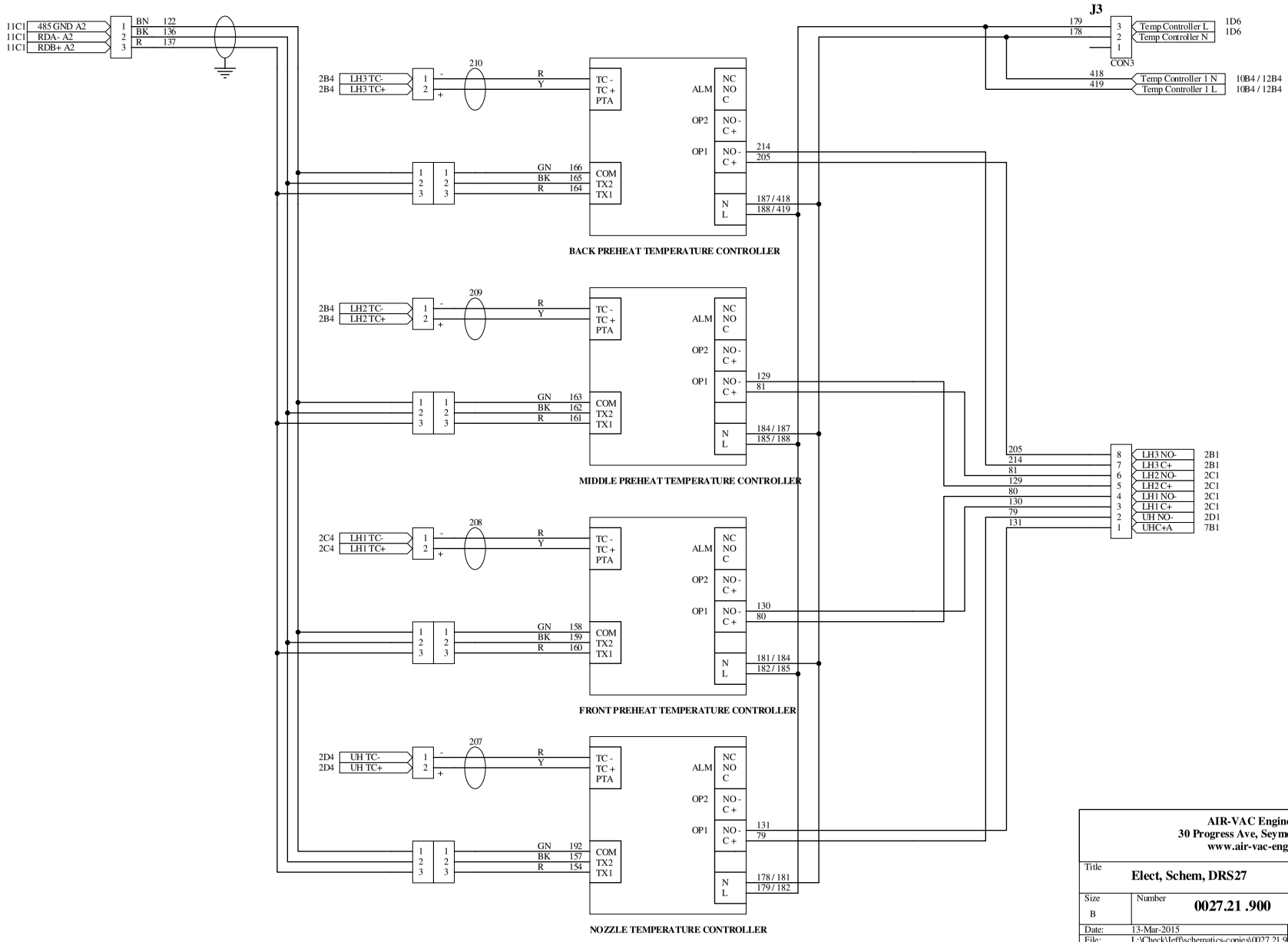
File: L:\Check\Jeff\schematics-copies\0027.21.900.dwg
Drawn By: Joe Koutrakos

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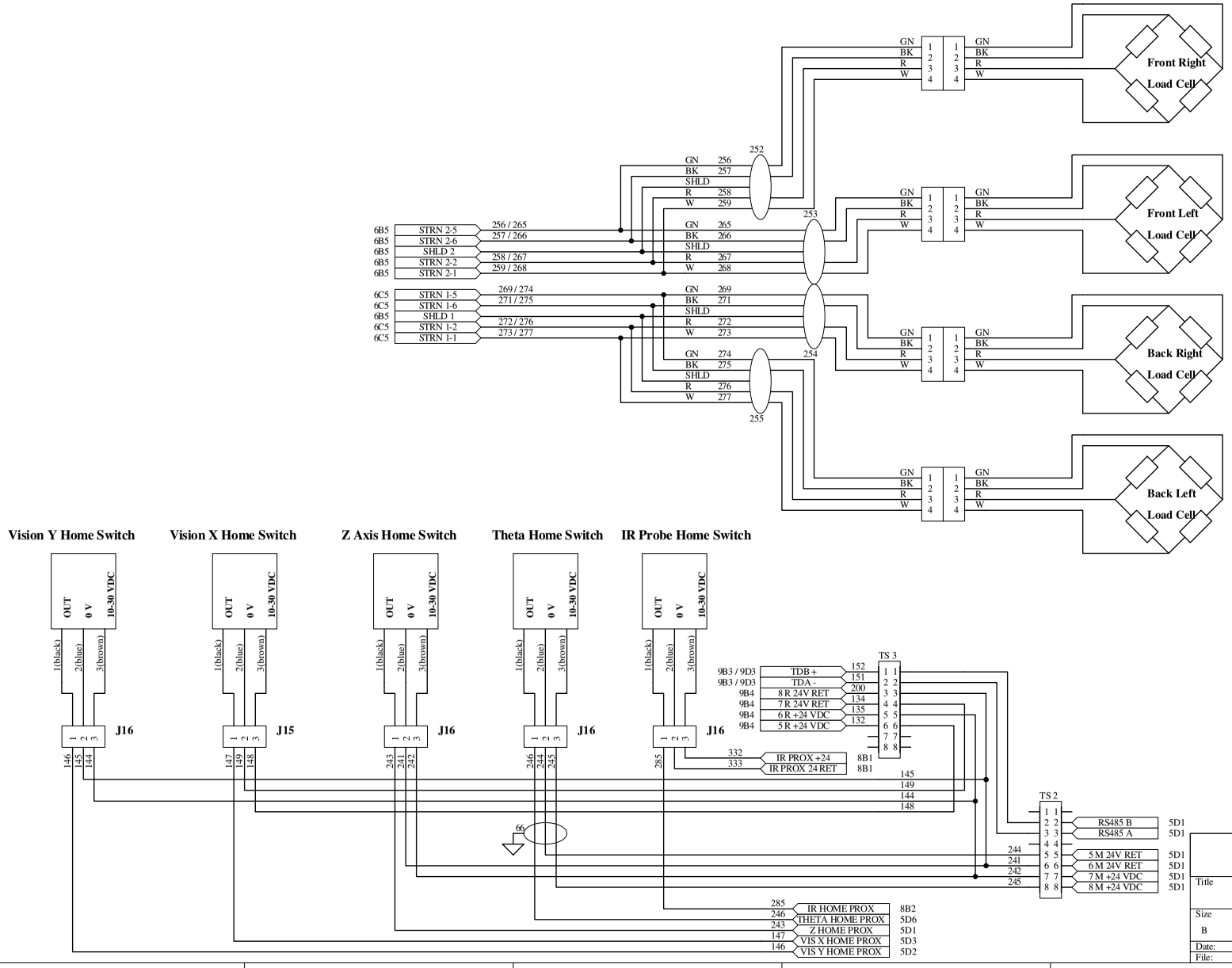
Date: 13-Mar-2015 | Sheet 3 of 15

