IR3100
&
IR4100

BGA Rework Stations

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WARNING
Read the safety & setup information sections in this manual before installing and using your new rework system.

Safety

1. Do not touch heaters or heater accessories during operation.
2. After powering down the system, be sure to let everything cool off before touching.
3. Make sure there is adequate ventilation or use fume extraction equipment.
4. Do not operate near combustible vapors.
5. Do not leave the equipment unattended while it is on.
6. Do not open the rear access door without first disconnecting the main power cable.

Specifications

Top Heater	Dual 250 Watt (500 Watt Total) Medium/Long wave Infrared Emitter with a temp. range of 100°-328°C (212°-624°F).
Vacuum	Approx. 25 in/Hg at vacuum pick; 4 in/Hg at accessory port
Optics	1080p color camera with a dichroic image splitting prism
Positioning Accuracy (Z travel)	Precision stepper motor with .0011" (28μm)accuracy
Video	Up to 240x zoom, Quad-Field imaging and image capture.
Component Nest	Maximum: 65x65mm (2.5" sq) Minimum: 1mm square

Part number	IR-3100	8007-0586 for 120V, 50/60hz
		8007-0587 for 230v, 50hz
Size	IR-3100	737mm (29") **H** x 686mm (27") **W** x 737mm (29") **D**
Weight	IR-3100	45kg (120lbs)
Preheater	IR-3100	1000 Watt Medium/Long wave infrared with a temp. range of 100°-221°C (212°-430°F). 1.5" of height adjustment.
PC Board Size	IR-3100	Maximum 12" x 12"; No minimum

Part number	IR-4100	8007-0591 for 120V, 50/60hz
		8007-0592 for 230v, 50hz
Size	IR-4100	737mm (29") **H** x 1188mm (44") **W** x 965mm (38") **D**
Weight	IR-4100	90kg (200lbs)
Preheater	IR-4100	1900 Watt total Medium/Long wave IR with a temp. range of 100°-221°C (212°-430°F) for both the center element and the auxiliary elements around the edge. 1.5" of height adjustment.
PC Board Size	IR-4100	Maximum 24" x 24"; No minimum

Packing List

8007-0586	IR3100, 120 VAC*				
8007-0587	**IR3100, 230 VAC****				
Part Id	**Description**			**Qty**	**UM**
1107-0037	PC MONITOR, 24" Widescreen, LCD			1	EA
1107-0041	Keyboard, Computer, Wireless			1	EA
1332-0134*	POWER CORD, DOM DETACHED			1	EA
1332-0093**	POWER CORD,DETACHABLE,230V			1	EA
1332-0280**	Power Cord, Type G, to C13, 230V, Fused			1	EA
1332-0287**	AC Adapter, Type G to Type A/B (US)			2	EA
1332-0288**	AC Adapter, Type E/F to Type A/B (US)			2	EA
3008-0383	Cable, HDMI to HDMI, Male to Male, 1M			1	EA
5005-0164	BANDING, CUT-TO-LENGTH, 1/2" WIDE, BLACK			86	IN
5005-0165	BUCKLE, REUSABLE, 1/2" BAND WIDTH, BLACK			1	EA
5005-0170	SHIPPING CRATE, TF1800/IR3100			1	EA
5050-0597	INSTR,INSTALLATION,SODR-CAM,IR3100/4100			1	EA
6000-0468-01	SODR-CAM ARM ASSY, IR3100			1	EA
6020-0257	COMPUTER, INTEL NUC loaded build			1	EA
6993-0306	IR/TF Monitor Arm Kit			1	EA
7008-0332*	TOP ASSEMBLY, IR3100 DOMESTIC			1	EA
7008-0333**	TOP ASSEMBLY, IR3100 EXPORT			1	EA
7950-0160	IR3100 PACKOUT			1	EA
	Part Id	**Description**		**Qty**	**UM**
	1001-0001	STENCIL,COMPONENTS,LEADS		1	EA
	1100-0100	PACE MousePad, 9-2014		1	EA
	1100-0231	TOOL,NOZZLE/CHIP ASSY		1	EA
		Part Id	**Description**	**Qty**	**UM**
		1209-0025	GRIP, NOZZLE/CHIP TOOL	1	EA
		1317-0017	PAD, NOZZLE/CHIP TOOL	1	EA
		1360-0067	TOOL,NOZZLE/CHIP	1	EA
	1100-0303	NOZZLE CHANGE PAD		1	EA
	1100-0312	HEX KEY, 5MM, LOOPED T-HANDLE		1	EA
	1132-0070	TOOL, 3/32" BALL_END SCREWDRIVER		1	EA
	1132-0071	TOOL, 5/64" BALL END SCREWDRIVER		1	EA
	1340-0174	K-TYPE THERMOCOUPLE 40 GA		4	EA
	3008-0295	Cable, USB-A / USB-B, Male, 6'		1	EA
	3008-0931	CABLE,1M,USB3.0,TYPE A MALE,TYPE B MALE		1	EA
	4018-0100-P1	OPTICAL ALIGNMENT		1	EA
	6000-0245	FLUX TRAY ASSEMBLY		1	EA
	6000-0247	STENCIL PLATFORM ASSY.		1	EA
	6000-0448	CENTERING CLAMP ASSY		1	EA
	6000-0453-P4	ODD-SHAPED BOARD HOLDER KIT		1	EA
	6000-0473-P4	HEAVY DUTY ODD-SHAPED BOARD HOLDER KIT		1	EA
	6016-0033	SET, HEX KEY TF1700/2700		1	EA

		Part Id	Description	Qty	UM
		1100-0310	WRENCH, OPEN END 1/4"	1	EA
		1132-0057	WRENCH, HEX 1/16"	1	EA
		1132-0058	WRENCH, HEX 3/32"	1	EA
		1132-0059	WRENCH, HEX 9/64"	1	EA
		1132-0060	WRENCH, HEX 5/64"	1	EA
		1132-0061	WRENCH, HEX 3/16"	1	EA
		1132-0062	WRENCH, HEX 5/32"	1	EA
		1132-0064	WRENCH, HEX, .050"	1	EA
		1132-0065	WRENCH, HEX, 1.5MM	1	EA
		1132-0066	KEY, HEX, 1/8"	1	EA
		1351-0774	LABEL, IDENT, 1.75 SQUARE	1	EA
	6993-0290	KIT, IR VACUUM PICK 6 SIZES		1	EA
		Part Id	Description	Qty	UM
		1121-0920	VACUUM PICK, TF, 5MM	1	EA
		1121-0921	VACUUM PICK, TF, 2.5MM	1	EA
		1121-0922	VACUUM PICK, TF, 9.5MM	1	EA
		1121-0952	Vacuum Pick, 10 mm Dia,	1	EA
		1121-0953	Vacuum Pick, 13 mm Dia,	1	EA
		1121-0954	Vacuum Pick, 6 mm TF	1	EA
		1213-0102	ORING VITON, AS568A-008	4	EA
	6993-0298	IR Stencils Pack		1	EA
		Part Id	Description	Qty	UM
		4058-0004-01	Shields 0.5"sq opening	1	EA
		4058-0004-02	Shields 0.75"sq opening	1	EA
		4058-0004-03	Shields 1"sq opening	1	EA
		4058-0004-04	Shields 1.25"sq opening	1	EA
		4058-0004-05	Shields 1.5"sq opening	1	EA
	6993-0313	JAWS KIT, SQUARE COMPONENT		1	EA
	6993-0314	JAWS KIT, RECTANGULAR COMPONENT		1	EA
	7027-0001-M	HANDPIECE, PV-65, PIK-VAC		1	EA
	CD5050-0459	CD,PACE MANUALS 7 LANG.		1	EA

* Only included with 120V units
**** Only included with 230V units**

8007-0591	IR4100, 120 VAC*		
8007-0592	**IR4100, 230 VAC****		
Part Id	**Description**	**Qty**	**UM**
1107-0037	PC MONITOR, 24" Widescreen, LCD	1.00	EA
1107-0041	Keyboard, Computer, Wireless	1.00	EA
1332-0289*	Power Cord, Type Nema 5-20P to C19, 120V	1.00	EA
1332-0281**	Power Cord, Type E/F to C19, 230V	1.00	EA
1332-0282**	Power Cord, Type G to C19, 230V	1.00	EA
1332-0287**	AC Adapter, Type G to Type A/B (US)	2.00	EA
1332-0288**	AC Adapter, Type E/F to Type A/B (US)	2.00	EA
3008-0383	Cable, HDMI to HDMI, Male to Male, 1M	1.00	EA
5005-0164	BANDING, CUT-TO-LENGTH, 1/2" WIDE, BLACK	104.00	LI
5005-0165	BUCKLE, REUSABLE, 1/2" BAND WIDTH, BLACK	1.00	EA
5005-0169	SHIPPING CRATE, TF2800/IR4100	1.00	EA
5050-0597	INSTR,INSTALLATION,SODR-CAM,IR3100/4100	1.00	EA
6000-0468-02	SODR-CAM ARM ASSY, IR4100	1.00	EA
6020-0257	COMPUTER, INTEL NUC loaded build	1.00	EA
6993-0306	IR/TF Monitor Arm Kit	1.00	EA
7008-0334*	TOP ASSEMBLY, IR4100 DOMESTIC	1.00	EA
7008-0335**	TOP ASSEMBLY, IR4100 EXPORT	1.00	EA
7950-0161	IR4100 PACKOUT	1.00	EA
	Part Id	**Description**	**Qty**	**UM**
	1001-0001	STENCIL,COMPONENTS,LEADS	1.00	EA
	1100-0100	PACE MousePad, 9-2014	1.00	EA
	1100-0231	TOOL,NOZZLE/CHIP ASSY	1.00	EA
		Part Id	**Description**	**Qty**	**UM**
		1209-0025	GRIP, NOZZLE/CHIP TOOL	1.00	EA
		1317-0017	PAD, NOZZLE/CHIP TOOL	1.00	EA
		1360-0067	TOOL,NOZZLE/CHIP	1.00	EA
	1100-0303	NOZZLE CHANGE PAD	1.00	EA
	1100-0312	HEX KEY, 5MM, LOOPED T-HANDLE	1.00	EA
	1132-0070	TOOL, 3/32" BALL_END SCREWDRIVER	1.00	EA
	1132-0071	TOOL, 5/64" BALL END SCREWDRIVER	1.00	EA
	1340-0174	K-TYPE THERMOCOUPLE 40 GA	4.00	EA
	1348-0700-01	KIT,SUPPORT LEG,BRD HLDR,TF2800/IR4100	1.00	EA
	1405-1047	SCR,SKT,8-32X2.25,SSNAHS	4.00	EA
	3008-0295	Cable, USB-A / USB-B, Male, 6'	1.00	EA
	3008-0931	CABLE,1M,USB3.0,TYPE A MALE,TYPE B MALE	1.00	EA
	4018-0100-P1	OPTICAL ALIGNMENT	1.00	EA
	6000-0245	FLUX TRAY ASSEMBLY	1.00	EA
	6000-0247	STENCIL PLATFORM ASSY.	1.00	EA
	6000-0448	CENTERING CLAMP ASSY	1.00	EA
	6000-0453-P4	ODD-SHAPED BOARD HOLDER KIT	1.00	EA
	6000-0463	PCB ANTI-SAG SUPPORT MECHANISM, TF2800	1.00	EA
	6000-0473-P4	HEAVY DUTY ODD-SHAPED BOARD HOLDER KIT	1.00	EA
	6016-0033	SET, HEX KEY TF1700/2700	1.00	EA
		Part Id	**Description**	**Qty**	**UM**
		1100-0310	WRENCH, OPEN END 1/4"	1.00	EA
		1132-0057	WRENCH, HEX 1/16"	1.00	EA

