MACHINE SOLUTIONS INC.

BEAHM DESIGNS THERMAL TRAVERSER

MODEL 710-A

Equipment User Manual

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Equipment User Manual

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PM-58279 Rev E

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WELCOME

Machine Solutions, Inc. (MSI) would like to take this opportunity to thank you for purchasing your new 710-A Thermal Traverser machine. At MSI, we are dedicated to bringing innovative process development solutions to both medical device and nonmedical organizations. The MSI proprietary segmental technology has been successfully implemented in manufacturing clean rooms on five continents, and continues to expand – meeting, growing, and facilitating the abilities of device companies around the globe. MSI looks forward to helping your organization provide life-improving devices to your customers, today and tomorrow.

MACHINE DESCRIPTION

The Beahm Designs Inc. Model 710-A Thermal Traverser is a system for the purpose of recovering heat shrinkable materials onto a catheter shaft type of substrate by means of traversing a thermal nozzle along the length of the materials at a controlled speed.

SAFETY

- Use of eye protection when working with compressed gases and heated materials is advised.
- The maximum observed Sound Pressure Level is below 70 dBA.
- Nozzle will become hot during operation and, depending on temperature set point, can cause severe skin burns if contact occurs.

Caution: high voltage. Remove power and use safety precautions when servicing.

Caution: hot surface. Contact may cause burn. Allow to cool before servicing.

Caution: pinch point. Keep hands and body parts clear while in operation.

USER ALERTS

Do not use the equipment other than as prescribed. Examples: Do not attempt to sit on or climb on the equipment. Do not place heavy objects or containers of liquid on the machine. Do not insert any foreign objects into the machine. Do not attempt to defeat any guards or otherwise operate the machine in any manner other than that in which it is explicitly intended.

Note: The equipment is not for use with materials that can decompose or ignite below the maximum operating temperature of the machine. Hazards are materials that outgas hazardous substances and or ignite. (260°C/500°F).

Note: This equipment is not for use in an ATEX environment.

CONTENTS

Included with the system are the following contents:
1. IEC Power Cord

UNCRATING

Caution: This machine weighs minimum 185 lb. Safety standards require a minimum of two people to life the lift this machine.

1. Remove the front panel of the crate.
2. Place the crate on the edge of a bench with a corner overhanging. Remove the hex screws. The crate must remain in an upright position.
3. Remove the machine from the crate.

INSTALLATION

Caution: heavy. Do not attempt to move the machine manually. Due to its weight, the machine should be moved with a forklift and placed on a reinforced surface. If a forklift is not available, then ensure adequate personnel and mechanical aids are used.

Note: It is recommended that this equipment be placed at a height where the machine is at an ergonomically viable height for the user population.

1. Place the system on a level, sturdy surface.
2. Connect the power cord to the system and then to a 120 or 220 VAC 50/60 Hz. outlet (Refer to MSI sticker on machine for voltage).
3. Connect an air supply hose to the system and then to a clean, dry, and filtered compressed air source.

PROCESS OVERVIEW

The Shrink Laminator is used to heat shrink material on a single catheter assembly. Variable speed and distance controls allow the shrinking to start at any position on the assembly. A fixture grips the devices to be processed. A heater array is mounted on a linear actuator. After the heater array is moved to the home position, the operator installs the catheter in the grip mechanism. The hot air system is brought to the correct temperature. When the process is started, the heater array is moved to a start position. The heater assembly is moved out to the catheter, then the heater array is moved across the length of the catheter through up to eight speed zones. The heater array is retracted and returns to the loading position. The operator can select a recipe from a set of 100 recipe files using a barcode scanner. Each file contains the variables used by the process sequence. A passcode is used to control access to the recipe settings, machine settings, and several test screens on the HMI.

LAMINATOR SETTINGS AND RECIPE CONTROLS

The settings for the laminator are adjustments that are rarely altered. The recipe controls allow easy process development with storage of the recipe when a good process has been established.

Alternate Display Units

The laminator's native units for distance are millimeters. The native temperature units are degrees Fahrenheit. The HMI is organized to show the user's preferred units. For each distance, speed, and temperature on the operating screens, one of two text strings are displayed.

- Distance: mm or inch
- Speed: mm/S or IPS
- Temperature: °F or °C

The settings table and internal recipe storage are maintained in mm and °F.

Passcode Required to Change Settings

Changes to the settings require the entry of a user passcode. Two different user passcodes are adjustable in the settings. A passcode of "2694" is hard coded into the passcode logic. The passcode is cleared after a time delay passes when the HMI is displaying the Run Parts screen. The time delay is adjustable in the settings and can be defeated by setting the timeout to ZERO.

Laminator Setting Values

The laminator settings are shown in the table below. Each setting has a minimum and maximum value that restricts the data entry keypad's range. The min/max is user adjustable.

Table 1. Laminator Setting Values

Laminator Setting	Default	Default Range	Description
s00. Temperature Units (0 or 1)	0 = °F	-	Enter a 1 to select °C
s01. Distance Units (0 or 1)	0 = mm and mm/s	-	Enter a 1 to select inch and IPS.
s02. Actuator Home Speed mm/S	25	50-200	Actuator speed to seek the left limit switch.
s03. Actuator Fast Speed mm/S	45	50-300	Actuator speed used to find the upper travel limit. Also sets the maximum recipe speed.
s04. Actuator Slow Speed mm/S	5	2-100	Actuator speed to find home position off the upper travel limit
s05 Actuator Acceleration mm/S/sec	2000	500-2000	Actuator acceleration for speed changes.
s06. Actuator Steps per mm	836	200-20000	Number of step pulses to move 1 mm
s07. Maximum Length	600	500-3000	Sets the tool length. Sets the maximum positions in the recipe.
s08. Minimum Start Position mm	0	0-250	Sets the minimum heater array position relative to the grip elevator to avoid tooling crashes when the thruster extends the heater.
s09. Overtemp Setpoint °F	750	500-750	Temperature limit
s10. Max Temperature Setpoint °F	750	0-750	Limits heater setpoint entries.
s11. Temp Deviation Limit °F	±5.0	1-100	Heater deviation band for acceptable temperatures.
s12. Heater Cool off Temperature ºF	120	80-140	Temperature limit for stopping the airflow through the MFC.
s13. Minimum Recipe Speed mm/sec	0.01	0.01-1	Lowest acceptable recipe speed setting.
s14.	0	0	Spare

s15. MFC Full Scale Flow LPM	*50.00	40-60	Calibration value for the heater MFC.
*The value for setting s15 MFC Full Scale Flow is factory set to 50.00 LPM at MSI. Although this value is adjustable, MSI strongly recommends not changing this value as any modifications to this value from 50.00 LPM will change the performance of flow through the MFC, changing the relationship between Parameter in process to the output from the MFC.			
s16. MFC Deviation Limit LPM	±0.4	0.1-2	Flow deviation limit for heater zone airflow. Range enforced by PLC logic.
s17. MFC Minimum Rate LPM	15	10-47	Calibration for the Cooling Jet MFC.
s18. Grip Full Scale Pressure PSIG	130	60-140	Nameplate from regulator
s19. Grip Deviation Limit PSIG	2	0.1-10	Allowable process deviation
s20.	0	0	Sapre
s21. Zone 1 Control TC Offset °F	0	-25 to 25	Offset added to thermocouple reading
s22. to s25.	0	0	Spare
s26. Use Thruster (0 or 1)	1= YES	-	Option to disable the heater thruster.
s27. Use Barcode Scanner (0 or 1)	1= YES	-	Operator must use the scanner to select a recipe.
s28. to s35.	0	0	Spare
s37. Passcode Timeout secs	0= NO	0-9999	The user passcode is cleared after this time interval when observing the RUN PARTS screen. If set to zero, there is no timeout.
User Passcode Code 1	1	1-99999	Access code for settings and screens
User Passcode Code 2	2	1-99999	Second access code.

Recipe Settings and Descriptions

100 different recipes are stored in the PLC. The operator optionally uses a barcode scanner to select a recipe. With a valid passcode entered, the recipe can be selected from a list. The passcode is required to make alterations and to save a recipe in the database. Many recipe entries are restricted by the settings noted above. For example, heater temperature is limited by setting s10. The recipe is a collection of setpoints that are directly copied to the machine controls when the recipe is selected.

Information Messages

Information Messages are overlays triggered by the PLC. The messages are cleared from the display after a few seconds.

Table 2. Information Messages

Msg	Information Messages	Description
1	Passcode Required to Change this Item	Access code required.
2	Entry was too High or Low	Appears if a blank recipe was selected, indicates one or more recipe settings was changed.
4	Passcode is CLEARED	Access code was cleared by timeout or entry of an invalid code.
5	Barcode Saved into this Recipe	Confirms barcode association was successful
6	Barcode Match - First Match File Selected	Match was found for the barcode with an existing recipe.
7	No Match Found for this Barcode	No recipe file matched the scanned code.

Alarms

The PLC monitors the laminator for multiple alarm conditions. When an alarm occurs, it brings up an alarm overlay banner on the HMI. The HMI stores the alarm time and the alarm text in an alarm log.