File: L:\Check\Jeff\schematics-copies\0027.21.900.dwg | Drawn By: **Joe Koutrakos**

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Title: **Elect, Schem, DRS27 6 Zone**

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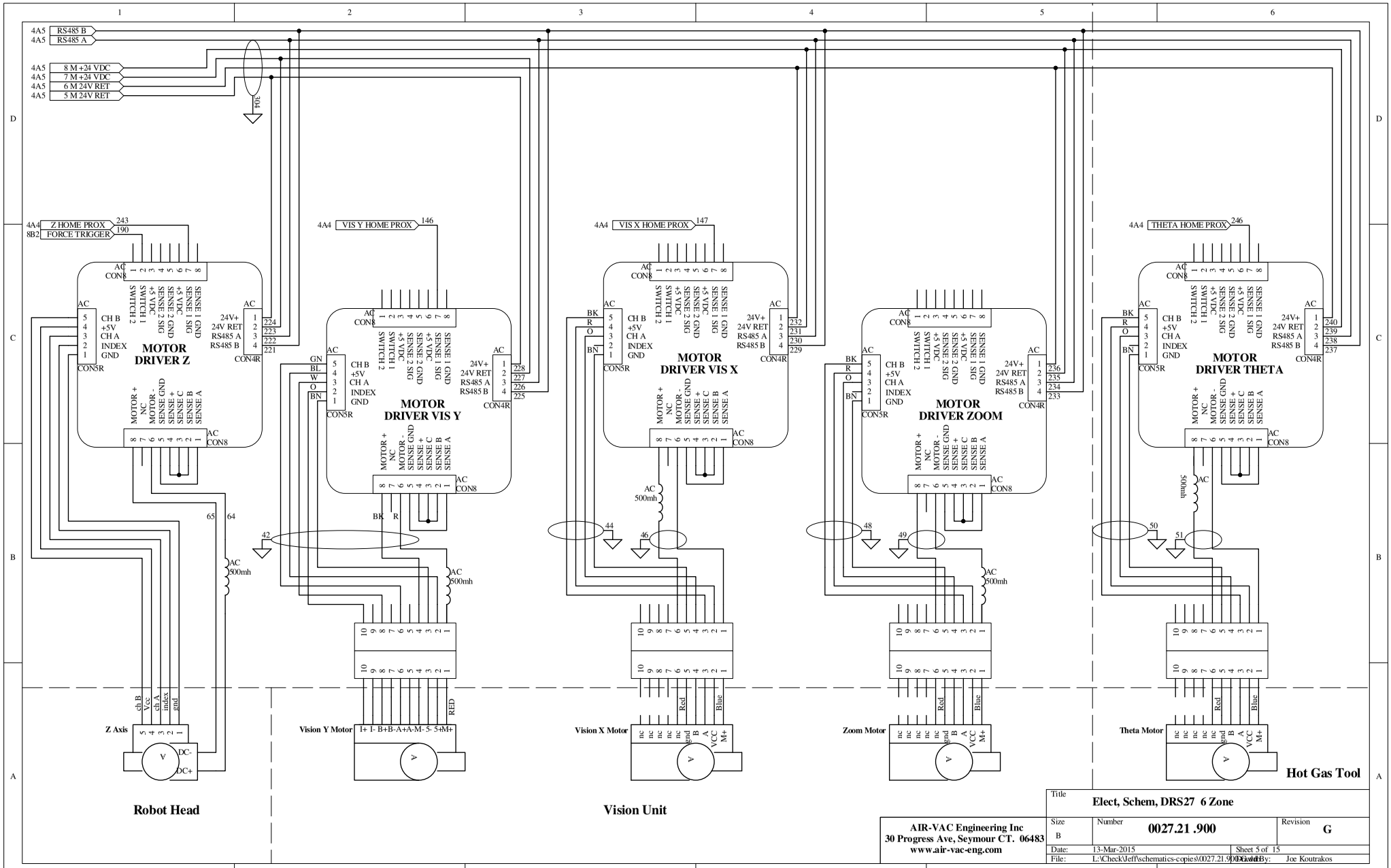