		Part Id	Description	Qty	UM
		1132-0058	WRENCH, HEX 3/32"	1.00	EA
		1132-0059	WRENCH, HEX 9/64"	1.00	EA
		1132-0060	WRENCH, HEX 5/64"	1.00	EA
		1132-0061	WRENCH, HEX 3/16"	1.00	EA
		1132-0062	WRENCH, HEX 5/32"	1.00	EA
		1132-0064	WRENCH, HEX, .050"	1.00	EA
		1132-0065	WRENCH, HEX, 1.5MM	1.00	EA
		1132-0066	KEY, HEX, 1/8"	1.00	EA
		1351-0774	LABEL, IDENT, 1.75 SQUARE	1.00	EA
	6993-0290		KIT, IR VACUUM PICK 6 SIZES	1.00	EA
		Part Id	**Description**	**Qty**	**UM**
		1121-0920	VACUUM PICK, TF, 5MM	1.00	EA
		1121-0921	VACUUM PICK, TF, 2.5MM	1.00	EA
		1121-0922	VACUUM PICK, TF, 9.5MM	1.00	EA
		1121-0952	Vacuum Pick, 10 mm Dia,	1.00	EA
		1121-0953	Vacuum Pick, 13 mm Dia,	1.00	EA
		1121-0954	Vacuum Pick, 6 mm TF	1.00	EA
		1213-0102	ORING VITON, AS568A-008	4.00	EA
	6993-0298		IR Stencils Pack	1.00	EA
		Part Id	**Description**	**Qty**	**UM**
		4058-0004-01	Shields 0.5"sq opening	1.00	EA
		4058-0004-02	Shields 0.75"sq opening	1.00	EA
		4058-0004-03	Shields 1"sq opening	1.00	EA
		4058-0004-04	Shields 1.25"sq opening	1.00	EA
		4058-0004-05	Shields 1.5"sq opening	1.00	EA
	6993-0313		JAWS KIT, SQUARE COMPONENT	1.00	EA
	6993-0314		JAWS KIT, RECTANGULAR COMPONENT	1.00	EA
	7027-0001-M		HANDPIECE, PV-65, PIK-VAC	1.00	EA
	CD5050-0459		CD,PACE MANUALS 7 LANG.	1.00	EA

* Only included with 120V units
** Only included with 230V units

Hardware Overview and Identification
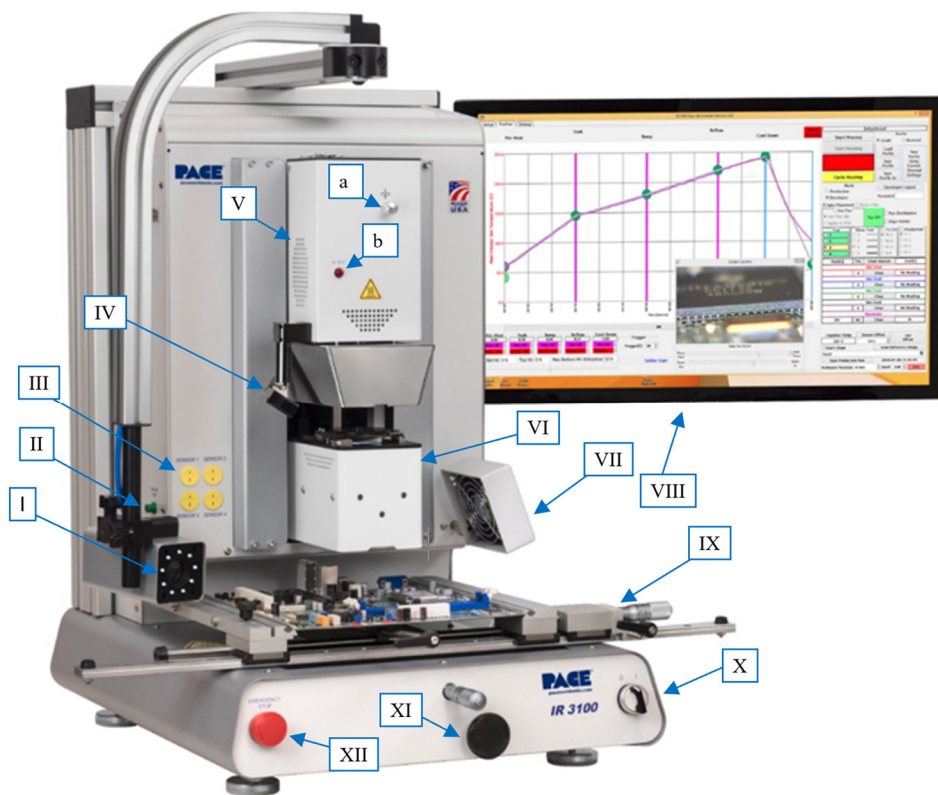
I. **Sodr-Cam with Ring of Light** – The Sodr-Cam provides a close-up view of the action at the reflow site, for real time monitoring of the solder reaching liquidus.

II. **Pik-Vac switch and mount** – The switch next to the Pik-Vac holder will activate the vacuum pump for 15 minutes, so that components can be handled manually using the included PV-65 Pik-Vac tool.

III. **Thermocouple Inputs** – Up to 4 K-type thermo-couples can measure temperatures around the work piece in addition to the IR sensor.

IV. **IR Sensor**– A non-contact IR Temperature Sensor monitors and controls the ramp-up and temperature of the component in real time, by controlling the top heater's output throughout the heating process.

V. **Reflow Head** – Houses the Infrared emitters for top-side heating and the component vacuum pik. The Reflow head moves up and down via precision stepper motor for consistent and reliable positioning.

   a. Theta Adjustment Knob – For rotating the component to align it with the pads on the board, once it has been picked up by the vacuum pik in the Reflow Head.

   b. IR Heater Indicator – Neon lamp indicating the IR emitter activity levels.

VI. **Optics Housing** – Contains the High-Def (1080p) Optical Alignment System (Camera, Prism and lighting.) The optics housing extends and retracts automatically as needed during the process.

VII. **Cooling Fan** – The component and PCB are cooled by the cooling fan, which is activated automatically during the cool down zone or operated manually as needed.

VIII. **LCD Monitor** – Displays software package from PC.

IX. **Board holder with Board Support Wand** – Fine adjustment of the board holder can be made in the X and Y directions by using the micrometer knobs located on the front of the unit and on the right side of the holder itself. The board holder also has a Board Support Wand, used to help prevent sag of large/heavy boards.

X. **On/Off switch** – Used to turn the machine on or off. Always turn the machine on before starting the software, and allow the software to close before turning off the unit.

XI. **Bottom Heater Height Adjustment** –   Used to adjust the distance between the bottom heater and the workpiece.

XII. **Emergency Stop** – This button is used to cut power to the machine immediately in case of an emergency.

Unpacking & Initial Set-up

Unpacking

1. ***Attention: Packaging must be saved for all future shipping requirements!*** – This includes the entire shipping container and all internal foam packaging material. It will be needed, should the unit need to be returned to PACE for any reason.

2. ***Warning! Lift machine by frame. Do not lift by board holder rail(s)! Serious damage to machine will occur, voiding warranty.*** – There are cutouts in the base foam insert for 2 people to have easy access to the hand holds located at the front and rear of the machine frame.

3. ***Do not cut reusable band!*** – Band is required for all returns to immobilize heater head during shipment. Use a flat-blade screwdriver to pry buckle pawl away from band and release tension.

4. ***Prior to use, remove red shipping cushion by rotating micrometer head clockwise until cushion can be easily removed.*** – Retain cushion and reinstall if unit is transported. The board holders utilize springs to maintain force against the Y-axis adjustment micrometer spindle point. Vibration during shipment can cause the board holder to bounce, potentially loosening or damaging the micrometer.

5. ***Sodr-Cam Installation Instructions*** – For IR3100/4100 units, the Sodr-Cam arm assembly ships detached from the unit and must be installed by the customer as detailed in the ***5050-0597*** installation instructions included in the package.

6. ***Prism Shipping Screw Warningl*** – This label is affixed to the alignment camera cover and reads as follow: "Using 3/32" hex driver, loosen these two shipping screws ½ turn (do not remove) prior to connecting power to the machine or verifying prism alignment. Retain this label for future use. Re-tighten screws and reapply label if machine is shipped or transported."

Set-up

1. **Connections –**
   a. Place the PC next to the machine and connect the provided USB/HDMI cables.
   b. Assemble the monitor arm kit onto the right side of the machine, attach monitor and connect to PC.
   c. Set out wireless keyboard and mouse, make sure they are turned on and the wireless receiver has been plugged into the PC.
   d. Plug in the power cords for the PC, Monitor, and the BGA unit.

