

MACHINE SOLUTIONS INC.



USER MANUAL

BEAHM DESIGNS HOT AIR SYSTEMS MODELS 160-A, 185-A, AND 210-A



BEAHM
DESIGNS

Machine Solutions Inc. 2951 W. Shamrell Blvd. Flagstaff, Arizona 86005 USA
Tel: 928.556.3109 • Fax: 928.556.3084
info@machinesolutions.com • www.machinesolutions.com

© 2011 Copyright Machine Solutions Inc. All rights reserved.

Table Of Contents

List of Figures	3
List of Tables	3
Purpose	4
Overview	4
Contents	4
Installation	4
Safety	4
User Alerts.....	5
Set Up and Configuration.....	5
Nozzle Installation.....	6
System Controls and Features	7
Parameter Settings	9
Temperature	9
Heater Air Flow	9
Pressure (210-A Only)	9
Vacuum (210-A Only)	10
System Operation	10
Tuning Temperature Controllers (Eurotherm Model 3216e)	10
Maintenance	11
Exchanging Thermal Nozzles	11
Operational Requirements	12
System Specifications 160-A/185-A and 210-A	12
Calibration (See Notes Below)	12
Temperature Control Flow Rate Adjustments	12
Low Flow Rate	12
High Flow Rate	12
Switching from Fahrenheit to Celsius	13
Critical Spare Parts (Contact Beahm Designs for pricing)	13
Diagnostics (Troubleshooting)	13

Facility Requirements (160-A, 185-A, and 210-A)	13
System Schematics	14
Servicing	18
Heating Element	18
Temperature Controller	18
Power Controller	18
Warranty	18
Return Material Authorization	18

List of Figures

Figure 1. Nozzle set screw	6
Figure 2. Thermocouple tip	6
Figure 3. Secure thermocouple wire placement	7
Figure 4. Standard Hot Air System (Model 160-A)	7
Figure 5. Standard Hot Air System (Model 185-A)	8
Figure 6. Balloon Development System (Model 210-A)	8
Figure 7: Thermal Nozzles	9
Figure 8: Nozzle Cover (Optional)	11
Figure 9: System Electrical Schematic 160-A	15
Figure 10: System Electrical Schematic 185-A and 210-A	16
Figure 11: System Pneumatic Schematic 160-A	17
Figure 12: System Pneumatic Schematic 185-A and 210-A	17

List of Tables

Table 1. 160-A Control and Display functions	7
Table 2. 185-A and 210-A Control and Display functions	8
Table 3. 210-A Control and Display functions	9
Table 4. 160-A/185-A, and 210-A System Specifications	12
Table 5. Critical Spare Parts with descriptions	13
Table 6. Diagnostics and Troubleshooting	13

Purpose

The purpose of this document (*Original Instructions*) is to describe the electrical and software design of the control system for the Hot Air Stations; Models 160-A, 185-A, and 210-A. This document also includes operator instructions.

Overview

Beahm Designs Hot Air Stations are compact, bench-top systems designed to deliver precisely controlled heated air through a variety of multi-port nozzles. Various shapes and sizes of thermal nozzles are available to deliver a focused stream of controlled-temperature air to a desired zone. Process applications include heat fusing, shaping, tipping, heat shrinking, welding/bonding and balloon forming and tubing expansion.

The A-series Hot Air Stations provide stable, precise air temperature control using a high accuracy controller with thermocouple monitoring and feedback.

Safety interlocks are provided between the electrical and pneumatic system to prevent heater burnout during accidental loss of air pressure.

Contents

Included with the system are the following contents:

1. Heater remote and main control
 2. IEC Power Cord
 3. Compressed Air Supply Hose Assembly
-

Installation

Note: See Maintenance Section for facilities requirements

1. Place the system on a sturdy, and level surface.
 2. Connect the remote heater enclosure to the main control unit.
 3. Connect the power cord to the main control unit.
 4. Connect the air supply hose to the system, and then to a clean, dry, and filtered compressed air source.
 5. Auto-tune Temperature Controllers (please refer to Page 10 for procedure details).
-

Safety

- Enclosure heating can occur when using a small nozzle at flow rates above 35 scfh.
 - Use of eye protection when working with compressed gases and heated materials is advised.
 - The maximum observed Sound Pressure Level is below 70 dB(A).
-



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 to 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 to insert any foreign objects into the machine and do not attempt to bypass any guards or otherwise operate the machine in any manner other than that in which it is explicitly intended.

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

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.

Set Up and Configuration

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

1. **Thermal Nozzle Diameter** - The nozzle diameter should be .187" - .25" larger than the material to be processed.
2. **Thermal Nozzle Width** - The width of the thermal nozzle should be sized equal or

slightly greater (approximately 1.0mm) than the length of the overlap of the materials.

3. **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 website at www.machinesolutions.com for more information on available accessories and/or to request a quote.