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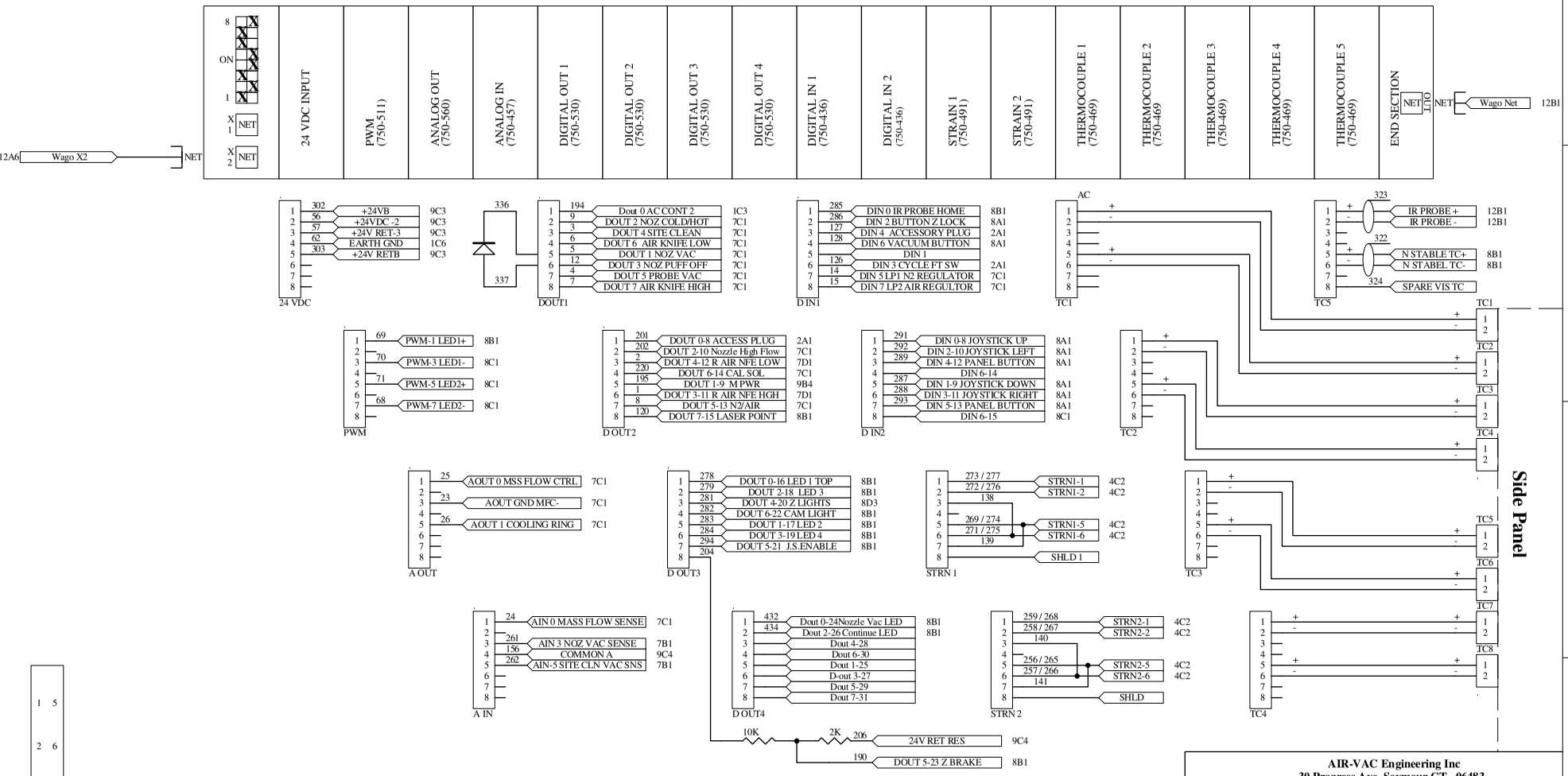
# Wago Panel-1

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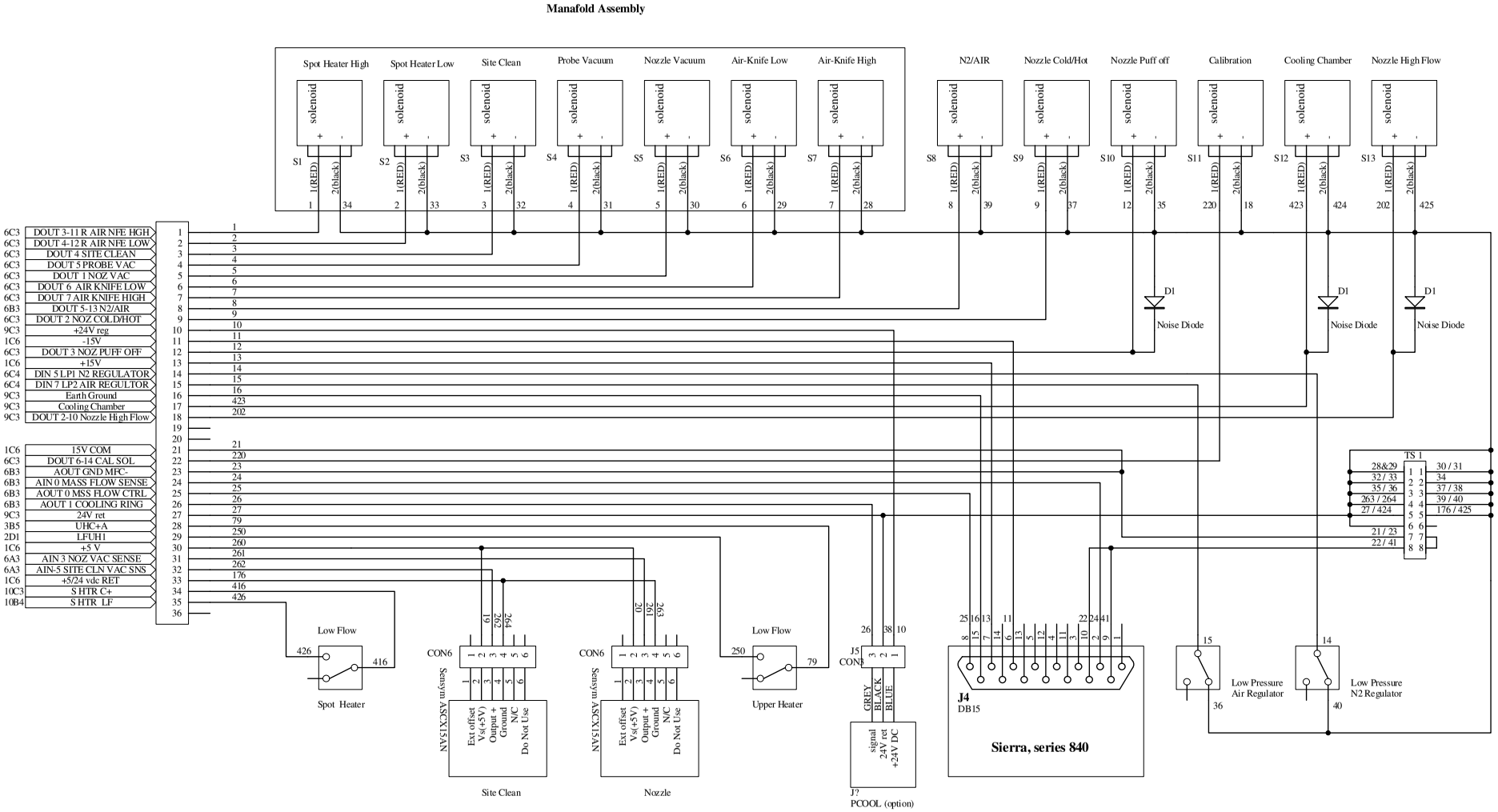
| File: L:\Check\Jeff\schematics-copies\0027.21.900.dwg | | Drawn By: Joe Koutrakos | |