2. **Accessories –**
   a. Insert a vacuum pick-
      i. Select the smallest vacuum pick that can lift the component. If the component cannot be reliably picked up, move to a larger vacuum pick.
      ii. The vacuum pick will thread into the shaft located between the IR emitters at the bottom of the heater head assembly. Never use tools to tighten the vacuum pick as doing so can damage the threads or bend the pick.

3. **Power on –**
   a. Make sure everything is connected to an appropriate power source.
   b. Turn on circuit breaker on back of the IR machine.
   c. Turn on PC and monitor.
   d. Turn on the switch at the front right-hand corner of the machine.
   e. Once PC has finished booting up and the machine is running, double-click on the PACE IR software icon.

The Profiler Screen (Production Mode)
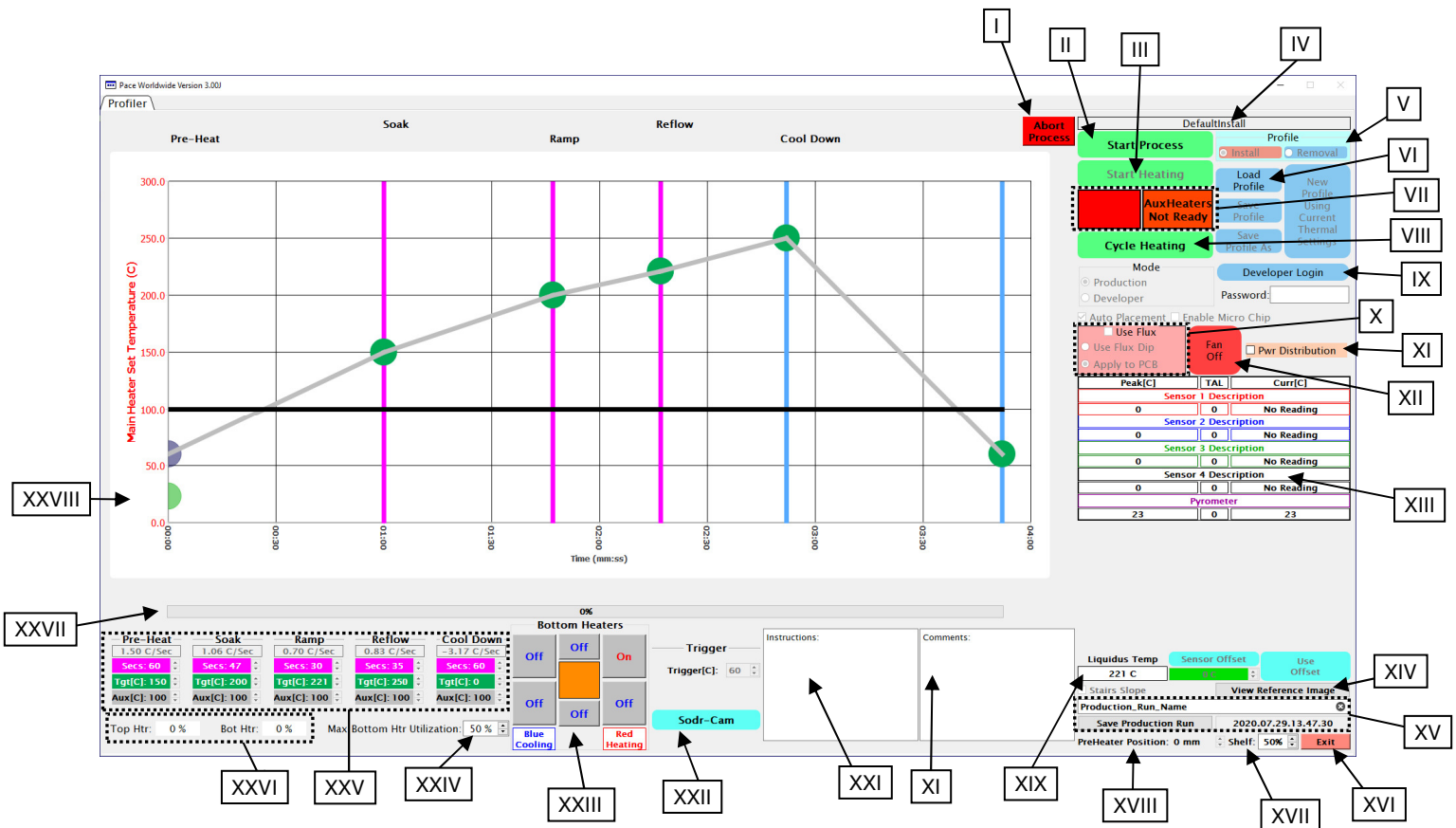
I. **Abort Button** – Used to end the current process and reset the machine back to home.

II. **Start Process** – Used to begin the removal or installation process from the home position.

III. **Start Heating Button** –Used to initiate heating, as directed by the selected profile. Initially, the bottom heater will be used to achieve the "Target Temperature" of the PCB set for the profile. Once the "Target Temperature" is reached, the main thermal profile will begin accordingly.

IV. **Profile Name** – Displays the name for the active profile.

V. **Profile type** – Indicates if the loaded profile is an install or removal. Options are grayed out and cannot be selected in Production Mode. Profile type changes depending on the profile loaded. See Developer Mode for more information on Profile creation.

VI. **Load Profile** – Click here to select an existing profile to be run.

VII. **Temperature Trigger indicators** – This area displays status of the machine in relation to the Temperature Trigger Point. The Trigger Point must be reached before the process can begin.

VIII. **Cycle Heating** – This button will move the heater head down into position over the board assembly and run the thermal profile, skipping all set-up and alignment steps. For use when manually placing components.

IX. **Developer Login** – Used to enter "Developer Mode" for profile creation and editing.
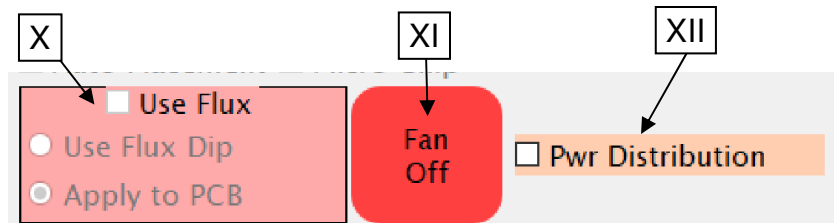
X. **Use Flux** – If selected, the profile will include one of two different methods for applying flux, as previously chosen by the developer of the current profile.

- **Flux Dip** – This method will require the user to use the semi-automated flux dip process, which occurs prior to the component alignment portion of the profile.

- **Apply to PCB** – This option will add a scripted pause after the component alignment has been completed, to allow the production operator to apply flux directly to the PCB.

XI. **Power Distribution** – This opens a small repositionable window that will display, in real time, the percentage of time that the top IR emitter is spending at a given power range. Useful for monitoring availability of heat throughput from the top heater.
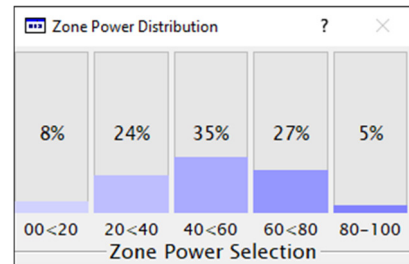
XII. **Cooling Fan** – Turns the external cooling fan on or off. (Fan runs automatically during the cool down portion of the thermal profile.)

XIII. **Sensors** – The current and peak temperatures for any attached K-type thermocouples will be shown in real time during a profile run. Also displays **TAL** (**T**ime **A**bove **L**iquidus).

XIV. **View Reference Image** – Used to view the reference image associated to the current profile, if one was added during development.

XV. **Save Production Run** – For saving information from a production run as a .PDF for later reference. When saving, an option to Log Sensor Data will appear, this will create a time-tagged CSV file showing thermocouple data and heater commands. The files will be named with a time stamp and the user designated text shown here as "Production_Run_Name".
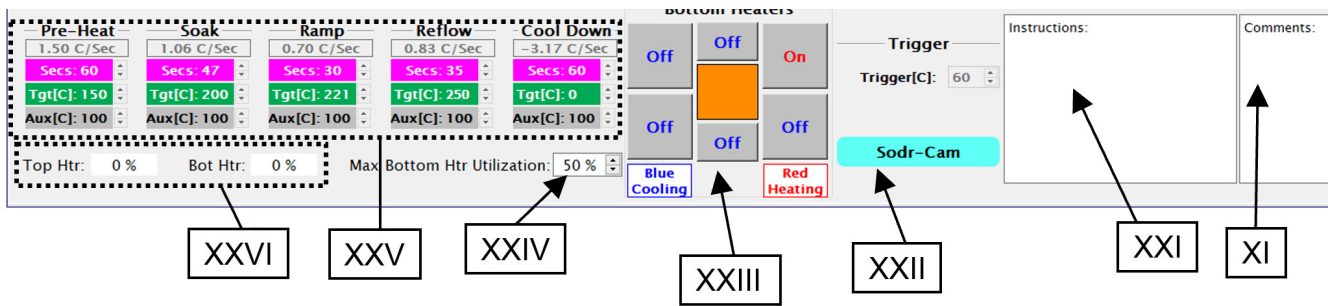
XVI. **Exit** – Exits the software.

XVII. **Shelf** – Used to change brightness of the under-shelf lighting illuminating the back of the board holder.

XVIII. **Preheater Position** – Reference to what height the preheater should be for the currently loaded profile.

XIX. **Liquidus Temp** – The liquidus temperature of the solder being used, as defined by the Developer during the creation of the currently loaded profile. Default Liquidus Temp is 221°C.