Note: To avoid damage to heater, MSI strongly recommends Flow be set at 35 scfh or greater while temperature is ramping up to set point. Flow can then be adjusted accordingly.

Nozzle Installation

1. Slide the nozzle on to the heater tube while simultaneously installing the thermocouple connector.
2. Tighten the set screw in the nozzle end.

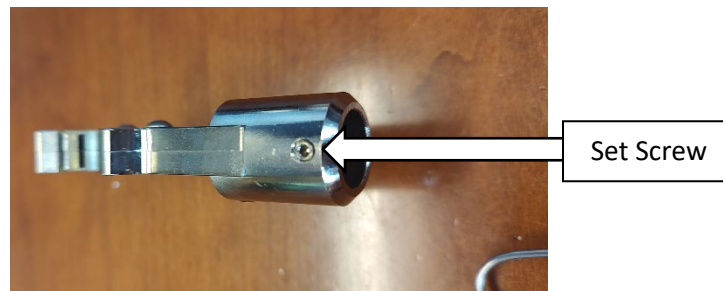


Figure 1. Nozzle set screw

3. Install the nozzle/thermocouple connector.

Recommended location of thermocouple end is at the point of hot air leaving the nozzle port.

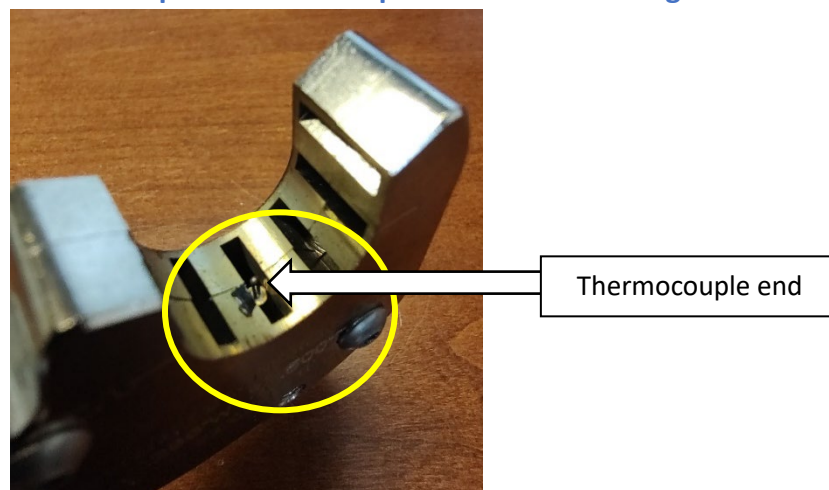


Figure 2. Thermocouple tip

4. Ensure thermocouple is secure in nozzle. This can differ between nozzle types.



Figure 3. Secure thermocouple wire placement

Note: Enclosure heating can occur when using a small nozzle at flow rates above 35 scfh.

System Controls and Features

Located on the front panel of the Hot Air System(s) are the following controls and/or displays and their functions:



Figure 4. Standard Hot Air System (Model 160-A)

160-A only (Starter System)

	Description	Function
1	Main power switch	Toggles system power and air on and off.
2	Heater Power Switch	Toggles heater power on and off.
3	Cooling Air Flow Adjust	Controls cooling air flow rate.
4	Cooling Air Toggle Switch	Toggles cooling air on/off
5	Heater Air Flow Meter	Controls heater air flow rate.
6	Temperature controller	Controls the temperature of the thermal nozzle.

Table 1. 160-A Control and Display functions

Equipment User Manual



Figure 5. Standard Hot Air System (Model 185-A)

185-A and 210-A

	Description	Function
1	Main power switch	Toggles system power and air on and off.
2	Heater Power Switch	Toggles heater power on and off.
3	Temperature controller	Controls the temperature of the thermal nozzle.
4	Heater Air Flow Meter	Controls heater air flow rate.
5	Cooling Air Flow Adjust	Controls cooling air flow rate.
6	Cooling Air Toggle Switch	Toggles cooling air on/off

Table 2. 185-A and 210-A Control and Display functions



Figure 6. Balloon Development System (Model 210-A)

210-A only

	Description	Function
1	Pressure regulator	Regulates the pressure at the PRESS/VAC. Port.
2	Pressure gauge	Displays the pressure at the PRESS./VAC. Port.
3	Vacuum Gauge	Display vacuum at the PRESS./VAC. Port.
4	Rotary Switch	Selects pressure or vacuum at PRESS./VAC. port
5	PRESS./VAC. port	Access port for the pressure and vacuum function.

Table 3.210-A Control and Display functions

Thermal nozzles are equipped to various Hot Air Systems. Designed to deliver precisely controlled, heated air to your thermal application; these nozzles are machined to your specification (Width and Diameter).

- Interchangeable nozzles.
- Offered in a variety of styles



Figure 7: Thermal Nozzles

Parameter Settings

Temperature

- Depress and hold the up or down arrow key of the temperature controller to scroll to the desired temperature. After 2 seconds the new value will be accepted, and the temperature will ramp to the new set point.