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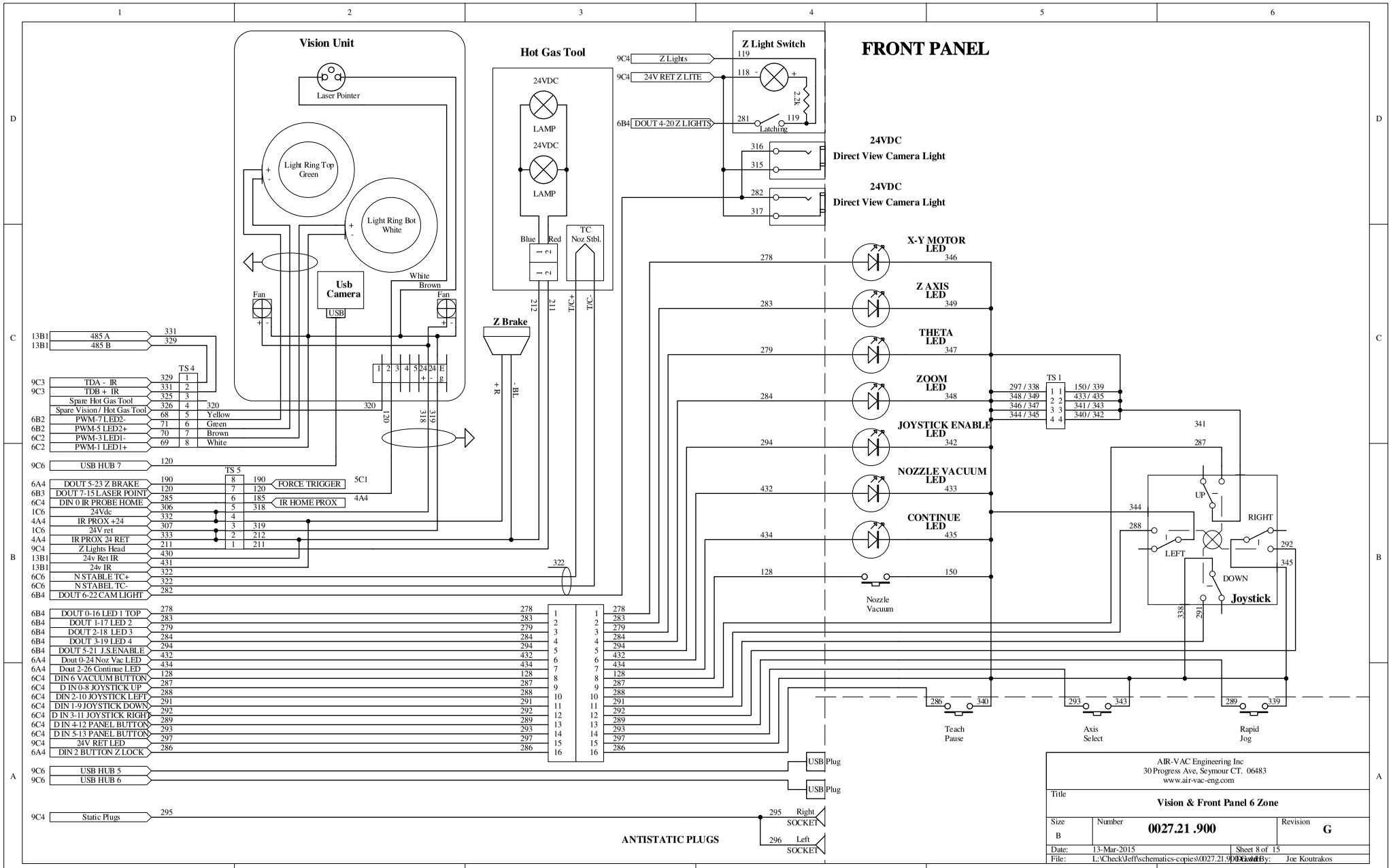
FRONT PANEL
Vision Unit
Laser Pointer
Light Ring Top Green
Light Ring Bot White
Usb Camera
USB
Fan
Fan
White
Brown
Hot Gas Tool
24VDC
LAMP
24VDC
LAMP
Blue
Red
TC Noz Stbl.
Z Brake
+ R
- BL
Z Light Switch
9C4 Z Lights
9C4 24V RET Z LITE
6B4 DOUT 4-20Z LIGHTS
Latching
2.2K
24VDC
Direct View Camera Light
24VDC
Direct View Camera Light
X-Y MOTOR LED
Z AXIS LED
THETA LED
ZOOM LED
JOYSTICK ENABLE LED
NOZZLE VACUUM LED
CONTINUE LED
Nozzle Vacuum
Teach Pause
Axis Select
Rapid Jog
Joystick
UP
DOWN
LEFT
RIGHT
13B1 485 A
13B1 485 B
9C3 TDA - IR
9C3 TDB + IR
Spare Hot Gas Tool
Spare Vision / Hot Gas Tool
6B2 PWM-7 LED2-
6B2 PWM-5 LED2+
6C2 PWM-3 LED1-
6C2 PWM-1 LED1+
9C6 USB HUB 7
6A4 DOUT 5-23 Z BRAKE
6B3 DOUT 7-15 LASER POINT
6C4 DIN 0 IR PROBE HOME
1C6 24Vdc
4A4 IR PROX +24
1C6 24V ret
4A4 IR PROX 24 RET
9C4 Z Lights Head
13B1 24v Ret IR
13B1 24v IR
6C6 N STABLE TC+
6C6 N STABEL TC-
6B4 DOUT 6-22 CAM LIGHT
FORCE TRIGGER
IR HOME PROX
5C1
4A4
6B4 DOUT 0-16 LED 1 TOP
6B4 DOUT 1-17 LED 2
6B4 DOUT 2-18 LED 3
6B4 DOUT 3-19 LED 4
6B4 DOUT 5-21 J.S.ENABLE
6A4 Dout 0-24 Noz Vac LED
6A4 Dout 2-26 Continue LED
6C4 DIN 6 VACUUM BUTTON
6C4 D IN 0-8 JOYSTICK UP
6C4 DIN 2-10 JOYSTICK LEFT
6C4 DIN 1-9 JOYSTICK DOWN
6C4 D IN 3-11 JOYSTICK RIGHT
6C4 D IN 4-12 PANEL BUTTON
6C4 D IN 5-13 PANEL BUTTON
9C4 24V RET LED
6A4 DIN 2 BUTTON Z LOCK
9C6 USB HUB 5
9C6 USB HUB 6
USB Plug
USB Plug
9C4 Static Plugs
Right SOCKET
Left SOCKET
ANTISTATIC PLUGS
TS 1
TS 4
TS 5
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Vision & Front Panel 6 Zone
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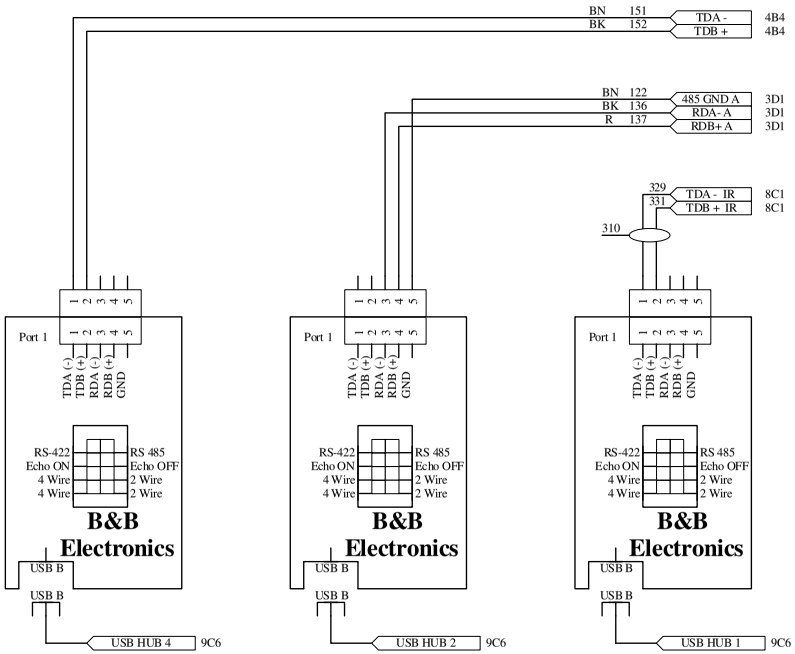
# Wago Panel-2