Pre-Heat	Soak	Ramp	Reflow	Cool Down
1.50 C/Sec	1.06 C/Sec	0.70 C/Sec	0.83 C/Sec	−3.17 C/Sec
Secs: 60	Secs: 47	Secs: 30	Secs: 35	Secs: 60
Tgt[C]: 150	Tgt[C]: 200	Tgt[C]: 221	Tgt[C]: 250	Tgt[C]: 0
Aux[C]: 100	Aux[C]: 100	Aux[C]: 100	Aux[C]: 100	Aux[C]: 100

Top Htr: 0 %   Bot Htr: 0 %   Max Bottom Htr Utilization: 50 %

Bottom Heaters

Trigger — Trigger[C]: 60

Sodr-Cam

Instructions: Comments:

XXVI   XXV   XXIV   XXIII   XXII   XXI   XI
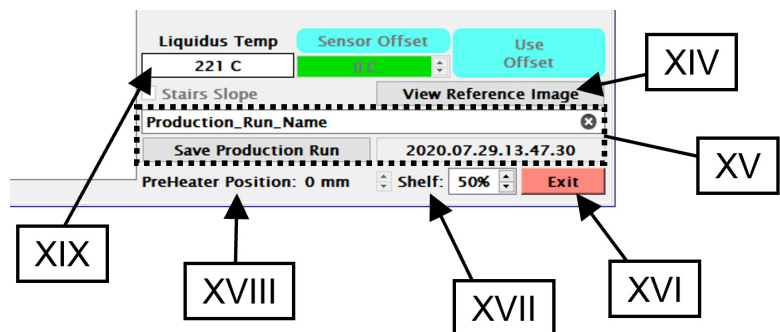
XX. **Comments** – This block can be used by the operator to record information about the production run to a file created by the Save Production Run feature.

XXI. **Instructions** – This block will display information the Developer of the currently loaded profile left at the profile's creation.

XXII. **Sodr-Cam** – This button, when activated, will bring up the viewing window for the Sodr-Cam. Lighting for the Sodr-Cam is adjusted using the knob on the camera. Zoom and focus are done using the onscreen commands.
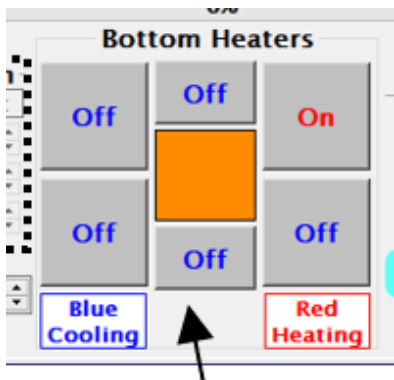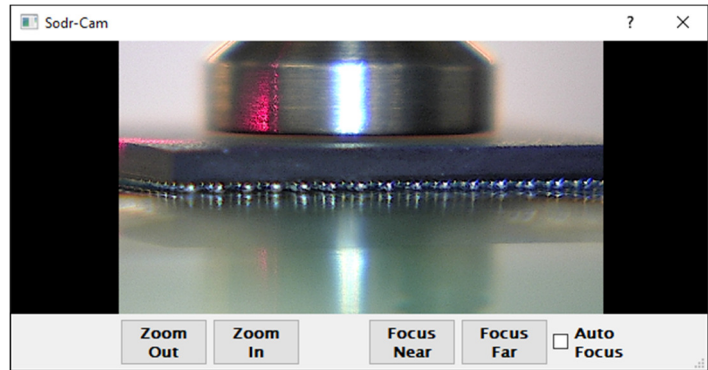
XXIII. **Bottom Heaters** – This section will appear when using an IR4100. The middle square will show what percentage of power (duty cycle) the bottom heater is operating at. Each of the surrounding squares corresponds to one of the auxiliary heaters in the IR4100.

XXIV. **Max. Bottom Htr Utilization** – This is a limit for the maximum power used by the bottom heater during the profile.

XXV. **Profile Phase Indicators** – These colored blocks show the numerical values for the different aspects of each phase of the profile and correspond to the colored indicators on the Profile Graph.

- **Magenta** – Length of time to run before moving to the next phase.
- **Green** – Target temperature for that phase of the profile.
- **Gray** – When using an IR4100, there is an additional indicator for the auxiliary heaters.
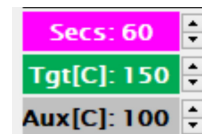

XXVI. **Top Htr/Bot Htr** – These areas are a quick reference point of how much power the machine is applying to the top or bottom heater elements of the machine while it is running.

XXVII. **Progress Bar** – A Visual reference indicating progress status of the process.

XXVIII. **The Profile Graph** – This chart will display real-time information about the temperature profile.

The Profiler Screen (Developer Mode)

The developer mode contains all of the options from the production mode with a few key additions and changes.
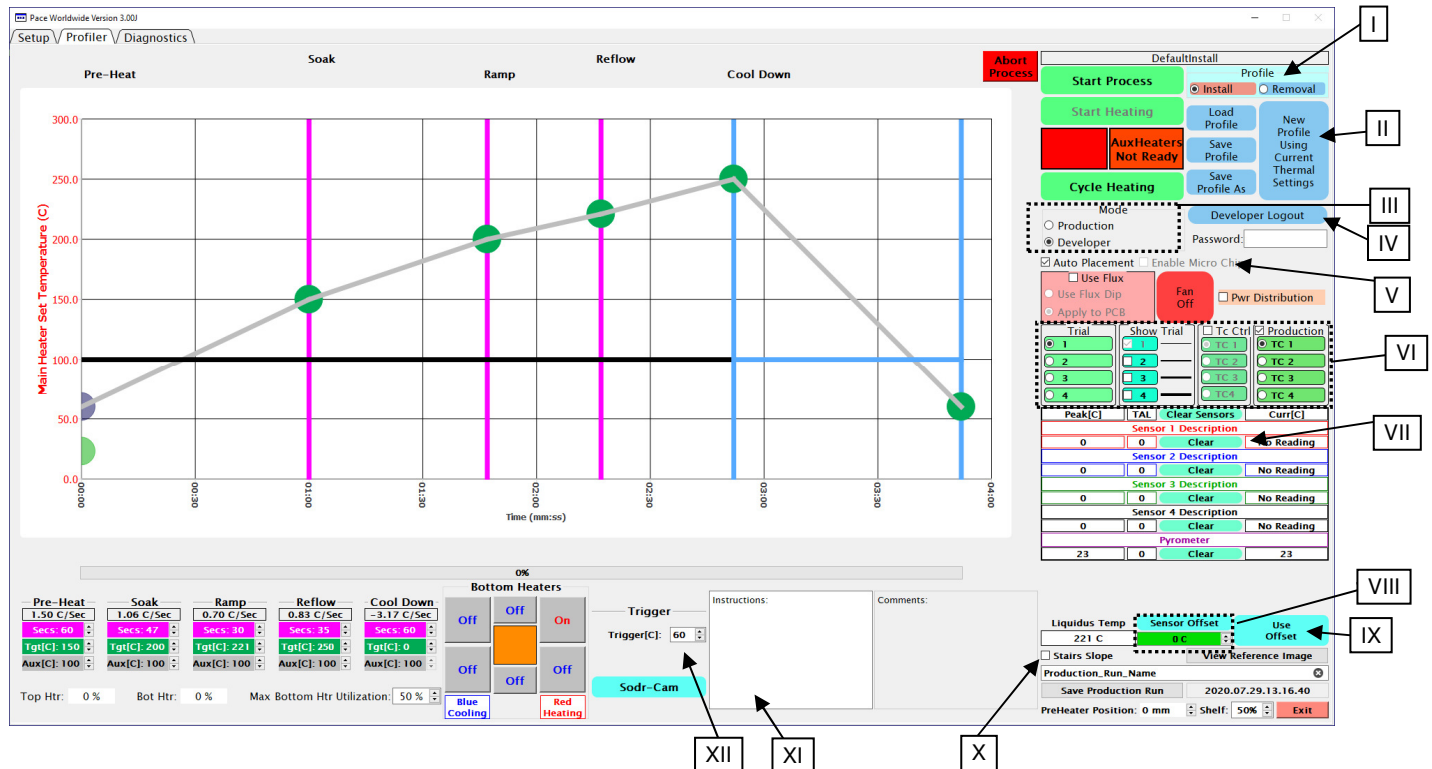
I. **Install/Removal** – Select to create either an Installation or Removal profile.

II. **Profile Buttons**:

- **Load Profile** – Same as the production mode, it will load a previously saved profile.

- **Save Profile** – Click to save the current profile. It is recommended to avoid overwriting the "DefaultInstall" and "DefaultRemove" profiles and to save profiles under a specific name.

- **Save Profile As** – Click to rename profile.

- **New Profile** – Used to create a brand-new profile. Saves existing thermal, time and flow settings on screen, but clears all heater head and camera distance settings used during automatic operations.

III. **Mode Indicator** – Selects how the Profile screen appears, either Production or Developer mode.

IV. **Developer Logout** – Click this to logout of developer mode and continue use in Production mode. Until the developer is logged back in profiles may only be loaded and run, no changes can be made to them.

V. **Automation Options** – The IR-3100 has the capability to remember heater head position to automate different steps in the installation or removal processes.

- **Auto Placement** – When checked, the IR-3100 will automatically place the component using distance settings input during the first profile development run. If unchecked the heater head and component will have to be manually controlled for each placement.

- **Enable Micro Chip** – This automated routine can be used during installation profiles of small components, to pick-up the new component from the board instead of the component nest.

- **Auto Removal** (not pictured) – This option takes the place of the other automation options when creating a removal profile. When checked, the IR-3100 will automatically remove the component at the end of the heating cycle.

VI. **Trial and Graph** options – These four columns control information displayed on the profile graph while a profile is run during development, as well as what is seen by anyone later running the profile from Production Mode.

- **Trial Number** – Selects which trial run is currently active.

- **Show Trial Graph** – Can be used to display the profile graph of multiple trial runs in the Profile Graph Chart for comparison.

- **TC Control** – When selected, this allows the profile to be controlled using the chosen thermocouple instead of the IR pyrometer.

- **Production Sensor** – This is used to select a profile graph from the chosen thermocouple sensor(s) to be displayed on the production screen for reference, once the profile has been saved.

VII. **Clear Sensors** – Pressing clear will reset the current and highest temperature for the respective sensor.

VIII. **Sensor Offset** (for IR Pyrometer) – This input will adjust the pyrometer ±50°c, to compensate for measurement variations that may come from different surface textures/finishes on the electronic components being reworked. Verify by using additional thermocouples or visual observation of solder melt using Sodr-Cam during a trial profile.