Heater Air Flow

- Rotate the flow meter knob clockwise or counterclockwise until the meter displays the desired value.

Pressure (210-A Only)

- Rotate the regulator knob clockwise or counterclockwise until the pressure gauge displays the desired value.

Vacuum (210-A Only)

- The vacuum strength is coupled with the pressure setting. A pressure value of 80 psi will generate maximum vacuum of the system specification.
- With vacuum switched on, rotate the pressure regulator knob clockwise or counterclockwise until the vacuum gauge displays the desired value.

System Operation

Tuning Temperature Controllers (Eurotherm Model 3216e)

Note: Auto-tuning can be performed at any temperature set point within the system operating specifications. This machine needs to be auto tuned at the temperature that your product will be processed at.

1. Ensure heater power is off and heater is at room temperature.
2. Ensure flow is set to a minimum of 35 scfh while temperature is ramping up.
3. Enter the process temperature setpoint using the ▼ or ▲ buttons.
4. Press ⌂ until **R.TUN** is displayed.
5. Press ▼ or ▲ to select **On**
6. **Press ⌂ to begin the auto tune process.**
7. **Turn heater power ON.**

Please note, after following this sequence, auto tune can take several minutes to start and complete.

Power On

1. Switch MAIN POWER on.
2. Set heater air flow to 20-40 SCFH.
3. Switch HEATER POWER on.
 - a. When the temperature is not within +/- 3 degrees of the set point the error message "TEMPERATURE ERROR" will be displayed.
4. Position components to be processed within the thermal nozzle for a timed duration.
5. Remove the components from the thermal nozzle and position them at the end of the Cooling air nozzle. Depress the foot switch or toggle, the panel switch will start the flow of air.

Power Off

1. Switch HEATER POWER off.
2. Place the Nozzle Cover (shown below in Figure 5) over the Thermal Nozzle appliance, to prevent heat related burns and/or injuries.
3. Let the heater cool for approximately 5 minutes.
4. Switch MAIN POWER off.

Note: Failure to let heater completely cool down will result in a shortened heater lifecycle.

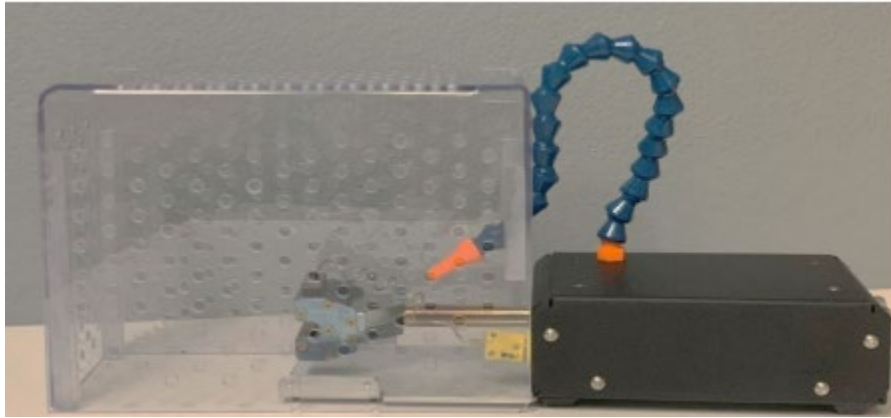


Figure 8: Nozzle Cover (Optional)

Maintenance



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

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



Warning

Note: Ensure the machine is unplugged for any servicing or maintenance work.

Note: Perform these steps ONLY when the machine is at room temperature.

Exchanging Thermal Nozzles

Note: Perform the following steps ONLY when the nozzle is at room temperature.

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.

Operational Requirements

System Specifications 160-A/185-A and 210-A

Description	Range	Resolution	Accuracy
160-A, 185-A, and 210-A			
*1. Temperature	200-750° F	1.0 deg.	+/- .25% F.S.
*2. Air Flow	20-50 SCFH	5.0 SCFH	+/- 4% F.S.
210-A Only			
1. Pressure	0-100 psi	2.0 psi	+/-3.5% F.S.
2. Vacuum	ATM-18 inHg	5.0 inHg	+/-5% F.S.

Table 4.160-A/185-A, and 210-A System Specifications

***Instrument specification does not represent specification at tooling output.**

Calibration (See Notes Below)

1. It is recommended that calibration be performed by a certified service, preferably with the system in the location of use. Calibration procedures are the domain of these service providers.
2. Calibration refers to the process of verifying that each of the systems' instruments that control a process parameter is within manufacturers' specification.
3. Calibration DOES NOT refer to the process of measuring the temperature at the center of the tooling and "matching" the value to the temperature controller set point.
4. The measured value at the tooling (thermal nozzle) may not match the temperature controller setpoint and the delta is dependent on nozzle style and dimensions as well as method of measurement.
 - a. Calibrate the temperature controller annually.
 - b. Calibrate the pressure gauge annually.
 - c. Verify the flow meter annually.