## Left Wall



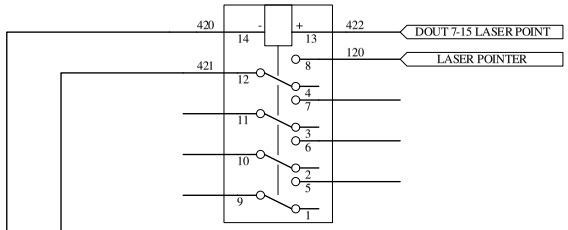

**Motor Dirvers**

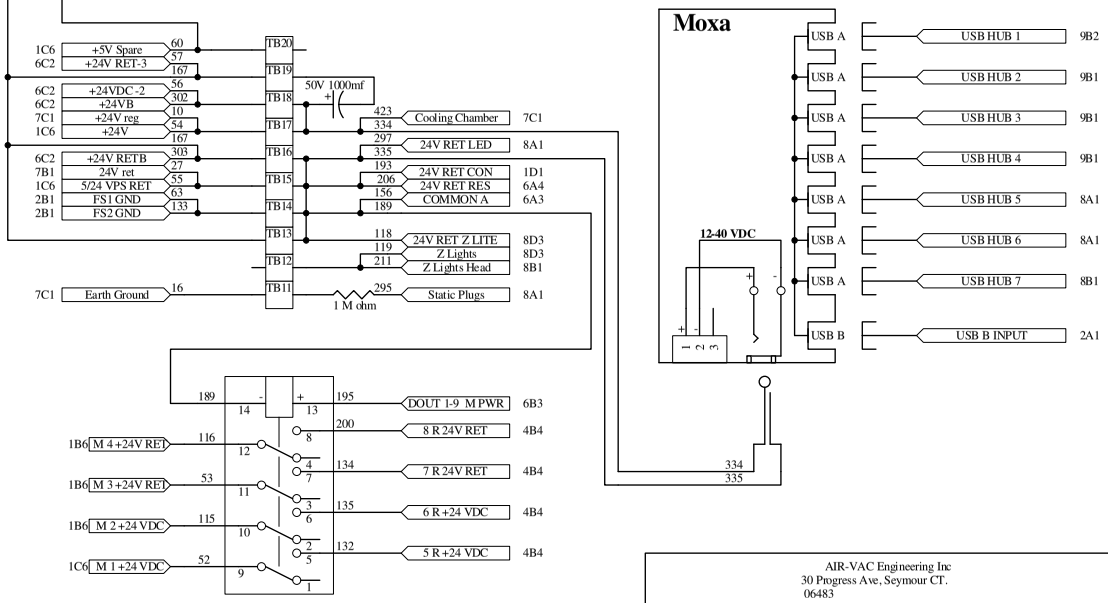
**Temp Controllers**

**IR Probe Option**

## Base

5 Vdc Laser Option (UL)

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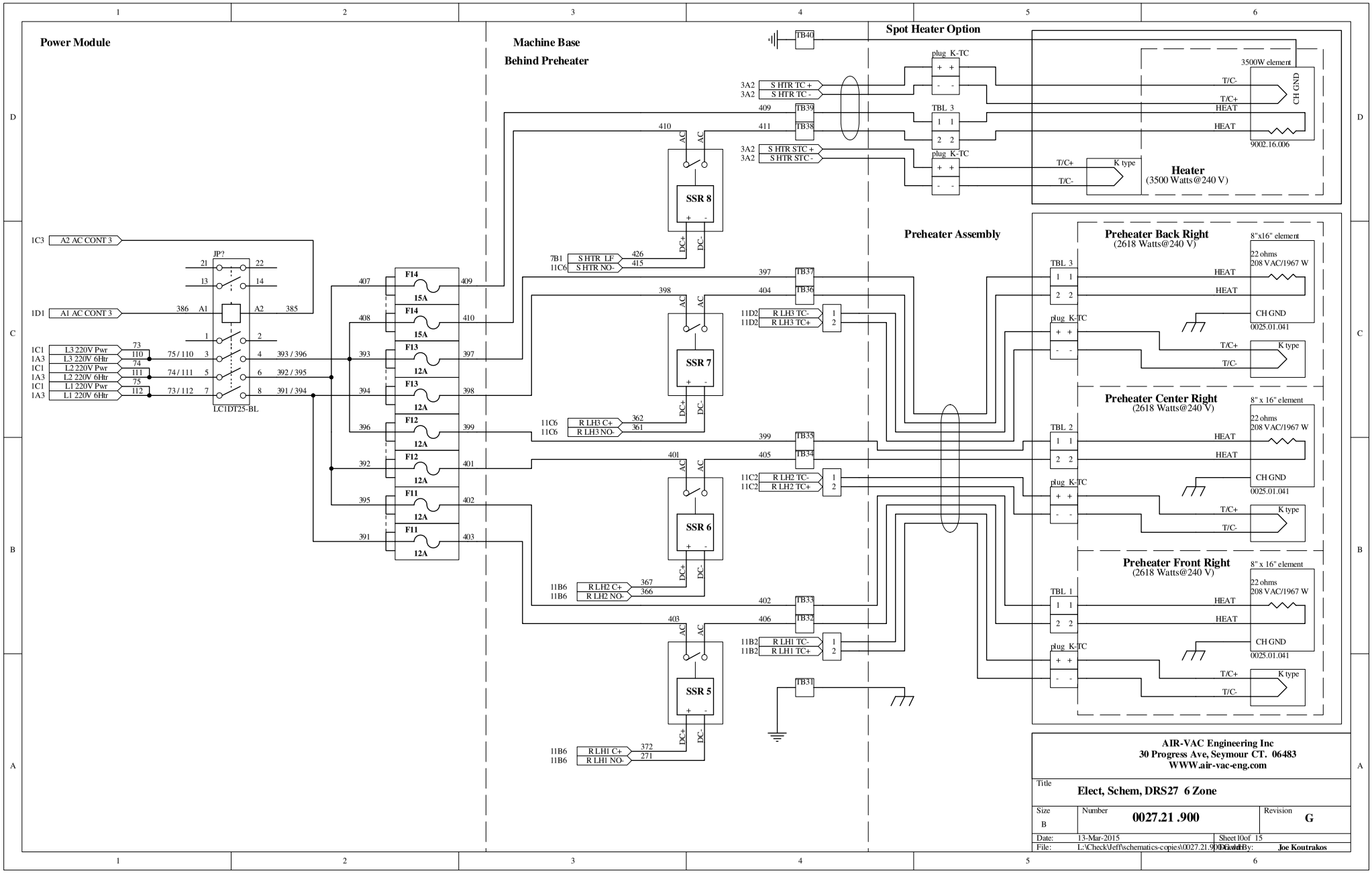
Power Module
Machine Base
Behind Preheater
Spot Heater Option
Preheater Assembly
1C3 A2 AC CONT 3
1D1 A1 AC CONT 3
JP?
LC1DT25-BL
1C1 L3 220V Pwr
1A3 L3 220V 6Htr
1C1 L2 220V Pwr
1A3 L2 220V 6Htr
1C1 L1 220V Pwr
1A3 L1 220V 6Htr
F14 15A
F13 12A
F12 12A
F11 12A
SSR 8
SSR 7
SSR 6
SSR 5
7B1 S HTR LF
11C6 S HTR NO-
11C6 R LH3 C+
11C6 R LH3 NO-
11B6 R LH2 C+