Table 3. Alarm Messages

Alarm Message	Comments
Alm00. PLC I/O Module Failure	Fault on one or more Compact I/O modules
Alm01. Eurotherm Mini8 Comms Fault	Ethernet communications not OK
Alm02. Eurotherm Mini8 Program Fault	
Alm03. MFC Feedback Open Circuit	4/20 mA input loop is open.
Alm04. Grip Regulator Feedback Open Circuit	4/20 mA input loop is open.
Alm05. Heater Array Drive Fault	Software or hardware fault
Alm06. Actuator Negative Limit Switch Trip	Ran into limit while processing
Alm07. Actuator Positive Limit Switch Trip	Ran into limit while processing
Alm09. Heater Broken Overtemp Thermocouple	No thermocouple report from Mini8
Alm10. Heater Broken Thermocouple	No thermocouple report from Mini8
Alm11. Heater Overtemp Trip	Overtemperature thermocouple reading above setting limit.
Alm12. Heater Temp Deviation Trip	Left deviation band while processing.
Alm13. Heater Airflow Deviation Trip	Left deviation band while processing.
Alm14. Grip Pressure Deviation Trip	Left deviation band while processing.
Alm15. Thruster Extend/Retract Failure	Extend or retract limit not made.
Alm16. Heat Shield Open/Close Failure	Open or close limit not made.

Alarms While Processing

If any alarm occurs during lamination, the thruster is immediately retracted, and the heater array motion is stopped. The operator must push CYCLE STOP to clear the alarm.

After the alarm is cleared, the heater array and grip elevator are brought to the load position so the faulted parts can be removed.

Airflow and Temperature Alarms

The airflow and temperature alarms are enabled only when processing and only if a part is installed in the grip.

Warnings

Warnings are shown on the HMI "Run Parts" screen as an aid to the operator.

Table 4. Warning Messages

Warning Message	Comments
Warn00. Controls Not Reset	Safety relay is not reset.
Warn05. Process Door is Not Locked	
Warn06. Door Interlock is Bypassed	Passcode needed to access the bypass button on the Settings screen.
Warn08. Passcode has Unlocked Controls	
Warn09. Auto Tuning in Progress	n/a
Warn31. PLC Memory Reloaded from SD Card!	PLC memory fault has caused the program to reload from the backup card. Also logged to the alarm log.

SET UP AND CONFIGURATION

Proper sizing of the thermal nozzle and alignment of the tooling are crucial to optimizing process results and repeatability. The following guidelines are the recommended methods; however all applications vary, and several iterations of tooling process development may be required and may not follow all the recommended guidelines.

Thermal Nozzle Diameter - The nozzle diameter should be .187"-.25" larger than the material to be processed.

Thermal Nozzle Width - The factory supplied width of 0.5" is optimal for lamination speed. (Custom sizes, made-to-order available).

Proximal (Home) Grip - This assembly must not be moved from its factory mounted position or damage to the system may occur.

Grip-to-Grip Distance - Position the proximal grip such that the heads do not grip the heat shrink but securely hold the product mandrel. Loosen the two fasteners at the bottom-rear of the assembly. Reposition the assembly and then tighten the two fasteners.

System Options - Many optional accessories are available to enhance the functionality of the system and improve process yield. Contact Beahm Designs' sales department or visit our web site http://machinesolutions.com/our-products/ for more information on available accessories and to request a quote. Examples of available accessories are:

- Vision systems with or without on-screen crosshair line generators
- Laser line generators
- Extended product support trays/guides
- Product grip nests/alignment tooling
- Bar Code Scanner

Barcode Scanner
The barcode scanner is used by the operator to select recipes. The scanner is connected to a USB port on the touchscreen and acts like a keyboard.

SYSTEM CONTROLS AND FEATURES

Located on the front panel are the following controls and/or displays and their function.

Table 5. System Controls and Features

Description	Function
Power Reset switch	Toggles system power and air on.
Power on indicator	Indicates when system power on by illuminating, off when not illuminated.
Power Off Switch	Disengages system Power and Air.
Emergency Stop Switch	Interrupts all system power and air.
HMI	Inputs all process parameters: Recipe management, access, maintenance, and password lockout.

SEQUENCES OF OPERATION

Master Control Sequence

The master control sequence boots up the laminator subsystems and serves as the main operator guide for the laminating operation. Any alarm will cause the sequence to jump to State 31. Touch the CYCLE STOP button to release the alarm. An alarm will retract the heater assembly and stop the actuator motion. Holding the CYCLE STOP button down for 2 seconds resets the master control sequence.

Table 6. Master Control Sequence

Master Control Sequence Label	Comments
Control System Full Reset	User must release the RESET button to leave this step. Door lock is released.
Controls Not Reset - Push POWER RESET Button	Master Control Relay is not reset. Clear the emergency stop and push the blue reset button.
STARTUP: Opening Main Air Valve	Allows 2 seconds for air to fill system.
STARTUP: Retracting Heater and Close Heat Shield	Heater must be retracted before moving actuator.
STARTUP: Touch CYCLE START to Lock Door	n/a
STARTUP: Waiting for Door to Close	Door lock is de-energized to latch the door. A signal is received when the latch is made.
READY: Touch CYCLE START to home Actuator	n/a. Homing starts when doors are closed.
HOMING: Homing Heater Array	Moves the heater array actuator up until the travel limit on the left side of the heater array is sensed, then moves to the home (zero) position just after the switch is restored.
HOMING: Move Actuator to Zero Position	Recipe.Load position is set to ZERO for the 710-A. Moves the heater array to zero. If an alarm has occurred during processing, jump to unload failed parts so that parts can be removed. The door is unlocked after this step.
STARTUP: Touch "Select Recipe w/ Scanner" and Use Barcode Reader	Used when setting [s27] is set to ONE. When power is reset, the operator must select a recipe using the barcode scanner.

	The operator must touch the keypad button to bring up the entry keypad. If the passcode is in effect, pushing the CYCLE START button bypasses this step. Door lock is released.
STARTUP: Turn on Heater	The operator must turn on the heater to loaded zones to proceed. The heater is not required if the passcode is in effect.
STARTUP: Starting Heater – OK to Load Parts	Turns on the MFC at the recipe flowrate. For each heater, the PLC waits for the airflow reading to match the setpoint, then turns on the heater's mechanical relay. For each heater, the PLC turns on the relay to send power to the heater. The sequence will stay on this step until all temperatures have stabilized around the setpoint.
LOAD: Load Parts or touch CYCLE START to run empty	The cycle may be run without parts for testing. This step is skipped if parts are present.
LOAD: Touch CYCLE START to Lock Door	Releases the door lock solenoids.
LOAD: Waiting for Door to Close	Holds here until the doors are closed.
READY: touch CYCLE START to begin Process	Waits for operator to begin the cycle. Touch CYCLE STOP to unlock the door. This jumps the sequence to "load parts."
RUN: Move Heaters to [Heater Start]	Moves actuator to initial position.
READY: touch CYCLE START to Run Parts	This inspection step is SKIPPED if the option on the Settting screen is set. Touching CYCLE START begins the laminating cycle. Touch CYCLE STOP to unlock the door. This jumps the sequence to "load parts."
RUN: Extend Heater	Opens the heat shield. The heat shield stays open until the cycle is completed. Step is skipped if the nozzle is OFF for this zone.

RUN: Zone [ZoneNumber] Dwell at [ZoneStartPosn] for DwellTimeLeft] sec	Shows remaining dwell time for this zone. The Dwell occurs at the beginning of the zone. Step is skipped if the Dwell is set to zero.
RUN: Zone [ZoneNumber] at [ZoneSpeed] for [ZoneLength] to[ZoneEndPosn]	Step where the heater actuator is jogged at the recipe speed either left or right. When the actuator is at or past the end position, the next zone settings are used to determine which step to execute.
RUN: Retract Heater	Retracts the nozzle if the nozzle is OFF for the segment.
RUN: Move Actuator to Zero Position	Moves to load position. Closes the heat shield. The load position is set to ZERO for the 710-A.
UNLOAD FAILED PART: Open Door and Remove Part Now	Waits at this state until all grips are opened. Jumps back to "load parts" when the grips are cleared. Door lock is released.
UNLOAD: Remove Finished Part - Touch Cycle Start to Proceed	Returns to "load parts" when CYCLE START is pushed. Door lock is released.
ERROR: Tripped on Alarm - Touch CYCLE STOP to reset	Alarm state. Stops motion and retracts thruster and closes the heat shield. Door lock is released.