Temperature Control Flow Rate Adjustments



Warning

Low Flow Rate

To protect the process from rapid changes in the setpoint, the flow will need to be set at 35 SCFH or greater when ramping to desired setpoint. The flow can be lowered once the temperature reaches the setpoint.

High Flow Rate

Enclosure heating and back pressure may occur when using a small nozzle at flow rates above 35 SCFH.

Switching from Fahrenheit to Celsius

If the system is equipped with the Eurotherm model 3216, use the following instructions:

1. Press and hold the page button (left most) until Lev 1 appears.
2. Press up arrow to Lev 2 appears.
3. Press scroll to code 0.
4. Press up arrow key for code 2.
5. Press scroll button until units appear.
6. Press up or down arrow key to select C.

Critical Spare Parts (Contact Beahm Designs for pricing)

Item	P/N	Description
1	1346288-001	Grade A Gauge (210-A Only)
2	1343250-001	3-way pneumatic valve
3	1150440-001	Temperature Controller
4	110254-001	Heater Quartz Tube

Table 5. Critical Spare Parts with descriptions

Diagnostics (Troubleshooting)

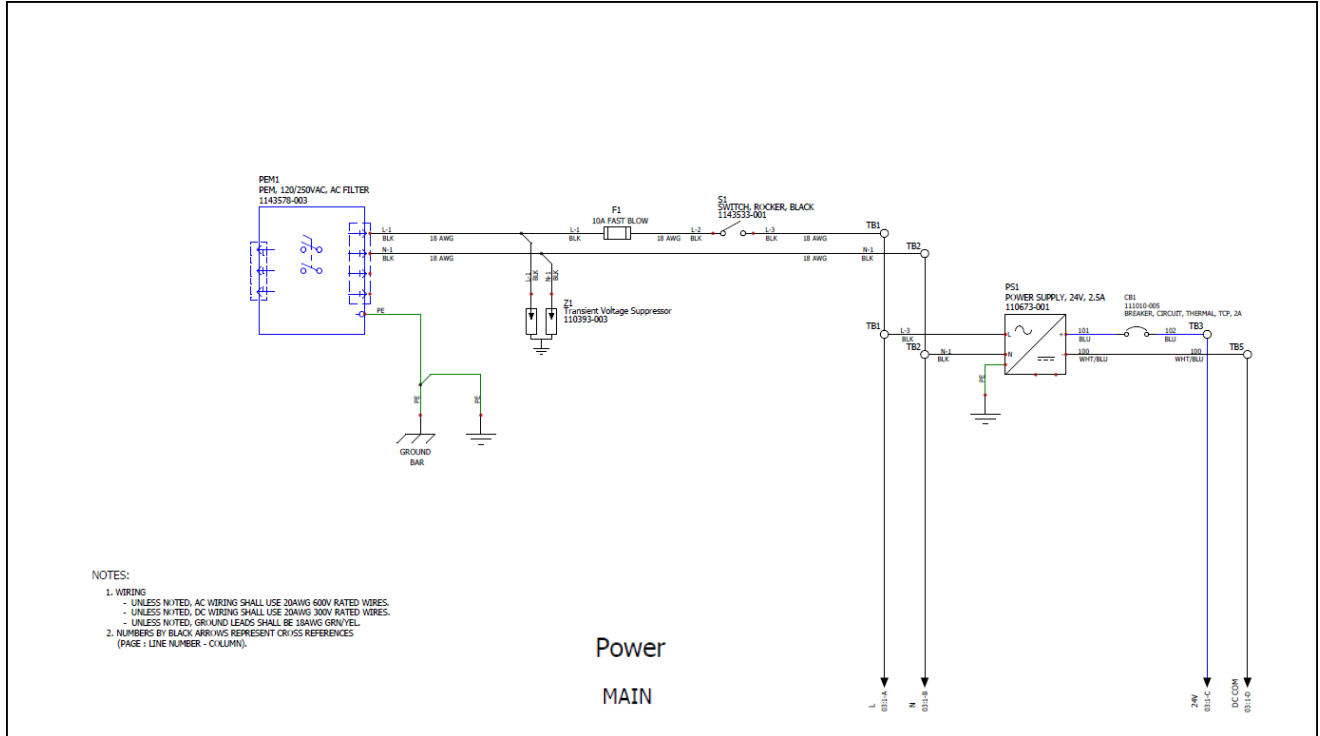
	Issue	Possible Causes	Solution
1	Temperature not stable	Thermal Nozzle replaced. Thermocouple loose	Auto-tune Re-install thermocouple
2	S.br	Break in thermocouple wire Thermocouple failure	Verify all connections from controller to remote TC jack Replace thermocouple
3	No heat at nozzle	Heater air flow too low Defective heating element Defective power control	Increase air flow Replace heating element. Contact Beahm Designs
4	.Err code in display	Temperature controller software failure.	Replace temperature controller.
5	System will not power on.	IEC power cord not fully connected.	Verify installation.