11B6 R LH2 NO-
11B6 R LH1 C+
11B6 R LH1 NO-
11D2 R LH3 TC-
11D2 R LH3 TC+
11C2 R LH2 TC-
11C2 R LH2 TC+
11B2 R LH1 TC-
11B2 R LH1 TC+
3A2 S HTR TC +
3A2 S HTR TC -
3A2 S HTR STC +
3A2 S HTR STC -
TB40
TB39
TB38
TB37
TB36
TB35
TB34
TB33
TB32
TB31
plug K-TC
TBL 3
3500W element
T/C-
T/C+
HEAT
CH GND
9002.16.006
K type
Heater
(3500 Watts@240 V)
Preheater Back Right
(2618 Watts@240 V)
8"x16" element
22 ohms
208 VAC/1967 W
0025.01.041
Preheater Center Right
(2618 Watts@240 V)
8" x 16" element
Preheater Front Right
(2618 Watts@240 V)
TBL 2
TBL 1
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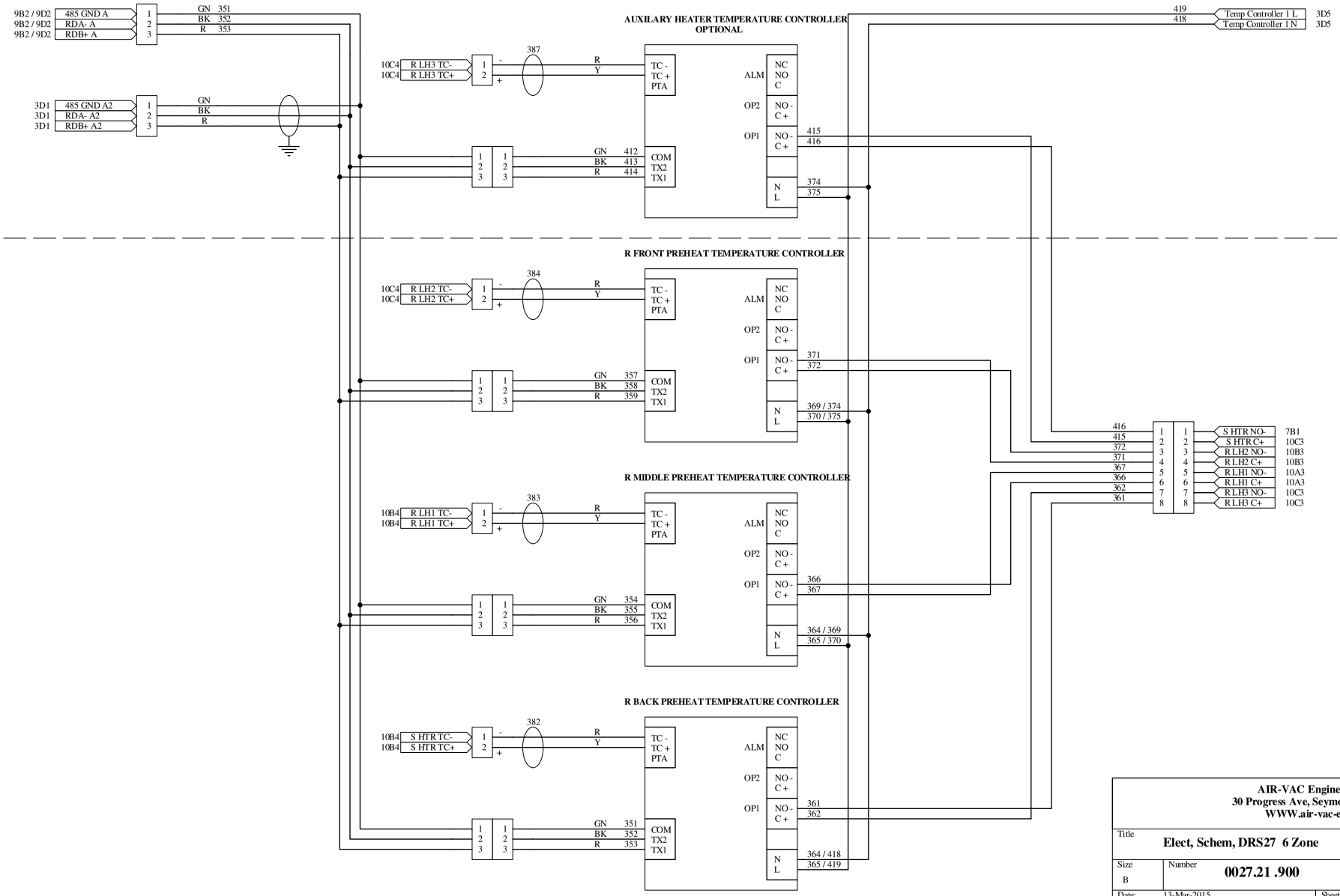