HMI DISPLAY

Main Menu

The Main Menu screen provides an access point to the remaining screens in the system. Some menu items are hidden unless the passcode has unlocked the HMI.
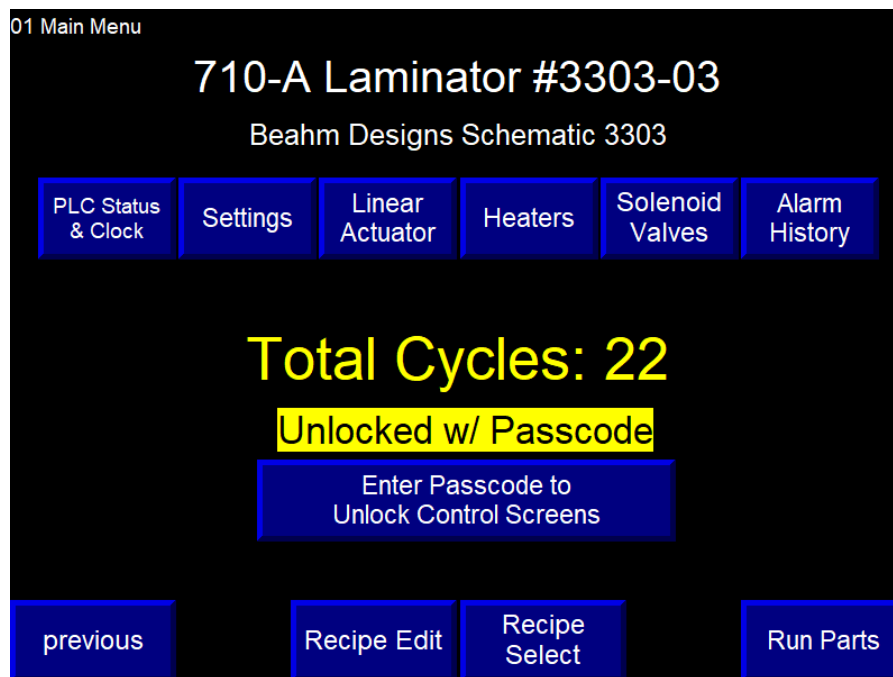
Figure 1. Main Menu Screen (Passcode Entered)

Table 7. Main Menu (Passcode Entered) Buttons/Displays and Descriptions

HMI Screen Object Descriptions	
Item	**Description**
Title	Unit number is read from the PLC.
PLC Status Settings Linear Actuator Heaters, Solenoid Valves, Alarm History	Menu Buttons. Made visible when a valid passcode is entered.
previous Run Parts	Menu Buttons. Always visible.
Total Cycles	Numeric Readout. Shows the number of times the laminator process has run to completion.
Unlocked w/ Passcode	Indicator. Shows a valid passcode is active
Enter Passcode to Unlock Screens	Keypad. Used to enter the passcode.

This is how the Main Menu appears when there is no passcode present.
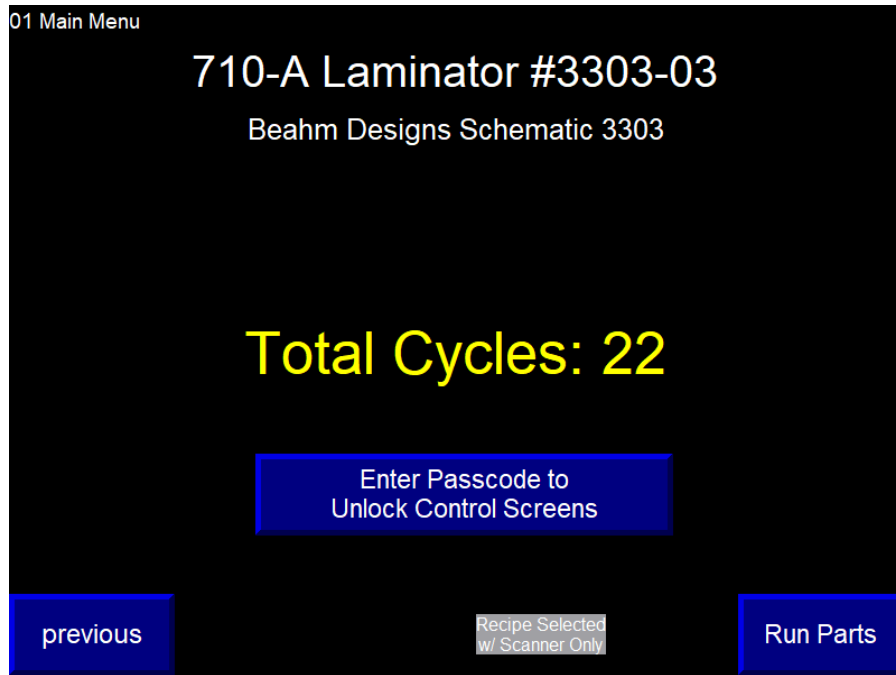
Figure 2. Main Menu Screen (No Passcode Entered)

Run Parts

This screen is used by the operator to start and stop the laminator and monitor the process.

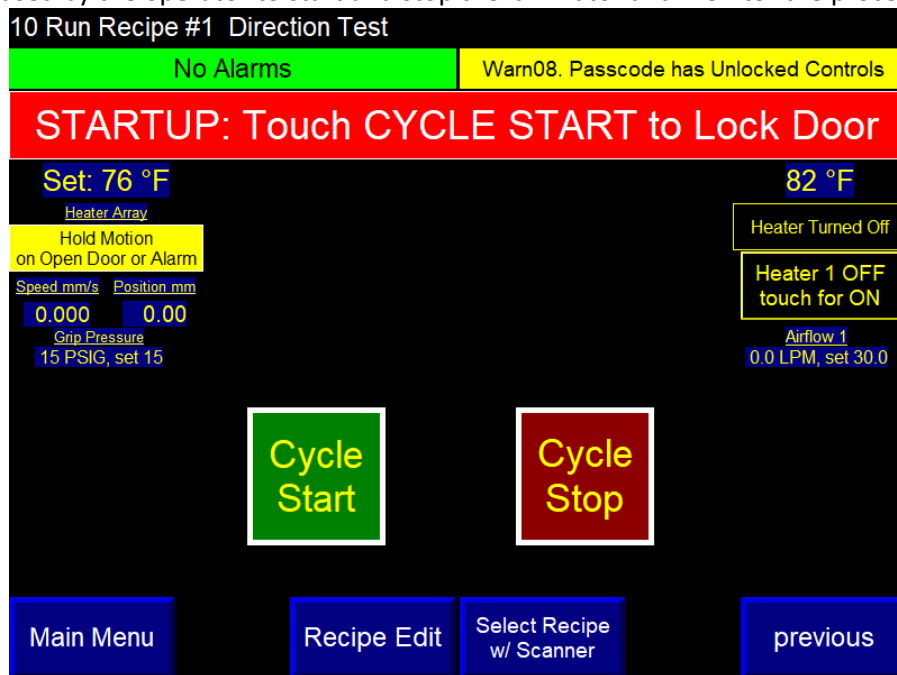**Figure 3. Run Screen**

Table 8. Run Screen Buttons/Displays and Descriptions

HMI Screen Object Descriptions	
Item	**Description**
Menu Buttons	Direct access to specified screens. RECIPE EDIT and RECIPE SELECT are only visible with a good passcode
Run Recipe #1 [NAME] Run Modified Recipe	Two-state indicator. Shows the recipe number and name. If the recipe has been changed, will show MODIFIED recipe in yellow.
No Alarms No Warnings.	Multistate Indicators. Indicators cycle through all alarms and warnings present.
READY: Touch CYCLE START to home Actuator	Multistate Indicator. Shows the state of the Master Control Sequence.
Heater Array Ready for Command	Multistate Indicator. Shows the state of the Actuator control sequence.
Speed, Position	Numeric Readouts. Shows the actuator's speed and position.
Temperature OK	Multistate Indicator (each heater). Shows the heater/airflow status.
300 ºF, set 300 ºF 10.0 LPM, set 10.0	Numeric Readouts (each heater). Shows the setpoint and actual value for the temperature and airflow.
CYCLE START CYCLE STOP	Pushbuttons. Used to start and stop the laminator sequence.
touch CYCLE STOP to UNLOCK DOOR`	Text. Appears when the CYCLE STOP button can be touched to unlock the door

Cycle Start Pushbutton

This button is used by the operator when prompted to advance the Master Control Sequence. The operator will be prompted to home the linear actuators, scan a barcode, load the mandrels, and run the process.

Cycle Stop Pushbutton

This button is used to reset alarms.
Holding the CYCLE STOP button down for 2 seconds forces a full Master Control Sequence reset.