Table 6. Diagnostics and Troubleshooting

Facility Requirements (160-A, 185-A, and 210-A)

1. Voltage: 120-240 VAC 50/60 Hz.
2. Wattage: 500 max.
3. Compressed Air: 100-125 psi, 1.0 SCFM, filtered 50 micron or greater, oil and water free.

System Schematics



- NOTES:**
1. WIRING
 - UNLESS NOTED, AC WIRING SHALL USE 20AWG 600V RATED WIRES.
 - UNLESS NOTED, DC WIRING SHALL USE 20AWG 300V RATED WIRES.
 - UNLESS NOTED, GROUND LEADS SHALL BE 18AWG GRN/YEL.
 2. NUMBERS BY BLACK ARROWS REPRESENT CRV/SS REFERENCES
(PAGE : LINE NUMBER - COLUMN).

Equipment User Manual

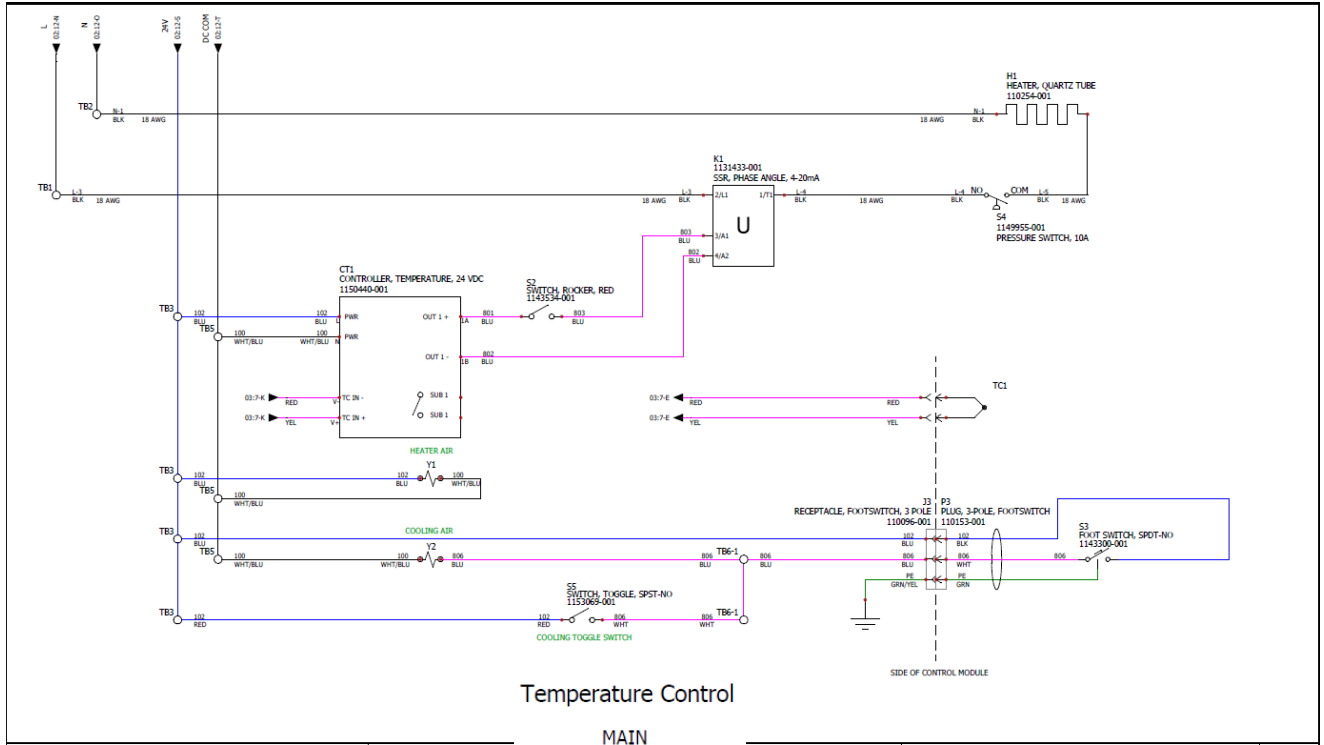
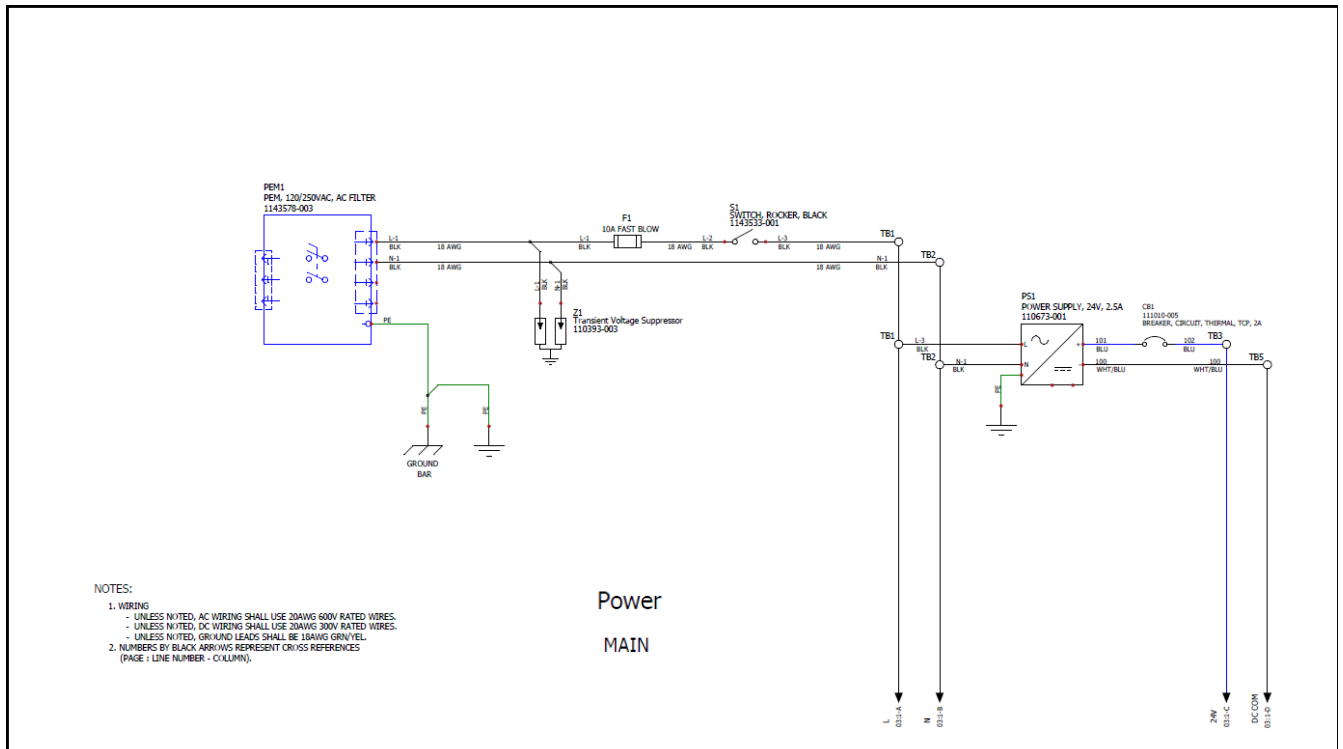