IX. **Use Offset** – Click this to use and save the current Sensor Offset to the profile.

X. **Stairs Slope** – Controls how the temperature slope measurement in the profile graph is interacted with. Selecting two points on the same temperature curve will display the *temperature over time* (or slope) for between the two points of the curve. When Stairs Slope is checked, selecting a point outside of an existing slope measurement will create a new measurement from the nearest end of the existing slope. When Stairs Slope is not engaged, selecting a point outside of an existing slope measurement will extend the measurement to that point, but selecting a point inside of the measurement will shorten it.

XI. **Profile instructions/specifications block** – This block can be used to store text notes or instructions about the profile for future reference during production runs. This information cannot be changed by the production mode user.

XII. **Trigger** – The trigger temperature is set for each profile and provides a consistent starting point each time the profile is performed. Represented in the Profile Graph as the first green dot on the left side. The Temperature Trigger Point can be set between 60-150°C by moving the left-most green point up or down on the Profile Graph or manually entering a number in the box.

The Component Alignment Screen
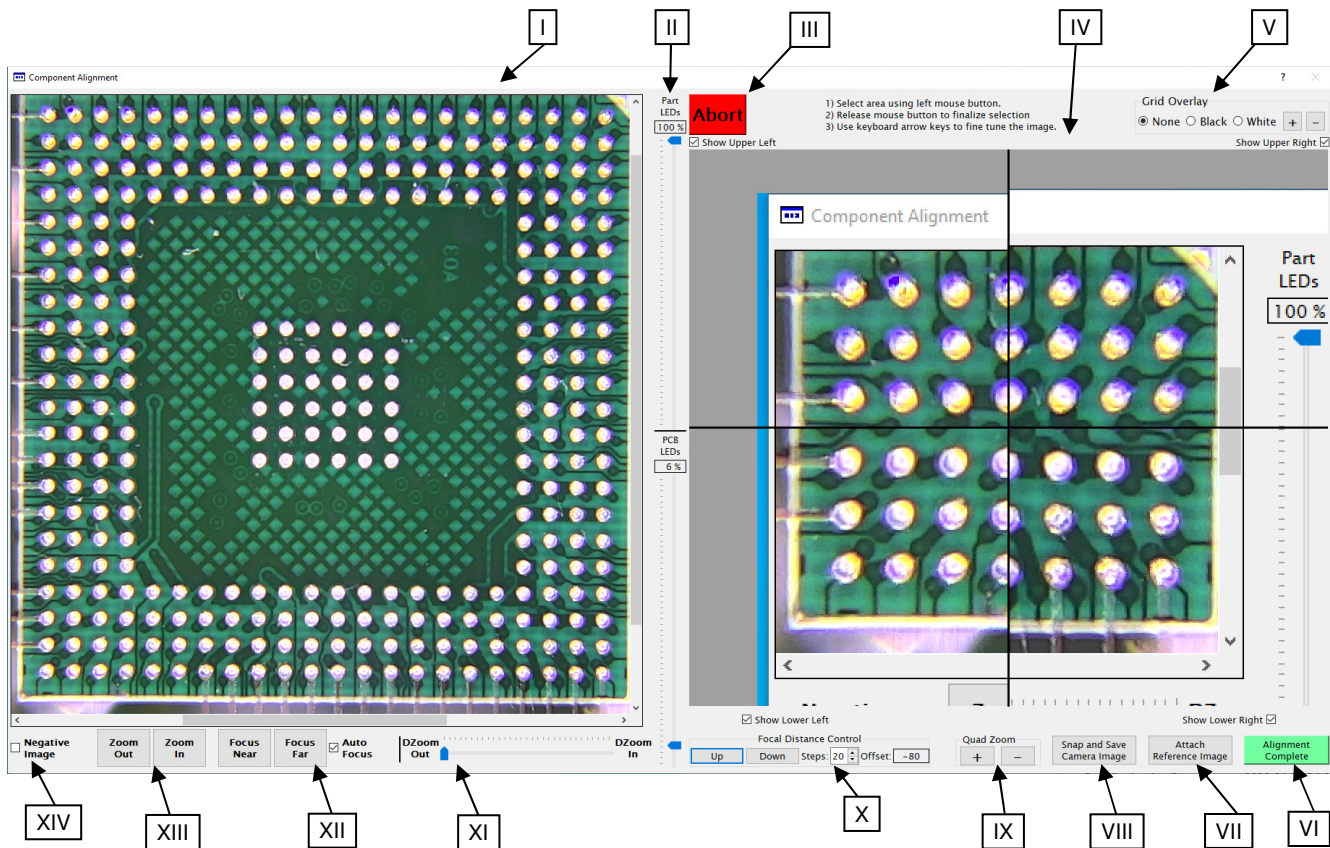
I. **Main Camera Image** – This is the main camera viewport. The viewport shows a combination of looking down at top of the board and looking up at bottom of the component. This allows the user to align the solder balls or leads of a component with the corresponding pads on the board.

II. **LED controls** – The two sliders in this column control LED intensity for the light shining up at the component part and down at the PCB.

III. **Abort** – Pressing this button will abort the operation and return to the previous screen while also returning the heater head and camera arm to their home positions.

IV. **Quad-Field Imaging** – These four viewports, or quadrants, allow portions of the Main Camera Image to be viewed in more detail when fine tuning alignment without the need for adjusting the Main Camera Image. Use this feature by left-clicking a point in the Main Camera Image and the associated Quad-Field viewport will center on that point. Each quadrant can be turned on/off individually.

V. **Grid Overlay** – When selected, this will show grid lines in the Quad-Field Imaging viewports. The grid lines can be set to black or white, and the +/- buttons will adjust the grid size.

VI. **Alignment Complete** – Once the component has been properly aligned, click this button to proceed.

VII. **Attach Reference Image** – Only appears in Developer Mode. Allows the developer to link saved images to a profile for reference during production runs.

VIII. **Snap and Save Camera Image** – Allows the user to capture and save images.

IX. **Quad Zoom** – Use this to increase/decrease digital magnification of the Quad-Field Imaging.
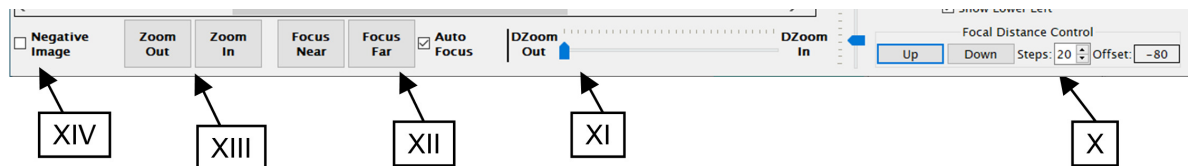
X. **Focal Distance Control** – This allows the developer to adjust the distance between the camera and bottom of the component to match the distance between the camera and top of the PCB to achieve the best image for alignment. The distance between the camera and PCB is not adjustable, but it can be impacted by the PCB thickness and its location on the board holder.

XI. **DZoom** – Used to digitally zoom the Main Camera Image up to 9x. The slider bars below and beside the Main Camera Image can be used to reposition the view.

XII. **Focus** – These buttons can be used to manually adjust the focus of the camera. If Auto Focus is checked, clicking the focus buttons will not change anything.

XIII. **Zoom** – These buttons can be used to manually change the optical zoom of the camera. The slider bars below and beside the Main Camera Image can be used to reposition the view.

XIV. **Negative Image** – This option will invert the colors of the camera images, which the user may find helpful during component alignment.
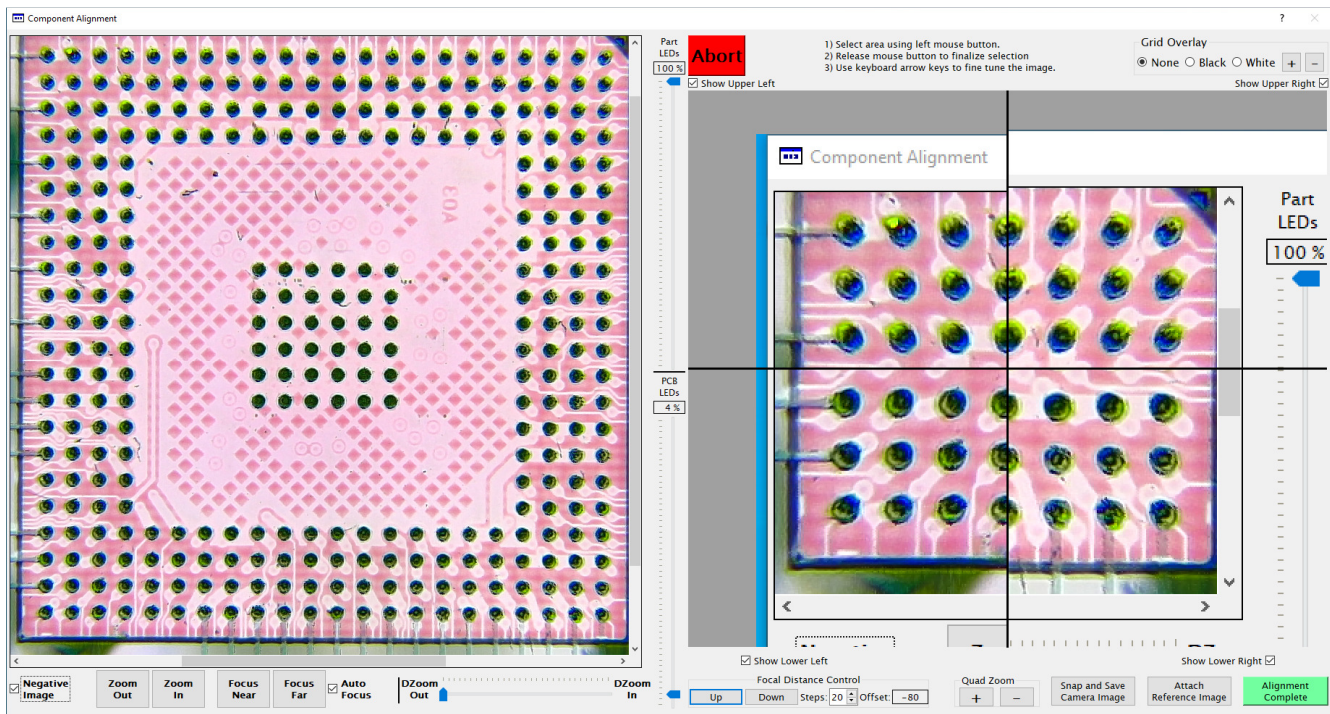
The Setup Screen
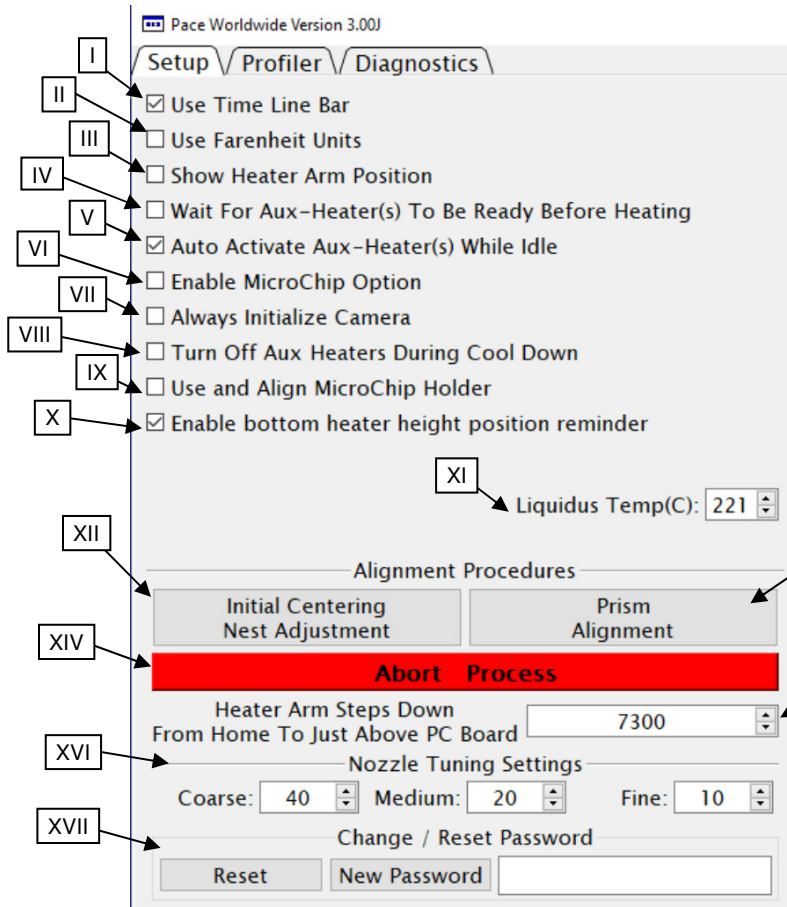
I. **Use Timeline Bar** – Turns on/off the progress bar on the Profile Graph.