Run Parts Screen (without passcode)

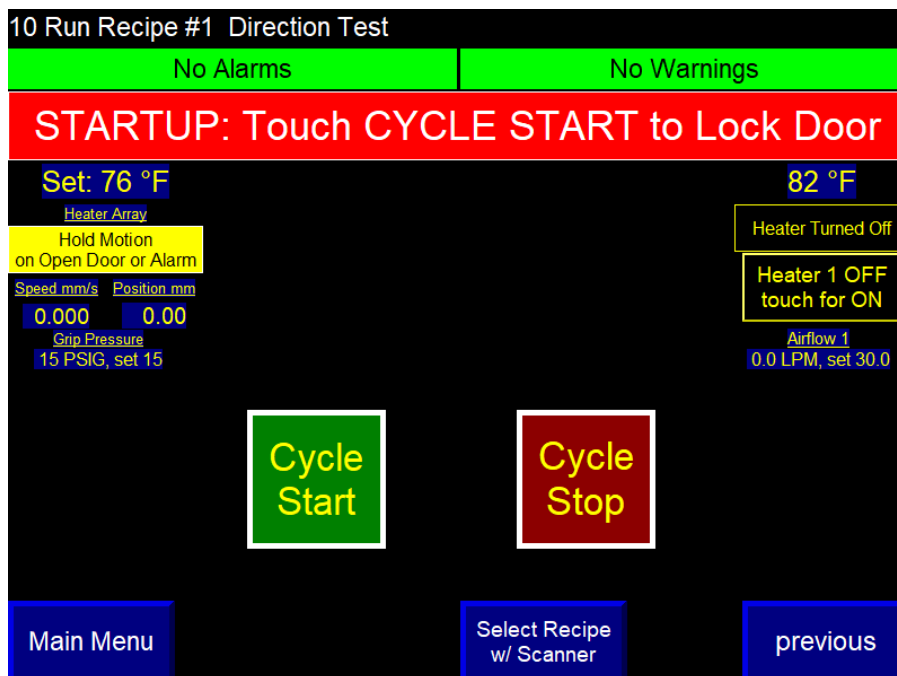The Run Parts screen is slightly different when the passcode hasn't unlocked the controls.

Figure 4. Run Screen Without Passcode

Barcode Required for Every Process Cycle

The operator must rescan the barcode before the process can run. Touching the "Select Recipe w/ Scanner" button brings up a keypad for the scanner entry.

Passcode Cleared on Laminator Power Up

Setting "s37 passcode timeout secs" is available to automatically clear the passcode after a length of time. The passcode is also cleared when power is first applied to the laminator.

Recipe Select

Access to this screen requires the passcode.

100 recipes can be stored on the Shrink Laminator. The buttons for saving a recipe are only visible when the passcode is entered.

If the barcode scanner is used, the 100 files will be searched for a match. The first recipe that has a match will be loaded as the current recipe.
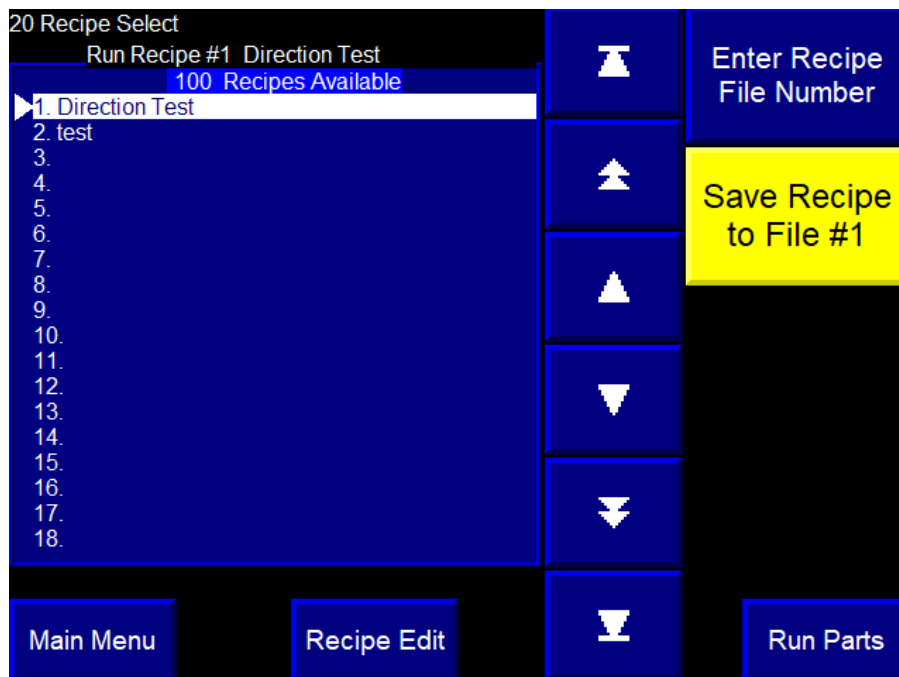
Figure 5. Recipe Select Screen

Table 9. Recipe Select Screen Buttons/Displays and Descriptions

HMI Screen Object Descriptions	
Item	**Description**
Menu Buttons	Direct access to specified screens.
Enter Recipe File Number	Keypad. Used to set the file number for recipe storage.
Save Recipe to File #1.	Pushbutton. The file number is shown on the button. When touched, the user has 5 seconds to touch a CONFIRM button to complete the save.
100 Recipes Available [Recipe Names on List]	List Selector. Use the middle row of navigation keys to point to the desired recipe. The recipe will be loaded when the screen is changed.

Recipe Edit

Access to this screen requires the passcode.
This screen is used to change the control settings for the laminator sequence.
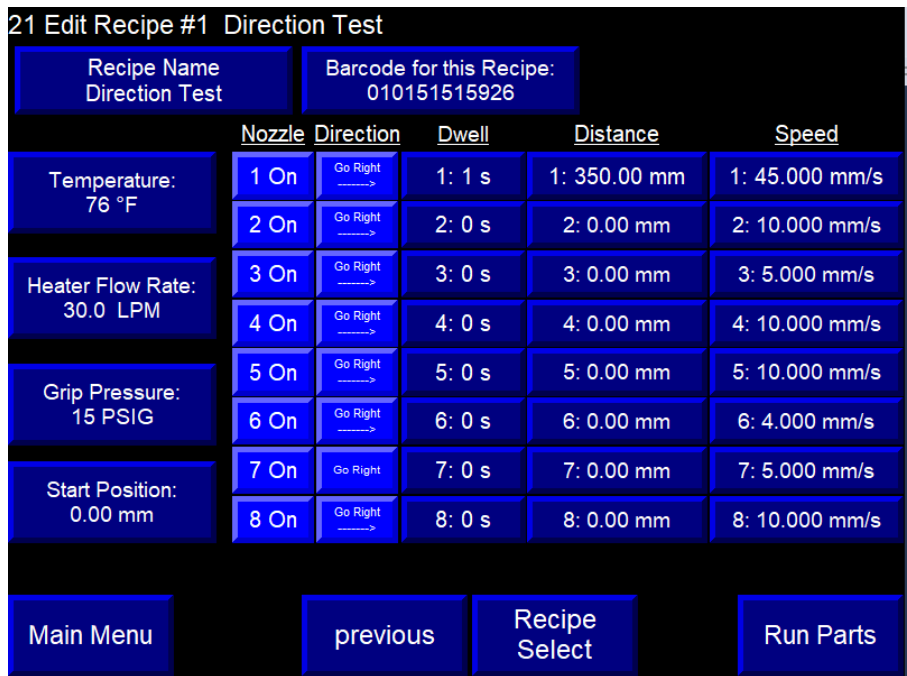
Figure 6. Recipe Edit Screen

Table 10. Recipe Edit Screen Buttons/Displays and Descriptions

HMI Screen Object Descriptions	
Item	**Description**
Menu Buttons	Direct access to specified screens.
Edit Recipe # [NAME]	Shows the currently loaded recipe file number and name.
Recipe Name	Alphanumeric keypad. Touch to enter a name for the recipe.
Barcode for this Recipe	Alphanumeric keypad. Touch and then scan the desired barcode.
Temperature through Nozzle 8 On/Off	Keypads and Pushbuttons. Each keypad has a minimum and maximum value.