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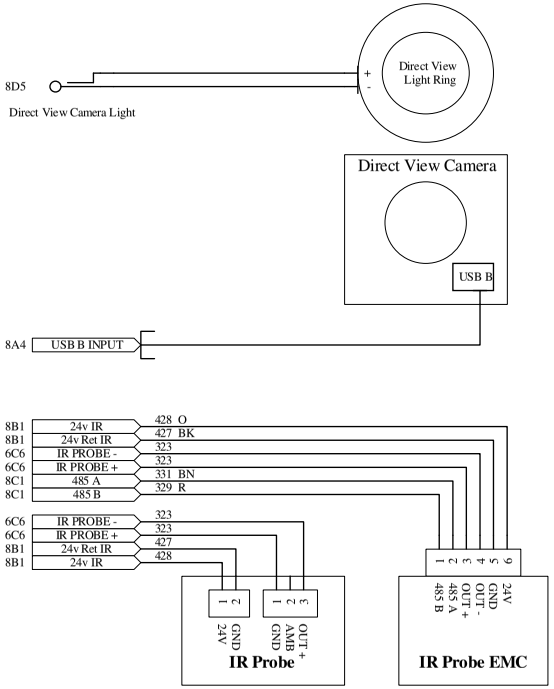
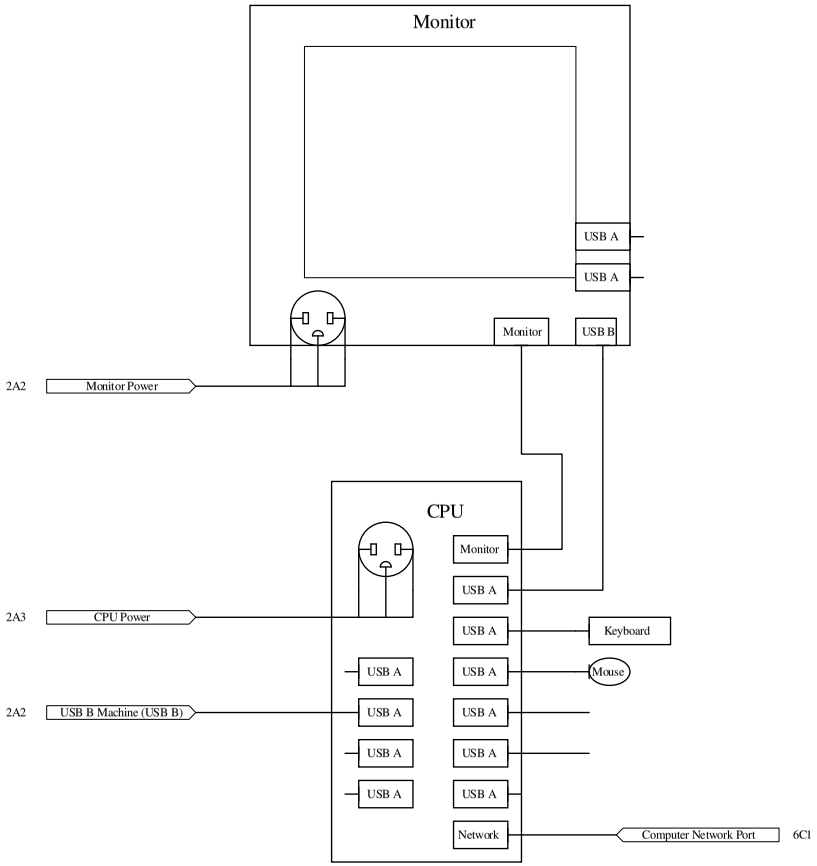
# Computer & Options