Figure 9: System Electrical Schematic 160-A



NOTES:

1. WIRING
 - UNLESS NOTED, AC WIRING SHALL USE 20AWG 600V RATED WIRES.
 - UNLESS NOTED, DC WIRING SHALL USE 20AWG 300V RATED WIRES.
 - UNLESS NOTED, GROUND LEADS SHALL BE 18AWG GRN/YEL.
2. NUMBERS BY BLACK ARROWS REPRESENT CROSS REFERENCES (PAGE | LINE NUMBER - COLUMN).

Equipment User Manual

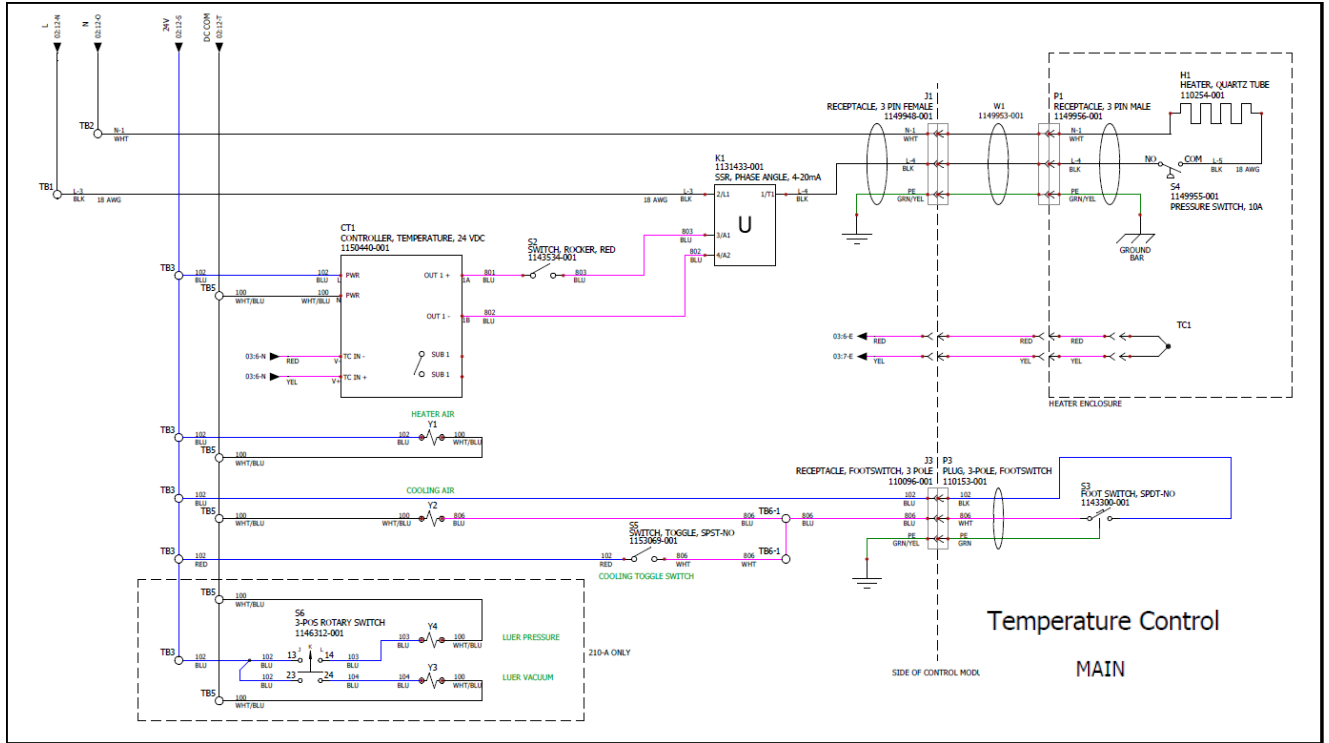


Figure 10: System Electrical Schematic 185-A and 210-A

Equipment User Manual

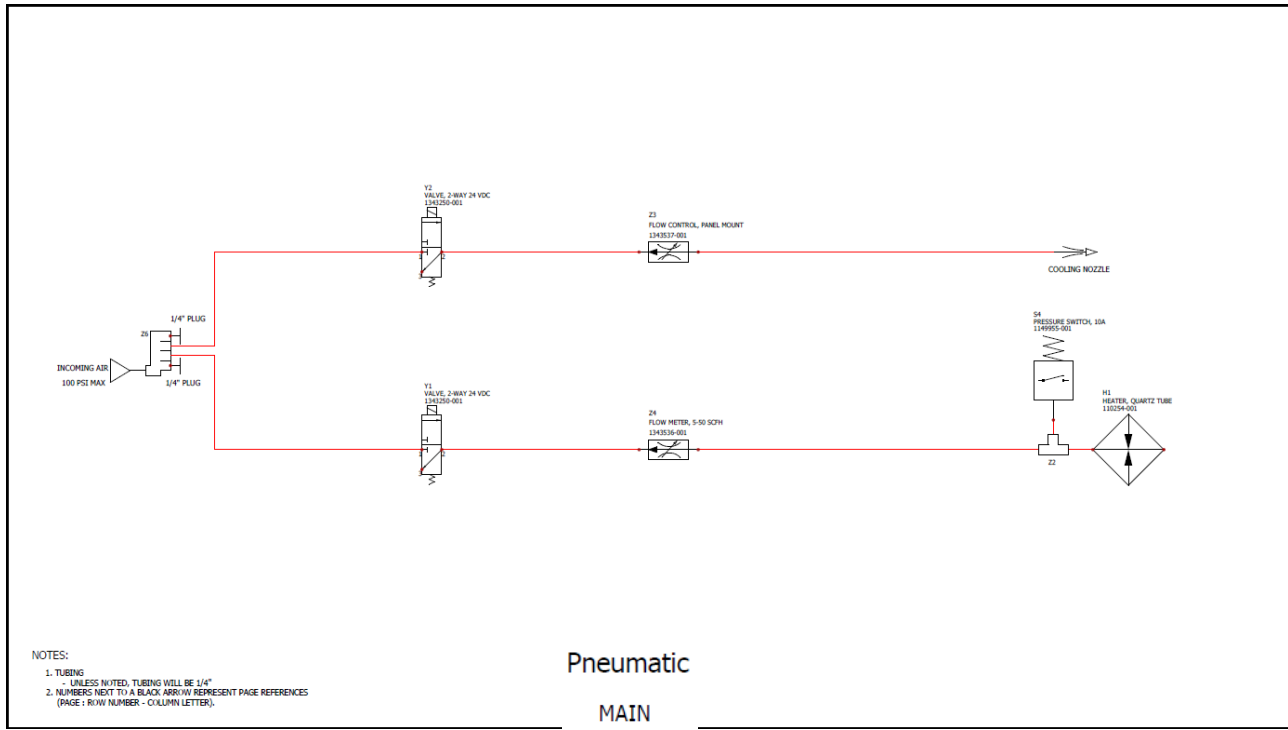


Figure 11: System Pneumatic Schematic 160-A

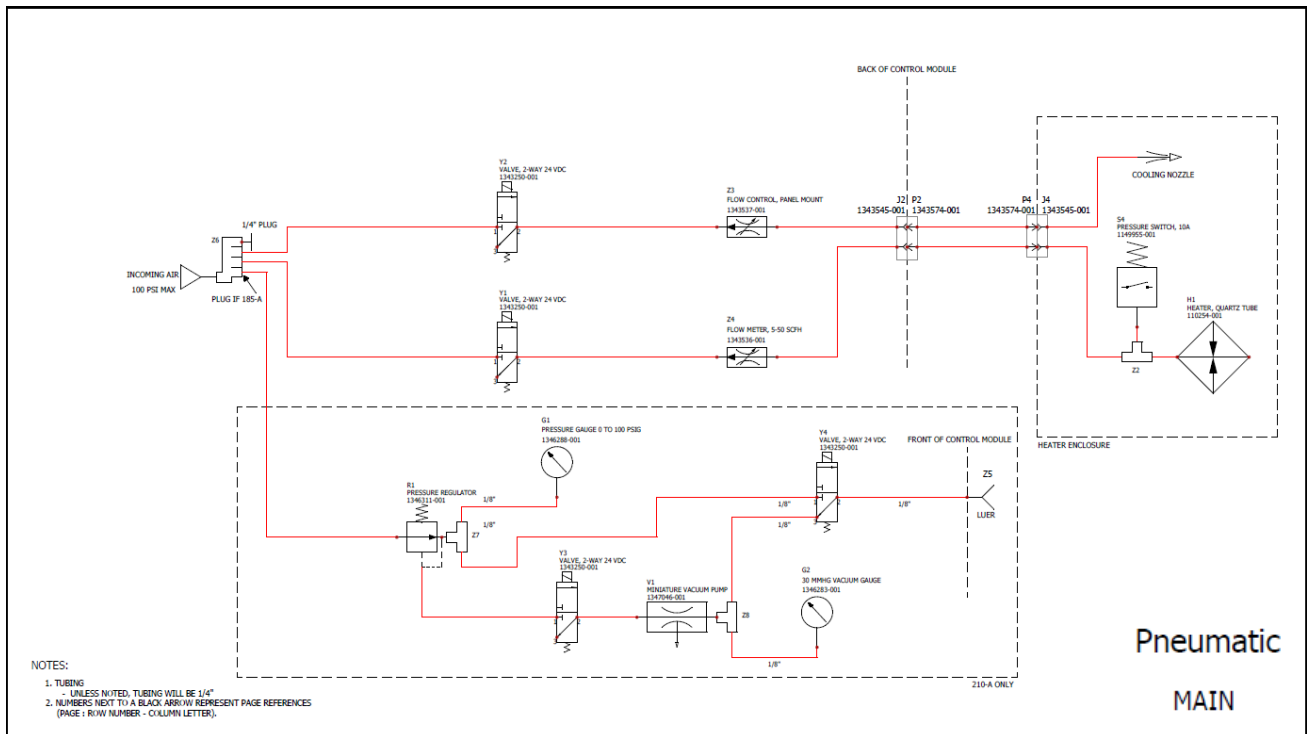


Figure 12: System Pneumatic Schematic 185-A and 210-A

Servicing

Note: Disconnect system main power and air before servicing any part of the product.

Heating Element

1. Remove the top cover of the remote heater enclosure.
2. Disconnect the two electrical quick-disconnects.
3. Disconnect the air line from the rear of the heater boot by carefully pulling it rearward.
4. Loosen the rear set screw on the left side of the heater mount block.
5. Push the heater airline to the side and then carefully slide the heating element rearward until it is fully clear of the mount block.
6. Install the replacement heater with the tab oriented down, inserting it fully into the mount block.
7. Re-install the air fitting into the heater boot.
8. Re-connect the electrical connections.
9. Install the top panel.

Temperature Controller

Contact Beahm Designs for further diagnostics and instructions.

Power Controller

Contact Beahm Designs for further diagnostics and instructions.

Warranty

Beahm Designs Inc. (BDI) products are backed by a 1-year warranty on parts and labor. Warranty is void for any product returned if BDI determines that:

- a. The asserted defect is not present,
- b. The asserted defect is attributed to misuse, improper installation, alteration (label removal and/or destruction, opening or removing external covers without authorization by Beahm Designs Inc.), mishandling and/or mishaps.
- c. The product was not sold to customer as new.

Return Material Authorization

Product may not be returned to Beahm Designs Inc. without first contacting BDI Aftermarket for a Return Material Authorization (RMA) number. If it is determined that the Product may be defective, you will be given an RMA number and instructions for Product return. End Users are required to include a copy of the RMA receipt inside the return box, in order to receive replacement product under the warranty. All unauthorized returns i.e., one for which an RMA number has not been issued, will be returned at the customers expense. To request an RMA, please contact us at [928-556-3109](tel:928-556-3109) or email info@machinesolutions.com



Equipment User Manual

For additional information on Beahm Designs, Hot Air Systems, please visit <http://machinesolutions.com/our-products/>