Settings

This screen is used to change Shrink Laminator settings. A passcode must be entered to make the screen accessible from the Main Menu.
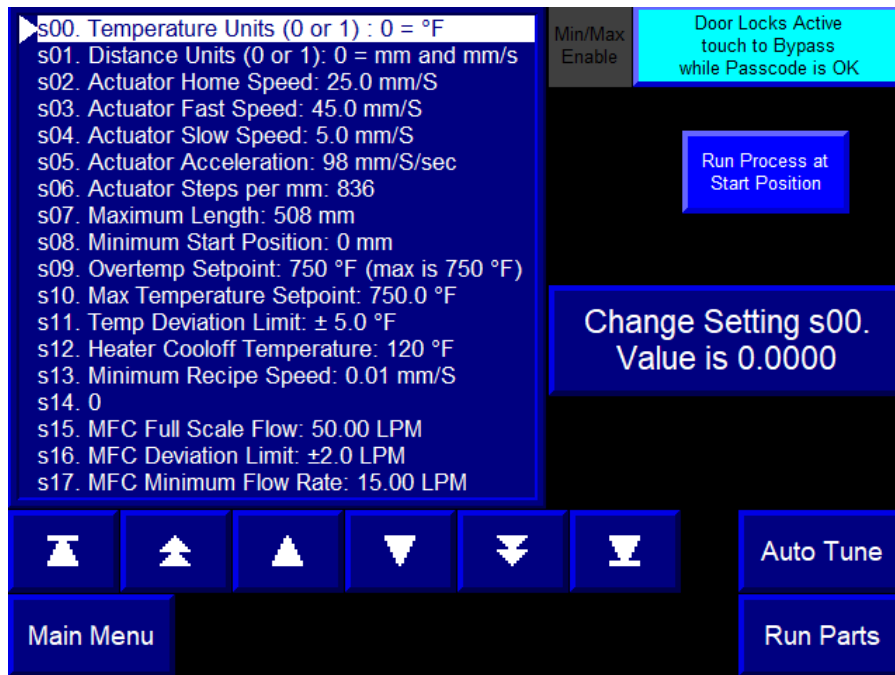
Figure 7. Settings Screen (s00-s17)
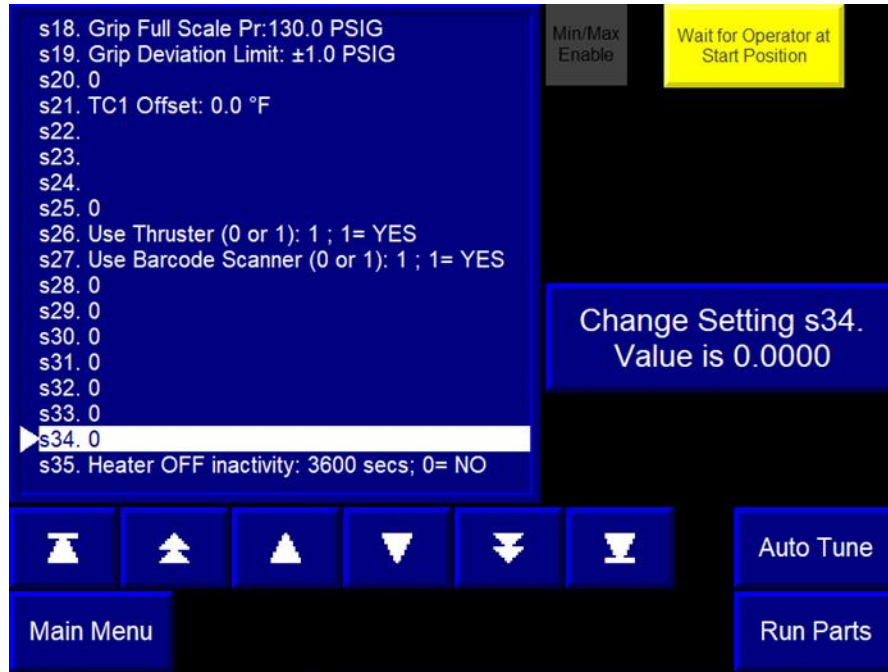
Figure 8. Setting Screen (s18-s35)
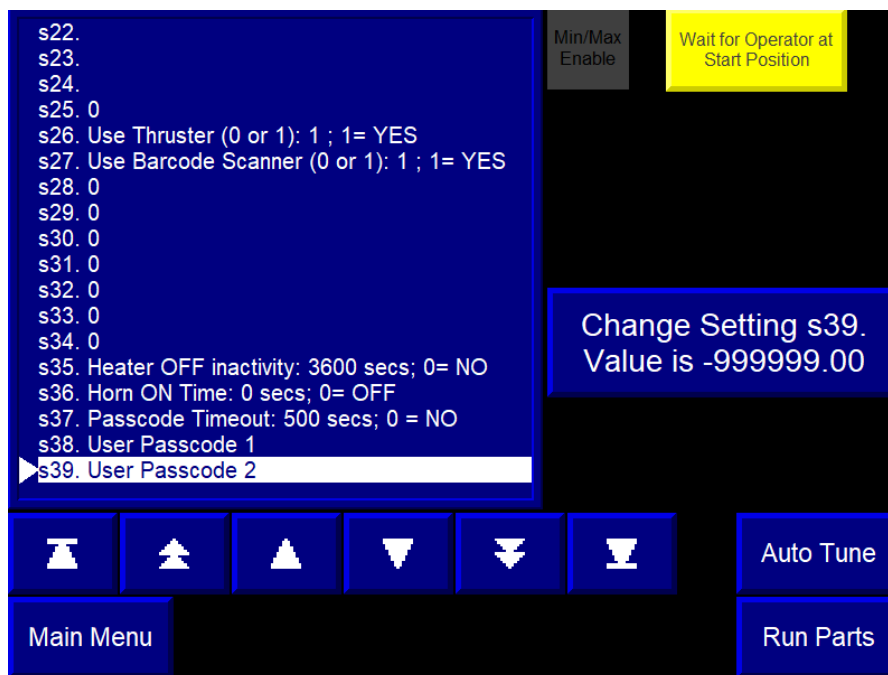
Figure 9. Setting Screen (s37-s39)

Table 11. Shrink Laminator Settings Screen Buttons/Displays and Descriptions

HMI Screen Object Descriptions	
Item	**Description**
Menu Buttons	Direct access to specified screens.
Settings List	List Selector. Use the arrow keys to navigate to a particular setting.
Change Setting	Keypad. Used to enter a numeric value for the selected list item.
Wait for Operator at Heater Start Position	Pushbutton. This option pauses the cycle sequence after the actuator has moved to the start position to let the operator make a final inspection before processing.
Auto Tune	Menu Button. Access to screen to cause the Mini8 to autotune.

This screen shows the appearance after the Min/Max Enable button is touched. The keypads will disappear if the HMI shifts to another screen.
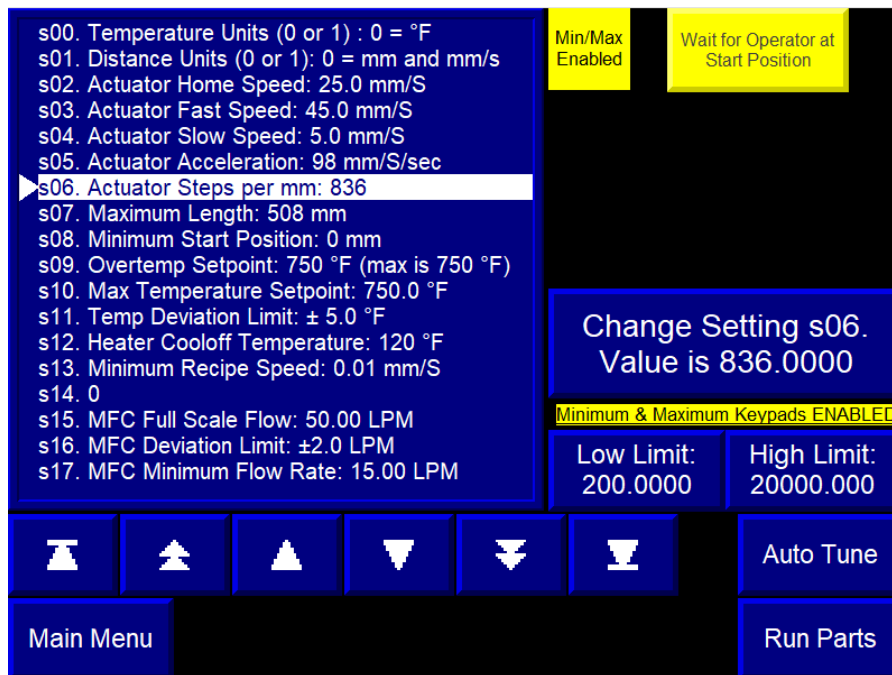
Figure 10. Setting Screen with Low/High Limits

Table 12. Settings Screen with Low/High Limits Buttons/Displays and Descriptions

HMI Screen Object Descriptions	
Item	**Description**
Min/Max Enabled	Pushbutton. Only appears with the 2694 factory code.
Low Limit High Limit	Keypads. Appear when min/max is enabled. Enter the desired minimum and maximum range for the associated list item.

Note: The MFC deviation limit is restricted to a range of 0.1 to 2 LPM in the PLC logic. This helps to prevent heater burnout.

Auto Tune

Use this screen to initiate an Auto Tune of the heater. Start with a cold heater at room temperature. On the heater and airflow controls screen, select "hand", then enter a flow rate and temperature. Touch the "Start Auto Tune" button and then go back to the heater and airflow control screen to turn on the heater.

04 Temp Controller Auto Tuning

Auto Tuning Procedure
1. Start with cold heater zones.
2. Turn on heater to desired tuning setpoint.
3. Touch the START AUTO TUNE button.
4. Heater will auto tune.
5. Auto tuning is completed when output is not 0% or 100%.
6. AUTO TUNE STARTED will clear after the preset time.