II. **Use Fahrenheit Units** – Switches the default temperature units from Celsius to Fahrenheit.

III. **Show Heater Arm Position** – Adds "Arm Pos" to the Profiler screen, which displays a numerical value representative of the heater head position above the board holder.

IV. **Wait for Aux-Heater(s) To Be Ready Before Heating** – Check the box to wait for IR4100 auxiliary heaters to reach set temperature before the Profile can start heating.

V. **Auto Activate Aux-Heater(s) While Idle** – If checked, auxiliary heaters will begin warming when a profile that uses them is loaded, or as soon as a they are turned on when in Developer mode.

VI. **Enable MicroChip Option** – Controls if the Micro Chip automation process will be available for selection during profile creation.

VII. **Always Initialize Camera** – By default, the software keeps the camera active for faster access. Checking this will completely deactivate the camera when not in use.

VIII. **Turn Off Aux Heaters During Cool Down** – A check here will turn off the auxiliary heaters of the IR4100 during the cool down phase.

IX. **Use and Align MicroChip Holder** – This option will allow for the user to exchange the standard component nest with the MicroChip Nest during an installation profile.

X. **Enable bottom heater height position reminder** – Add a reminder at the beginning of a profile run to check the bottom heater height.

XI. **Liquidus Temp (C)** – Enter the liquidus temperature of the solder being used here.

XII. **Initial Centering Nest Adjustment** – This can be used to immediately extend the camera arm and component tray for re-aligning the component nest.

XIII. **Prism Alignment** – This function is used to verify the camera prism is properly aligned.

XIV. **Abort Process** – Stops any action the machine is performing and goes back to the home position.

XV. **Heater Arm Steps Down** – This controls the position the heater head will descend to before initiating auto or manual placement protocols. Default location is 7300.

XVI. **Heater Arm Tuning Settings** – The settings here control how many steps the heater head will move when the respective button is pushed during manual positioning.

XVII. **Password Reset** – The items in this section are used to reset or change the developer password. If the current password is forgotten, you will need to contact PACE for a temporary access code.
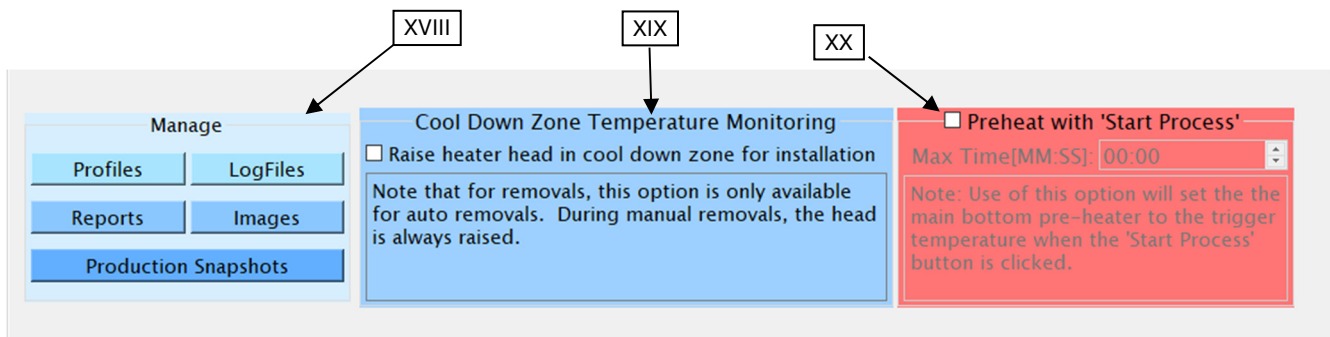
XVIII. **Manage** – This section of the setup screen hosts several shortcuts leading directly to the folders containing the information stored by the TF software. The default locations for these folders are;

- "C:/Pace/Profiles" – Where profiles are stored as .dat file along with an .pdf showing an image of the developer's Profiler Screen.

- "C:/Pace/LogFiles" – This folder has the logs containing time stamped .csv files from the sensor, heater, and flow meter for profiles ran with the Log Data box checked on the Profile Screen.

- "C:/Pace/Reports" – The .pdf reports created when "Save Production Run" is utilized from the Profile Screen are stored here.

- "C:/Pace/Images" -- This is the storehouse of .jpg images the developer has put in for reference during profiles run in production mode.

- "C:/Pace/Snapshots" -- This is the storehouse of .jpg images saved from profiles run in production mode for later examination.

XIX. **Cool Down Zone Temperature Monitoring** – This option will toggle between leaving the heater head in the lower position or during the Cool Down Zone or raising the heater head at the end of the Reflow Zone. Leaving the head down may decrease the cooling rate but it will keep the IR pyrometer on target for continued monitoring of temperature change until the Cool Down Zone has ended.

XX. **Preheat with 'Start Process'** – If selected, this will activate the bottom heater to begin preheating the PCB when clicking the Start Process button. If unchecked, the bottom heater will not be activated until the Start Heating button is clicked on. In either case, the bottom heater will heat up to the selected Target Temperature.

The Diagnostics Screen

The Diagnostics Screen is used to troubleshoot and test various aspects of the IR-3100 machine. The screen can be broken down into three sections. The Setup Commands can be used to have the machine perform an action. The different Status Request Commands will inform the user of what the software believes to be the current setting, position or status of the different parts of the machine. The bottom area contains read outs for the Status Request commands.

Setup Cmds

- ◉ Lower
- ○ Upper
- ○ Ring
- ○ Shelf
- 0 counts

LEDs Control

- ◉ Up
- ○ Down

Pick Solenoid

- ◉ In
- ○ Out

Optic Camera

View Optic Camera

- ☐ Off
- ○ Nitrogen
- ◉ Blower

15 LPM

Blower

Cooling Fan

Vacuum

Laser Pointer

IR Laser Pointer

- ◉ Main
- ○ Calibration

Camera Link

0 * 5ms

Beep Time

Heater Duty

0 %

Heater Temp (ºF)

0

Pre Htr # 1

Pre Htr Temp (ºF)

0

Heater Arm Pick

Heater Arm Home

Heater Arm Up

Steps: 1

Heater Arm Down

0000

To the left is the Setup Commands portion of the Diagnostics screen. Each box deals with activating a different aspect of the IR machine. The user can select or change options, then press the associated button in the box to implement the changes.

For example, the vacuum pick can be made to move into the up position by first selecting the up bubble and then pressing the button labeled "Pick Solenoid" to activate the command.

The red buttons in the middle will turn on/off the respective item. The button will turn green to indicate the item is on.

Below are the Status Request Commands. These will display what information the machine and software are sharing. Checking the "Display ASCII Sent/Received Packets" box will output information that may be helpful when attempting to diagnose problems the machine may be having or for simply examining in greater detail how different parts/functions of the machine operate.

Status Request Cmds

Htr Set Temp	Control Sensor	Optic Cam Pos
Htr On Time	Laser Pointer	Camera Link
Pre Htr Set Temp	IR Laser Pointer	LEDs Control
Pre Htr Actual Temp	TBD	TBD
Htr Core	Flowrate	Unit ID
Pre Htr Time	Blower	PreHtr Ver
Pre Heater Duty	Vacuum	Main Version
Heater Arm Pos	Cooling Fan	Errors
TC # 1	Heater/IR Temp	Comm Check
Thermocouples	Pick Solenoid	Abort

☐ Display ASCII Sent / Received Packets

ASCII Sent   ASCII Received   Status Details

Operation

General Overview

There are many variables that need to be considered for each component removal or installation. Acceptable ramp rates and maximum temperatures of the items used in the operation should be obtained from the appropriate sources. The rework cycle can generally be broken down into five parts as follows;

Pre-heat Phase

This part of the cycle is primarily to warm the work piece up to a low, even temperature to reduce the chance of thermal shock or stress damage to the components being worked on, as well as components elsewhere on the PCB.