## Machine Options




## Computer & Monitor

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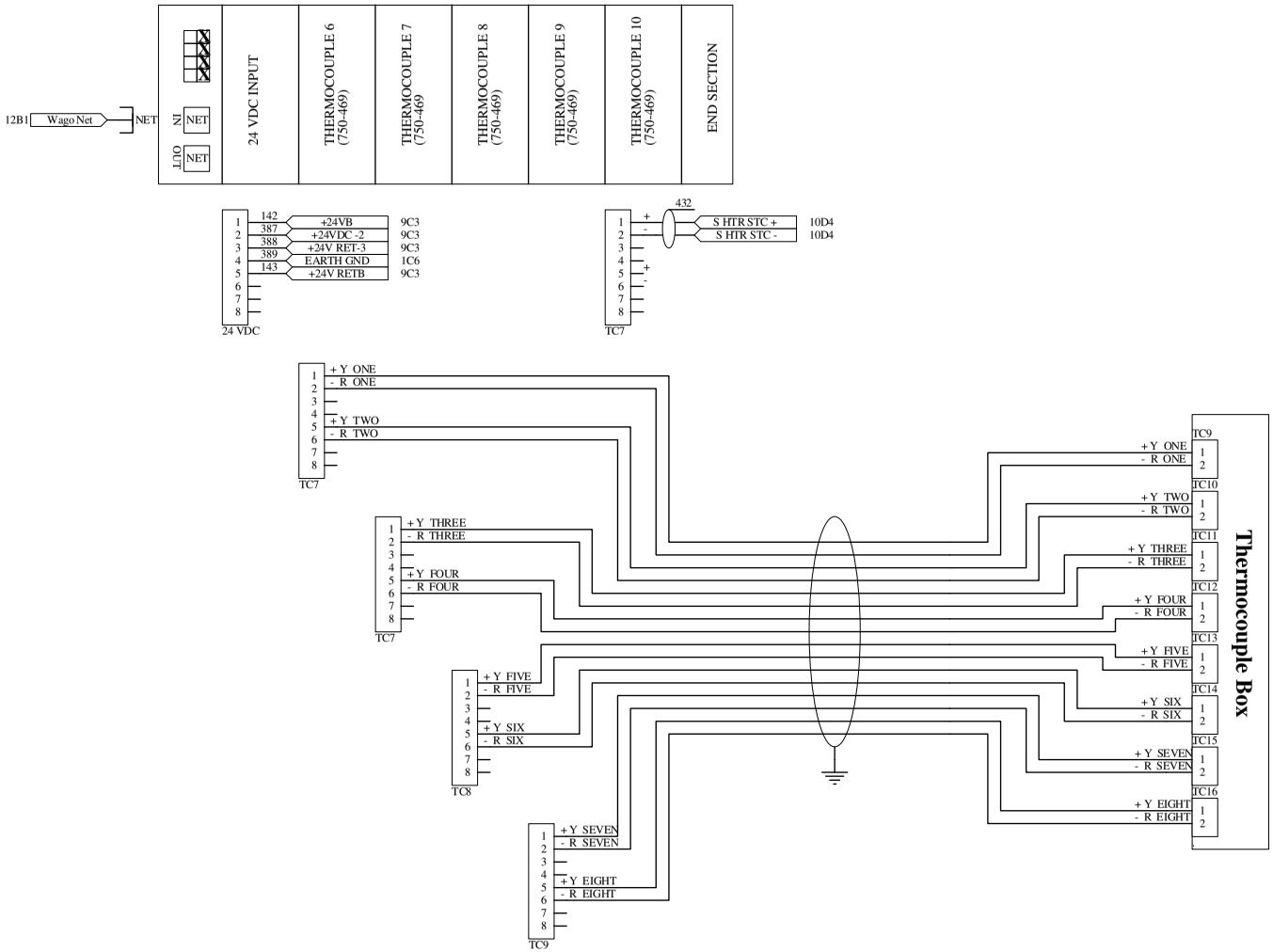


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Title
**Wago 2 Option**

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