Start Auto Tune

Auto Tune Time Left
600 secs

Main Menu   Settings   Run Parts
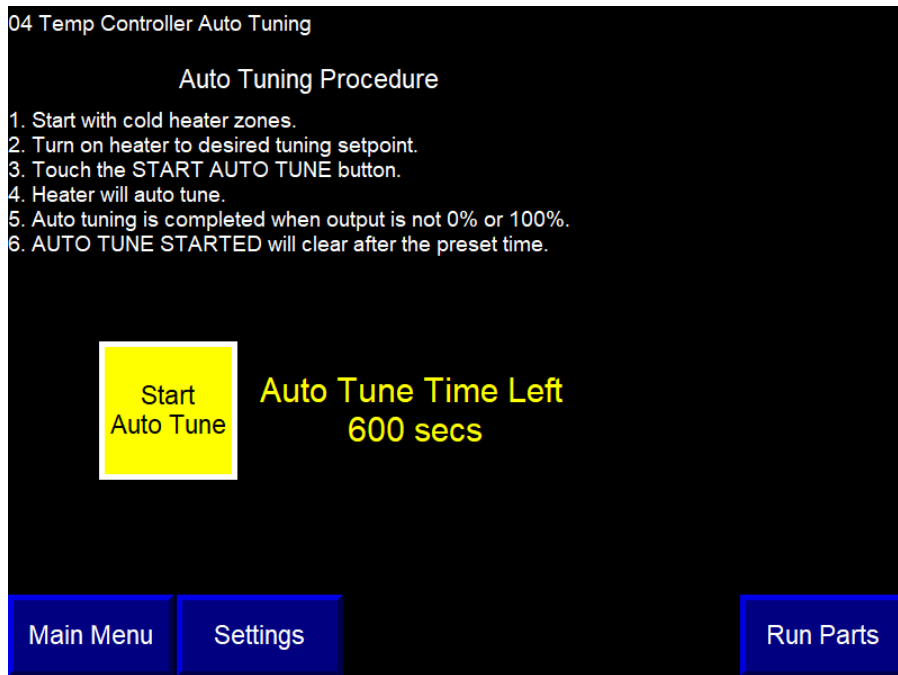
Figure 11. Temperature Controller Auto Tune Screen

Table 13. Temperature Controller Auto Tune Screen Buttons/Displays and Descriptions

HMI Screen Object Descriptions	
Item	**Description**
Menu Buttons	Direct access to specified screens.
Start Auto Tune	Pushbutton. Turns on PLC digital output connected to the Mini8
Auto Tune Time Left	Numeric Readout. Allows 10 minutes for auto tuning before automatically clearing the Auto Tune Started output.

Heater Array Actuator

Access to this screen is from the Main Menu when a passcode has been entered. The screen is used to manually move the actuator.
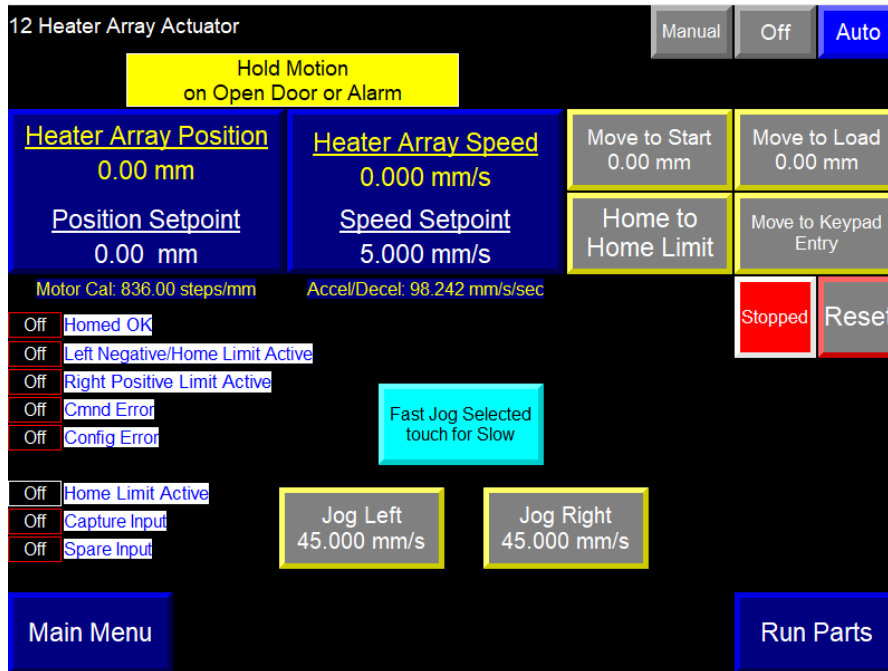
Figure 12. Heater Array Actuator Screen

Table 14. Heater Array Actuator Menu Buttons/Displays and Descriptions

HMI Screen Object Descriptions	
Item	**Description**
Menu Buttons	Direct access to specified screens.
Hand/Off/Auto	Interlocked Pushbuttons. Set to AUTO to run the process. Set to HAND to allow use of the controls on this screen. AUTO mode is forced when the CYCLE START button is pushed.
Stepper Module Not Ready	Multistate Indicator. Shows the state of the Actuator control sequence.
Actuator Position Actuator Speed	Keypads with Numeric Readout Overlays. Used to monitor and to manually enter position and speed setpoints.

Table 15. Linear Actuator Menu Buttons/Displays and Descriptions

Linear Actuator HMI Screen Object Descriptions	
Item	**Description**
Homed OK Neg Limit Active Pos Limit Active Drive Enable Output AKD No Fault Relay	Indicators. Shows the status of the travel limits and whether the stepper control module has problems.
Fast Jog Selected Touch for Slow	Pushbutton. Toggles between the fast and slow jog speeds.
Jog Up Jog Down	Pushbuttons. Used to manually move the step motor.
Home to Left Limit	Pushbutton. Causes the actuator to run to the left limit, then sets the zero offset just as the limit switch comes back on.
Move to Start Move to Load Move from Keypad	Pushbuttons. Once the actuator is homed, these buttons will cause absolute moves from the recipe settings or the keypad.
Stop	Pushbutton. Sends the stop motion command.
Reset	Pushbutton. Restarts the stepper control sequence.

Heater

Access to this screen is from the Main Menu when a good passcode has been entered. This screen is used to test the heating controls.
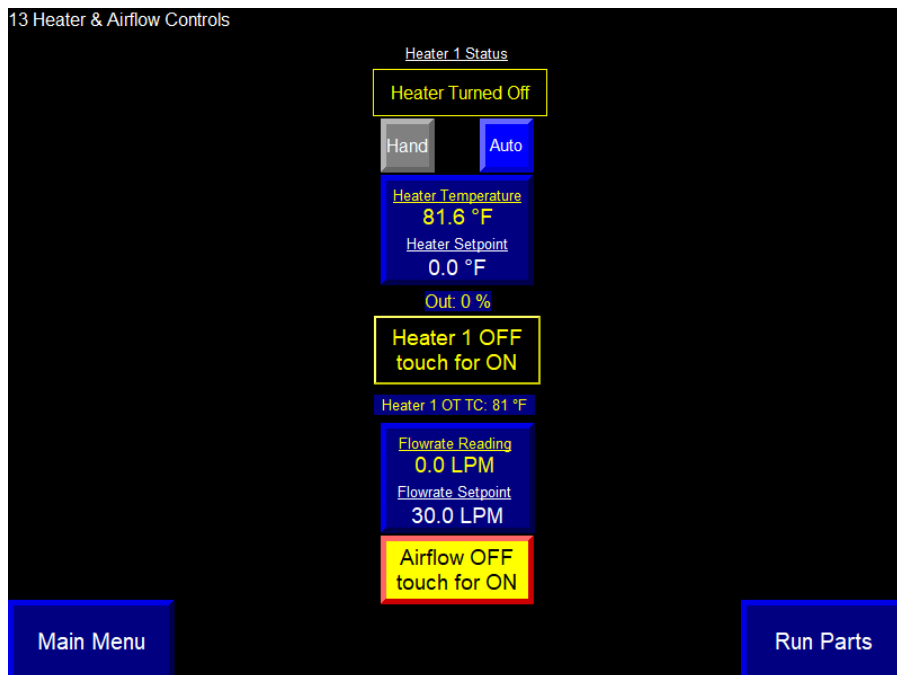
Figure 13. Heater and Airflow Controls Screen

Table 16. Heater and Airflow Screen Buttons/Displays and Descriptions

HMI Screen Object Descriptions	
Item	**Description**
Menu Buttons	Direct access to specified screens.
Heater Status	Multistate Indicators. Shows the heater/airflow status.
Hand/Auto	Interlocked Pushbuttons. Set to AUTO to run the process. Set to HAND to allow use of the controls on this screen. AUTO mode is forced when the Run Parts RUN button is pushed.
Heater Temp Heater Setpoint Loop Output	Keypad w/ Numeric Readout Overlay. Used to manually change the temperature setpoint.
Heater OFF touch for ON	Pushbuttons. Toggles the heater run request on and off. Heat will not be applied unless all interlocks are OK.
Flowrate Reading Flowrate Setpoint	Keypad w/ Numeric Readout Overlay. Used to manually control the MFC.
Airflow OFF touch for ON	Pushbuttons. Toggles the MFC on and off. The MFC will stay on if the heater is above the cool off temperature. The MFC auto-starts when the heater is turned on.

Solenoid Valves

Access to this screen is from the Main Menu when a good passcode has been entered. This screen is used to test the pneumatic components.