Soak Phase

The soak phase allows the temperatures to further normalize across the PCB and components while also beginning to gently bring the temperature up in preparation for the push through the ramp and reflow phases. Boards with large ground planes or other heat-sinking materials and components will benefit from a longer soak period to ensure uniform temperatures.

Ramp Phase

The ramp phase is an important transition zone between the soak phase and the reflow phase. It can be used to gently transition from the soak zone target temperature into solder melt temperature or it can be used as part of the reflow zone to provide additional bottom-side heat in thermally challenging applications.

Reflow Phase

This is where everything comes together and the solder reaches liquidus. **The lowest set temperature possible should be used to ensure safety of the component and PCB.** Refer to manufacturer specifications for temperature requirements of the materials being used.

Cool Down Phase

The cool down phase is used to bring the temperature of the component, solder joints, and PCB down below solder melt or reflow temperatures. This is beneficial for plastic component packages which can hold heat for a long time. Some components (such as CBGA or ceramic ball grid arrays) should be allowed to cool naturally without any external assistance. These types of components are sensitive to thermal shock and can be damaged by heating or cooling too quickly.

Procedure

It is recommended to conduct a trial operation each day before commencing with production to ensure the heater temperatures will be uniform and that everything is operating correctly.

Before operation, check for any components on both the top and bottom of the PCB that may not fit in the machine. Ensure the components are not going to crash into the heater head or camera arm as they move up/down and in/out. Also check that the bottom heater will not be obstructed and does not make physical contact with components on the board as this could cause uneven heating.

Production Mode

Example component installation – Note: If at any time you need to abort the process, click on the red "Abort" button.

1) First, power on the IR machine then PC, then initialize the software.
2) Navigate to the Profiler screen, if not already there.
3) Load a profile using the Load Profile button.
4) Install vacuum pick.
5) If desired use appropriate heater baffle.
6) Click "Start Process" and follow the onscreen instructions which will guide you through the following steps.
7) Place the PCB between the arms of the board holder and position the board so the red laser point is in the center of the placement site and tighten the board holder retention screw.
8) Adjust the Board Support Wand as needed.
9) Place the component in the mounting plate on top of the camera housing. Click "Okay".
10) The BGA workstation will pick up component. If the vacuum pick fails to pick up the component, reset the component in the nest and click "Retry".
11) Slide component nest out of the way, towards the back of the machine so the optics are unobstructed.
12) If Auto Flux Dip is selected, replace the component nest with the flux dip tray and follow onscreen directions. After fluxing is complete, restore flux dip tray and component nest to their original locations.
13) The component alignment screen will appear and the heater head will move down to the focal position.
14) Adjust the zoom and lighting as needed in order to see the pads on the PCB as well as the solder balls or leads on the component. Then using the theta adjustment and X/Y micrometers, align the component to the PCB.
15) After alignment is complete, click the Alignment Complete button to prepare for heating.
16) If Apply flux to PCB is active, the heater head will remain stationary and will guide applying flux to board. Then hit Okay.
17) The heater head will place the component into position over the board.
18) Verify bottom heater height reminder may appear.
19) Make sure IR Pyrometer or external thermocouples being used are in the correct location and click the Start Heating Button.
20) The selected temperature profile will run.
21) Allow the PCB to cool and remove.

Example component removal – Note: If at any time you need to abort the process, click on the red "Abort" button.

1) First, power on the IR machine then PC, then initialize the software.

2) Navigate to the Profiler Screen if not already there.
3) Load a removal profile using the Load Profile button.
4) Install the proper vacuum pick.
5) If desired use appropriate heater baffle
6) Click "Start Process" and follow the onscreen instructions which will guide you through the remainder of the procedure outlined in the following steps.
7) Place the PCB between the arms on the board holder and tighten the retention screw.
8) Position the board so the red laser point is roughly in the center of the component, click "Okay".
9) The camera will come out for aligning the vacuum pick to center of component precisely.
10) When done, press "Alignment complete" and the camera will retract. Now is a good time to verify the bottom heater height.
11) Align pyrometers/thermocouples, "Okay".
12) Press "Start heating".
13) Allow PCB and component to cool before touching.

Developer Mode

Developer Mode has all the same features of Production Mode, with a few additions to allow the creation and editing of installation and removal profiles.

Adjusting the parameters for each phase or step of the profile is done by moving the colored bars in each phase. More precise settings can be input using the up/down arrows next to each entry at the bottom of the temperature profile graph.

- Magenta – Time in seconds
- Green –Target temperature
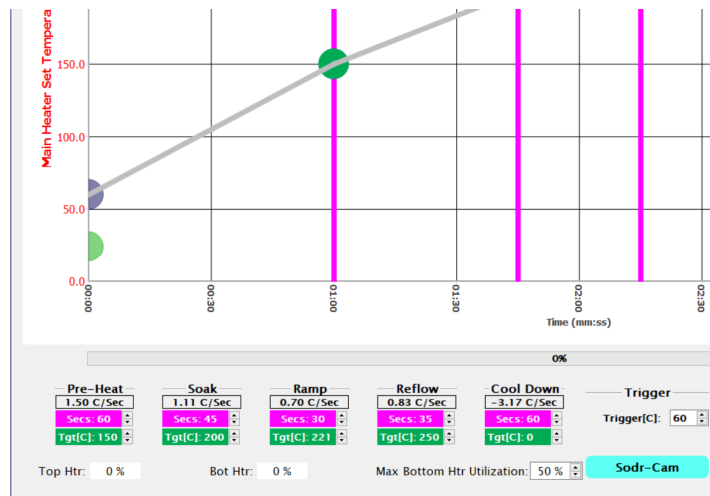
During the profile development process, up to 4 "trial runs" can be made/viewed for comparing and contrasting how well different settings work on a given application. The information displayed in each trial run can be altered using the buttons and check boxes above the temperature sensor readouts.

- Trial Number – This column designates which trial run is currently active for editing or being saved to the finished profile for reference in production runs.

- Show Trial – Select which trial run profile graphs are currently visible.

- Tc Ctrl –Use this to select one of the external thermocouple sensors instead of the pyrometer for controlling the temperature during a profile run.

- Production – Select external thermocouple temperature graph(s) to be visible as reference during production runs of the profile.

Sensor descriptions can be changed by the profile developer to better indicate to the production user where the sensors were located during profile creation.

Your new IR machine will come with default installation and removal profiles. These can be used as starting points for new custom profiles. The IR software will memorize the distance traveled by the heater head during some parts of an installation or removal process. The included default profiles do not have any distances stored. When altering any other pre-existing profile to work with different components, after loading the profile you must clear the distance settings with the "New Profile" button or the heater head could crash.

Following is a sample outline of steps needed to develop an installation profile by doing a new component installation. The process is essentially the same as doing a production run, except with the ability to make changes.

1. Turn on the IR machine and the PC, then start the PACE software.
2. Navigate to the Developer Mode screen if not already there.
3. Load a profile using the Load Profile button.
4. Install the proper vacuum pick.
5. Click "Start Process" and follow the onscreen instructions which will guide you through the following steps.
6. Place the PCB between the arms of the board holder and position the board so the red laser point is roughly in the center of the component placement site then tighten the retention screw.
7. Apply flux to the board if needed, and attach any thermocouples desired for additional process monitoring. Adjust the board support to the middle of the board.
8. Place the component in the mounting plate on top of the camera housing. Click "okay".
9. The BGA workstation will pick up component. If the vacuum pick fails to pick up the component, reset the component in the nest and click "Retry".

10. If Auto Flux Dip is checked, replace the component nest with the flux dip tray and follow onscreen instructions. After fluxing is complete, restore flux dip tray and component nest to their original locations.
11. Slide component nest out of the way, towards the back of the machine so the optics are unobstructed.
12. The component alignment screen will come up and the heater head will move down towards the focal position.
13. Adjust the zoom and lighting as needed in order to see the pads on the PCB as well as the solder balls or leads on the component. Then, using the theta adjustment and X/Y micrometers, align the component to the PCB.
14. After alignment is complete, click the Alignment Complete button to prepare for heating.
15. If Auto Placement is active, the heater head will lower the component into position over the board. Otherwise, use the onscreen adjustments to manually lower the heater head into final position.
16. Align the IR Pyrometer to the desired location using the laser indicator and click the "Start Heating" button.
17. The IR unit will run the selected temperature profile.
18. Allow the PCB to cool and remove.

If the component installation was successful, it is a good idea to try it once more to check for consistency and then save it! If the component installation was not successful, examine the situation and make changes to the profile for another trial run. Temperature graphs from up to 3 previous trial runs will be available for comparison to current settings. When saving a profile, don't forget to select the primary temperature sensor for future reference when repeating the profile in production mode.

Small Components

The IR-3100 is capable of working with very small components, as small as 1mm square. When working with components ranging from 5mm down to 1mm there are some additional steps required for accurate placement during installation procedures.

The standard Centering Nest can accommodate components between the sizes of 65mm and 5mm. To work with smaller components, between 1mm and 5mm, the Centering Nest can be replaced with the optional Microchip Nest, item 6993-0312. An in-program walk through of this process is added to a profile whenever the "Align Holder" box is checked.

<u>Maintenance</u>

LUBRICATION:

The horizontal rails of the board holder should be checked daily for debris and dry spots. The rails can be cleaned and lubricated by wiping with an ISOVG32 oil (such as; Mobil Vactra No. 2 SLC, Mobil DTE Light 32, Shell Tonna S2 M 32) with a lint-free cloth or sponge. A light coating should be left in the ball races. Avoid applying excessive amounts, which may pose a fire hazard near the preheater.

The two vertical rails should be lubricated if the heater head is sticking or stuttering. All rail covers will need to be removed (4 screws and brackets) in order to access the outer races. Apply ISOVG220 grease (Mobil Vactra No 4) to rails. Depending on the service conditions, the rails should be lubricated as a preventative measure at least annually.