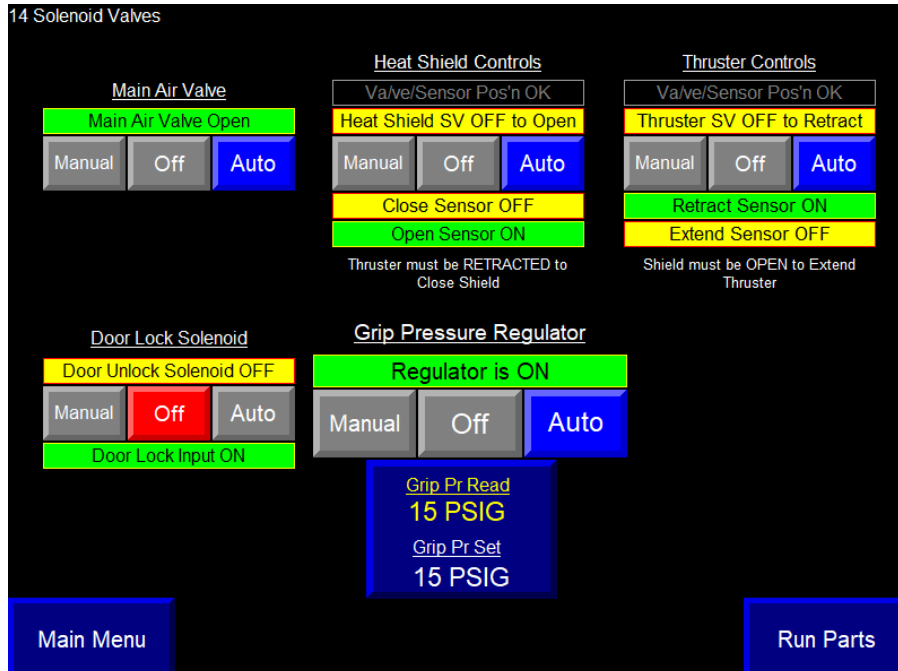**Figure 14. Pneumatics and Valve Screen**

Table 17. Pneumatics and Valve Screen Buttons/Displays and Descriptions

HMI Screen Object Descriptions	
Item	**Description**
Menu Buttons	Direct access to specified screens.
Main Air Valve Heat Shield Thruster Door Lock Solenoid	Interlocked Pushbuttons. Set to OFF or MANUAL to exercise the solenoid. Buttons are returned to AUTO when the CYCLE START button on the run screen is touched.

PLC Status and HMI Shutdown

Access to this screen is from the Main Menu when a good passcode has been entered. This screen shows the machine model number and some PLC variables. The HMI application can be shut down from this screen.
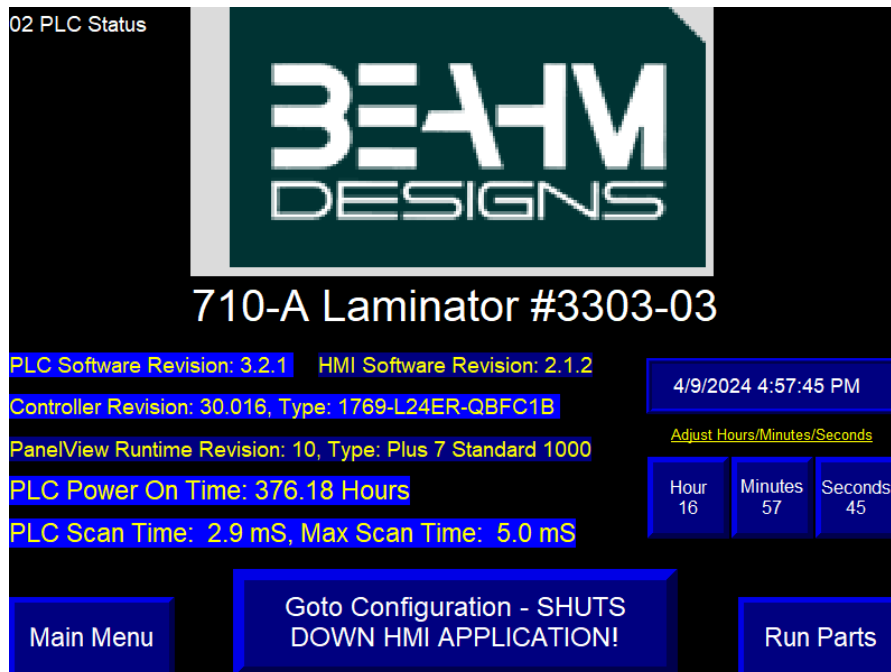
Figure 15. About Screen

Table 18. About Screen Buttons/Displays and Descriptions

HMI Screen Object Descriptions	
Item	**Description**
Menu Buttons	Direct access to specified screens.
Model Number.	Numeric Readout. Taken from the PLC in case of more than one unit.
PLC Software Revision	Version of PLC software.
HMI Software Revision	Version of HMI software
Controller Revision	PLC firmware
PanelView Runtime Revision	HMI firmware
Power On Hours Scan Times	Numeric Readouts. Length of time PLC has been running.
PLC Memory Battery OK PLC Memory Battery Low	Indicator. Shows the state of the PLC's memory battery, located under a cover on the left side of the PLC assembly.

Information Overlay

The Information Message Banner is triggered by the PLC. The banner automatically closes after 3 seconds, or the CLOSE button can be touched.
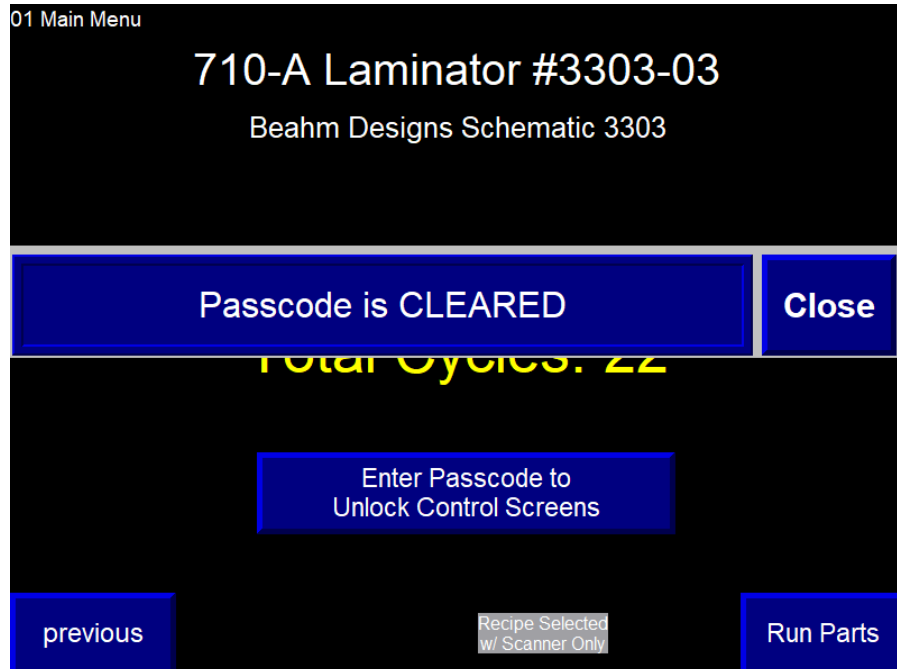
Figure 16. Passcode Cleared Banner

Alarm Banner Overlay

The Alarm Banner is triggered by the PLC. Use the CLOSE button to remove the banner.
If the banner legend is blank, an alarm occurred but has been restored. Check the Alarm Log to determine the specific alarm that triggered the banner.
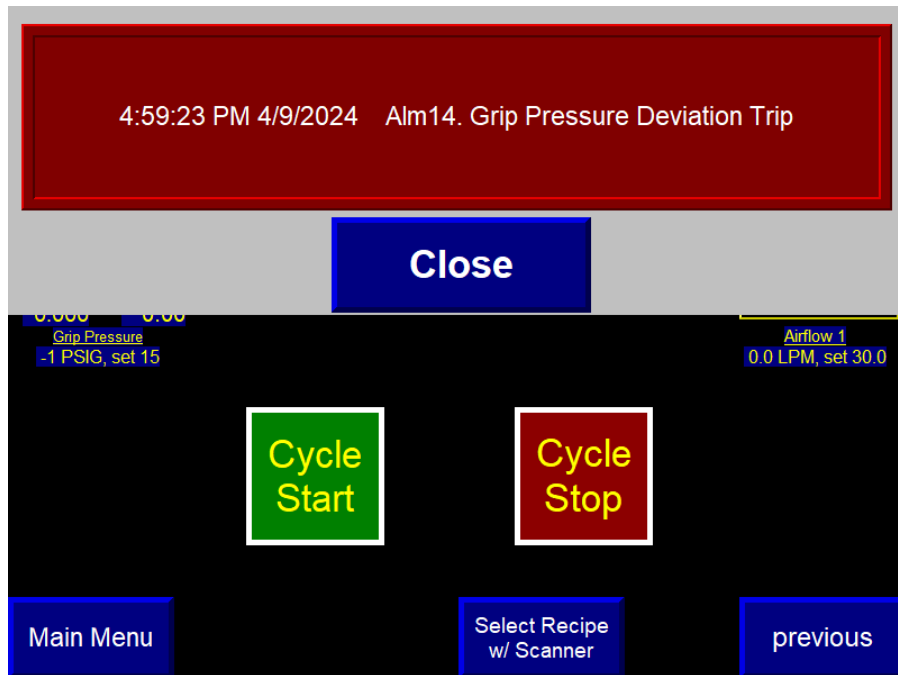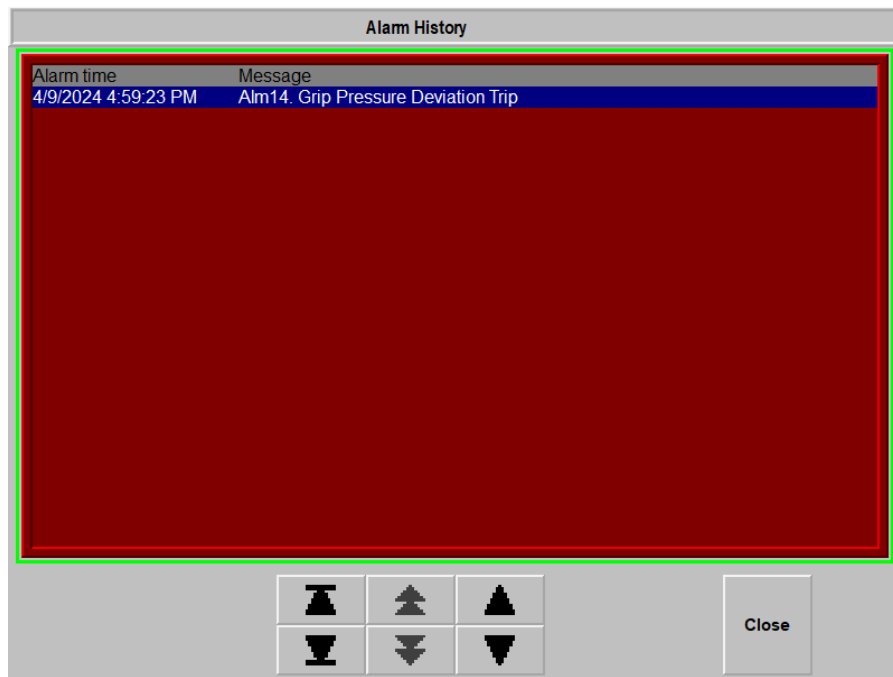

Figure 17. Alarm Banner

Alarm Log

The Alarm Log holds a record of the last 128 alarm occurrences. The alarm message is saved along with the time the alarm was tripped.

The time is taken from the HMI's internal real-time-clock. Shut down the application to adjust the clock.

Access to this screen is passcode protected.

Figure 18. Alarm History Screen

CALIBRATION

Important Notes:

- **Calibration should be performed by a certified service, preferably with the system in the location of use. Calibration procedures are the domain of these service providers.**
- **Calibration refers to the process of verifying that each of the systems' instruments that controls a process parameter is within specification.**
- **Calibration DOES NOT refer to the process of measuring the temperature at the center of the thermal nozzle and "matching" the value to the temperature controller set point.**
- **The measured value at the thermal nozzle will rarely match the temperature controller set point and the delta will increase towards the center of the nozzle.**
- **For temperature stability verification it is recommended that the air be measured .062"- .093" from the exit point of one of the flow ports. Stability should be +/-2.0 Degrees over one hour or at a minimum over the duration of a typical process cycle (customer/product specific)**
- **Flow meters must be verified vs. calibrated since they cannot be adjusted if out of manufacturers specifications.**

1. Calibrate the temperature controller annually.
2. Calibrate the pressure gauge annually.
3. Verify the actuator speed and distance annually.
4. Verify the heater air flow meter annually.

MAINTENANCE

Note: Ensure the machine is unplugged for any servicing or maintenance work.
Note: Perform these steps ONLY when the machine is at room temperature.

Caution: pinch point/crush hazard. Keep fingers, hands, and clothing clear of moving parts.

Caution: hot surface. Contact may cause burn. Allow to cool before servicing.

Cleaning

1. Use 99% isopropyl alcohol to wipe down the outside of the machine. Do not attempt to clean the inside of the machine. The machine should not be washed down.
2. Cleaning should be with a soft dry cloth only.

Exchanging Thermal Nozzle

1. Loosen the set screw at the top of the nozzle adapter.
2. Slide the nozzle while simultaneously removing the thermocouple connector.
3. Install the replacement nozzle/thermocouple connector.
4. Tighten the set screw in the adapter.

Exchanging Grip Heads

1. Remove the fasteners in each grip head.
2. Replace the grip head with the alternate.
3. Re-install the mounting fasteners.

Panel Removal – Use caution not to lose or misplace panel screws and ensure they are all replaced when any maintenance is completed.

Aligning Tooling

Note: Alignment should be performed on a prepared product subassembly.
Note: Alignment MUST be performed with system power off and heads at ambient temperature.
Note: Alignment must be performed on a flat and reasonably level surface.

1. Place a lamination subassembly within the proximal and distal grip assemblies.
2. Adjust the Vee guide and each grip such that the lamination subassembly is centered within the nozzle opening.

DIAGNOSTICS AND TROUBLESHOOTING

Table 19. Diagnostics and Troubleshooting

Issue	Possible Causes	Solution
Temperature not stable	• Thermal Nozzle replaced • Thermocouple loose	• Auto-tune • Re-install thermocouple
S.br	• Sensor Break • Thermocouple not installed	• Determine break and repair • Install thermocouple
No heat at nozzle	• Heater air flow too low • Defective heating element • Defective power control	• Increase air flow • Replace heating element • Contact Beahm Designs
System will not power on	• Emergency stop switch depressed • IEC power cord not fully connected	• Rotate switch knob to engage • Verify installation

SPECIFICATIONS

Table 20. System Specifications

Description	Range	Resolution	Accuracy
Temperature	200-750° F Upper temperature range is dependent on nozzle type and size.	1.0 deg.	+/-.75% F.S.
Speed	.16-20 mm/sec.	0.1 mm/sec.	+/- 5%
Length	1-558 mm	1.0 mm	+/-0.8mm/100mm
Pressure	0-100 psi	2.0 PSI	+/3.5% F.S.
Heater Flow	5-50 SCFH	5.0 SCFH	+/- 7% F.S.

Table 21. Machine Specifications

Description	Range/Accuracy
Line Voltage	120 VAC or 240 VAC
Operating environment	• 60 – 75°F (15 - 24°C) • 0 – 85% relative humidity, noncondensing
Storage temperature	32 – 120°F (0 – 48°C)
Approximate machine weight	185 lbs.
Approximate machine dimensions	Height: 28 IN Width: 48 IN Depth: 24 IN

Facility Requirements

- Voltage: 120 VAC or 240 VAC 50/60 Hz (Refer to MSI sticker on machine for voltage).
- Wattage: 500 max.
- Compressed Air: 60-125 psi, 0.5 CFM, filtered 50 micron or greater, oil and water free.

CRITICAL PARTS

For replacement or spare parts, please contact us at service@machinesolutions.com, or call 928-556-3109.

Table 22. Critical Parts List

Part Number	Description	Quantity
1345627-101	PRESSURE CONTROLLER	1
1330445-003	CYLINDER VALVE	1
1143709-001	SERVO MOTOR, NO BRAKE	1
110254-001	HEATER	1
1143133-001	.125" THERMOCOUPLE	1
1156357-001	SENSOR, PROX, PNP, NC, M8 THREAD	1
1143786-003	SENSOR, PROX, PNP, NO, M8 THREAD	1
1156569-001	HMI, ALLEN BRADLEY, PANELVIEW, 10 IN	1
1153240-001	DRIVE CONTROL, DC STEPPER, ST SERIES, ETHERNET/IP	1
1143287-001	DPDT RELAY 24 VDC	2
1145545-001	Eurotherm Mini 8	1
1145596-001	AB PLC	1
Belden 9534	DEVICE NET CABLE, 9534	1
1157614-001	SCANNER MODULE	1
1126636-002	ETHERNET CABLE 2 FT.	3
1145600-001	CONTACTOR, IEC 9A, AC1 16A, 600V/3P, 1 NC, 24VDC	2
1143310-001	Type SI safety relay, 2 NO, 24VDC power	1
1143312-001	POWER SUPPLY, 24 VDC, 100-240 VAC, 120W	1
1345768-015	REGULATOR, ELEC-PNE, 1500LPM, 90 PLG, FLAT BRKT	1
1345564-001	DWYER MFC, 0-50 LPM, RS485	1
1143541-001 (For 120 VAC)	120V EFit SCR	1
1145807-001 (For 240 VAC)	240V EFit SCR	1

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Machine Solutions Inc. welcomes your comments and inquiries about our products and services.

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E-Mail: Service@MachineSolutions.com

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