Vacuum pick bearings should be checked if pick does not fully descend to bottom position. Must remove theta adjust knob and 4 screws to remove heater head cover, and 4 screws to remove the IR pyrometer sensor assembly. Carefully clean off dust or debris from exposed parts of the vacuum tube with an anti-dust aerosol or lint-free cloth. Apply a thin coat of NLGI Grade 2 lubricant (suggested Dupont Krytox GPL 205) to the circumference of vacuum tube near each bearing. Next, manually move the vacuum pick up/down to allow grease to contact the balls; rotate the theta adjust knob and repeat the up/down movement. Depending on the service conditions, the bearings should be lubricated as a preventative measure at least annually.

VACUUM LINE FILTER
Check VisiFilter (rear door)

VisiFilter (1309-0020-P1) <u>TF-1800 pictured</u>

PACE worldwide

5050-0599   INSTR, HTR BULB REPLACEMENT, IR3100/4100   Rev. A
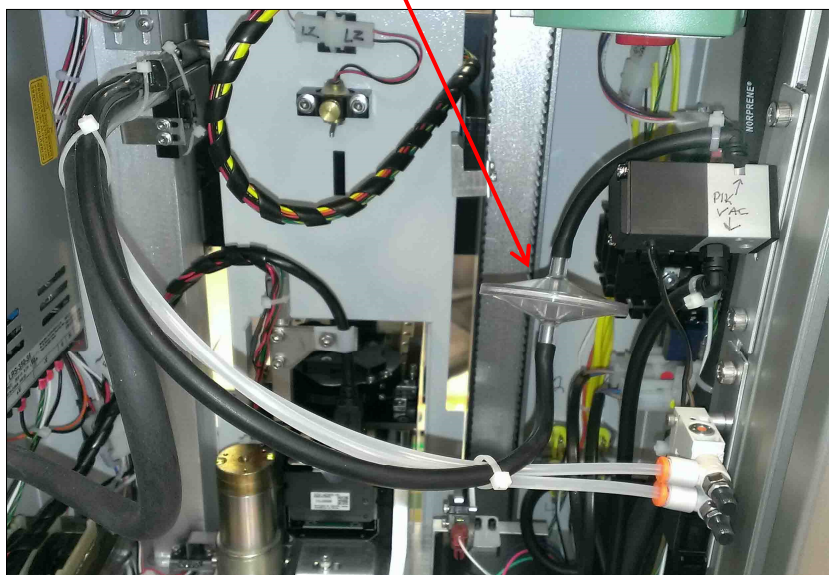
Installation Instructions for IR3100/4100 Top Heater Bulb Replacement

PARTS LIST

Item	Description
1	Knob, Theta Adjust
2	Cover, Heater Head
3	Screw, 4-40, 1/16" hex key
4	Screw, 4-40, 3/32" hex key
5	Pyrometer Assembly
6	Screw, 6-32, 7/64" hex key
7	Set Screw, 1/16" hex key
8	Knurled Thumb Nut
9	Heater Element (Right and Left)
10	Left Heater power leads
11	Right Heater power leads
12	Heater Terminal Block

DETAIL A

Lead length exaggerated for clarity.
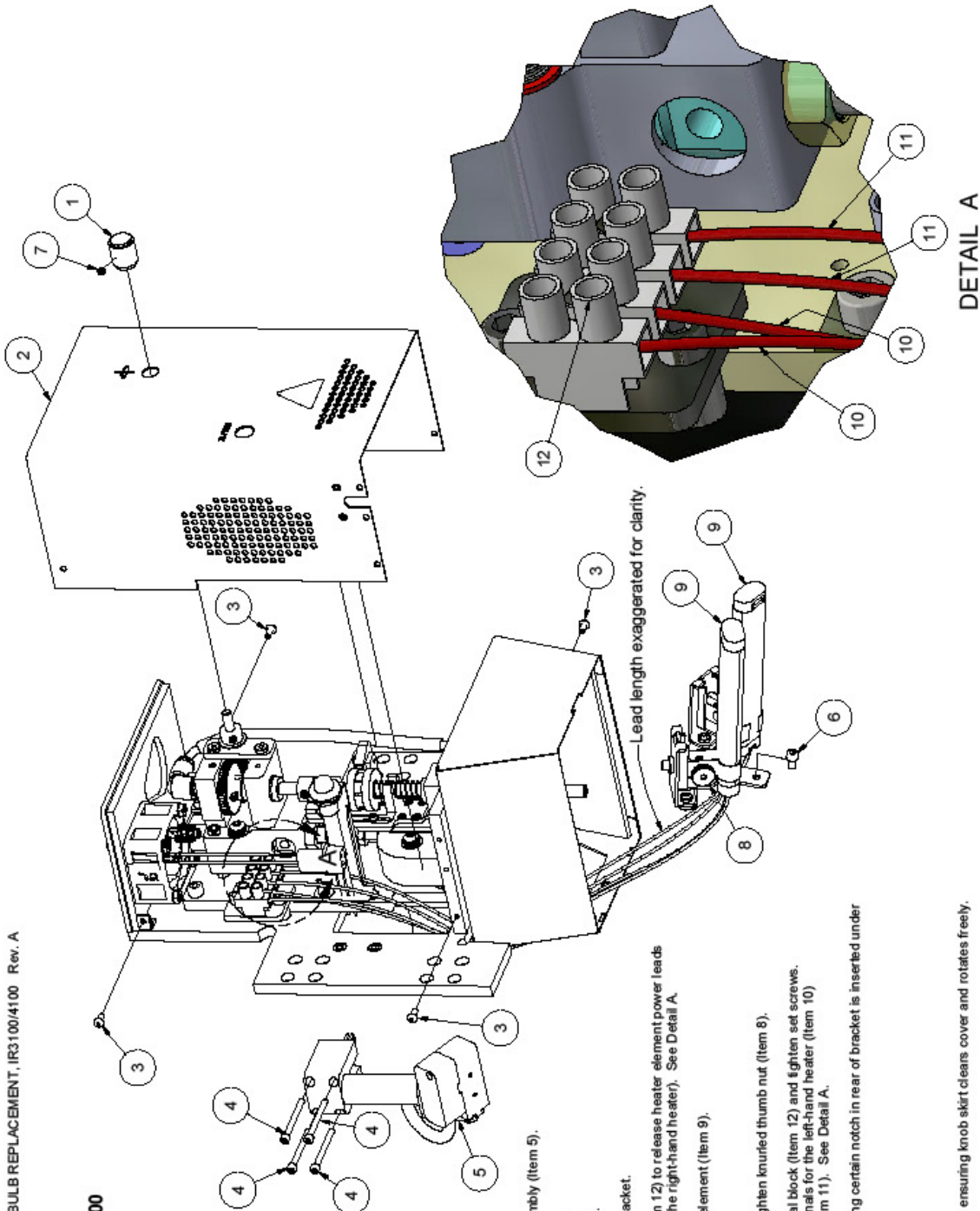
REMOVAL INSTRUCTIONS:

1. Remove 4 screws (Item 4) to release pyrometer assembly (Item 5).

2. Loosen set screw (Item 7) and remove knob (Item 1).

3. Remove 4 screws (Item 3) and remove cover (Item 2).

4. Remove screw (Item 6) to release heater mounting bracket.

5. Loosen lower set screws in heater terminal block (Item 12) to release heater element power leads (i.e., Items 10 for the left-hand heater or Items 11 for the right-hand heater).   See Detail A.

6. Loosen knurled thumb nut (Item 8) to remove heater element (Item 9).

INSTALLATION INSTRUCTIONS:

1. Insert new heater element (Item 9) into bracket and tighten knurled thumb nut (Item 8).

2. Route power leads as shown. Insert leads into terminal block (Item 12) and tighten set screws. Note there is no polarity requirement for the two terminals for the left-hand heater (Item 10) and for the two terminals for the right-hand heater (Item 11).   See Detail A.

3. Insert heater element assembly into heater box, making certain notch in rear of bracket is inserted under tab in heater box. Then reinstall screw (Item 6).

4. Reinstall cover (Item 2) with 4 screws (Item 3).

5. Reinstall pyrometer (Item 5) with 4 screws (Item 4).

6. Reinstall knob (Item 1) and tighten set screw (Item 7), ensuring knob skirt clears cover and rotates freely.

Warranty

PACE warrants that this equipment will be free of defects in materials and workmanship for a period of one (1) year from the date of receipt by the first user.

This warranty does not cover repair of replacement required as a result of misuse, mishandling or improper storage. Failure to perform recommended routine maintenance, alterations or repairs made other than in accordance with PACE's directions, or removal or alteration of identification plates in any way will void this warranty. This warranty is available only to the first user, but the exclusions and limitations therein apply to all persons and entities.

This warranty does not apply to consumable items such as filters.

PACE MAKES NO OTHER WARRANTY, EXPRESSED OR IMPLIED, AND MAKES NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

PACE will, at its option, repair or replace and defective equipment or parts at its facility or other location approved by it at no charge to the user, or provide parts without charge for installation by the user in the field at the user's expense and risk. User will be responsible for all costs of shipping equipment to PACE or other warranty location for warranty service.

EXCEPT FOR THE REMEDY ABOVE DESCRIBED, UNLESS OTHERWISE REQUIRED BY APPLICABLE LAW, PACE WILL HAVE NO OTHER OBLIGATION WITH REGARD TO ANY BREACH OF WARRANTY OR OTHER CLAIM WITH RESPECT TO THE EQUIPMENT, OR LIABILITY FOR ANY DIRECT, INDIRECT, CONSEQUENTIAL, OR INCIDENTAL LOSS OR DAMAGE CAUSED BY OR OCCURRING IN CONNECTION WITH ANY OF THE EQUIPMENT.

To obtain warranty service, contact the appropriate PACE company listed below

Do NOT return defective equipment or parts to PACE without obtaining prior authorization.

Any warranty or other claim with respect to the equipment must be made in writing and delivered to PACE (or local authorized PACE Distributor outside the U.S.) within a reasonable time of the expiration date of this warranty. Sufficient evidence of purchase and date of receipt must also be included, otherwise user's rights under this warranty shall be deemed waived.

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