

# MACHINE SOLUTIONS INC.



USER MANUAL

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



**BEAHM**  
DESIGNS

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## TABLE OF CONTENTS

Table of Contents .....	3
List of Figures .....	4
List of Tables.....	4
Welcome .....	5
Machine Description .....	5
Safety.....	6
User Alerts.....	6
Contents.....	7
Installation.....	7
System Controls and Features.....	8
Set Up and Configuration .....	11
Nozzle Installation .....	12
Parameter Settings.....	14
Temperature .....	14
Heater Air Flow.....	14
Pressure (210-A Only).....	14
Vacuum (210-A Only) .....	14
Eurotherm Temperature Controller .....	15
Tuning Temperature Controllers (Model 3216) .....	15
Switching from Fahrenheit to Celsius (Model 3216) .....	15
System Operation.....	16
Power On .....	16
Power Off .....	16
Temperature Control Flow Rate Adjustments.....	16
Low Flow Rate .....	16
High Flow Rate .....	16
Maintenance .....	17
Cleaning.....	17

Exchanging Thermal Nozzles.....	17
Heating Element .....	17
Fuse Replacement.....	18
Temperature Controller .....	19
Diagnostics and troubleshooting .....	20
Specifications .....	21
Facilities Requirements.....	21
Critical parts .....	22
Customer support and satisfaction .....	23
Warranty And Limitations .....	24

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## LIST OF FIGURES

---

Figure 1. Standard Hot Air System (Model 160-A).....	8
Figure 2. Standard Hot Air System (Model 185-A).....	9
Figure 3. Balloon Development System (Model 210-A).....	9
Figure 4: Thermal Nozzles .....	10
Figure 5. Nozzle Cover (Optional) .....	10
Figure 6. Nozzle set screw.....	12
Figure 7. Thermocouple tip.....	12
Figure 8. Secure thermocouple wire placement.....	13
Figure 9. Removing Fuse Insert.....	18
Figure 10. Fuse Replacement.....	19
Figure 11. Fuse Insert Replacement.....	19

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## LIST OF TABLES

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Table 1. 160-A, 185-A, and 210-A Control and Display functions.....	8
Table 3. 210-A Only Control and Display functions .....	9
Table 4. Diagnostics and Troubleshooting .....	20
Table 5. System Specifications .....	21
Table 6. Critical Parts List .....	22

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## WELCOME

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Machine Solutions, Inc. (MSI) would like to take this opportunity to thank you for purchasing your new Hot Air Systems 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.

This machine has been thoroughly tested to ensure it meets the highest quality standards and is ready for immediate integration into your production process. Your machine has undergone functional and safety testing to ensure it meets all manufacturing specifications.

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## MACHINE DESCRIPTION

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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.

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## SAFETY

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- 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 dBA.



**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.**



**Warning**

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## USER ALERTS

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Do not use or otherwise operate the machine in any manner other than that in which it is explicitly intended. 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.

**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.**

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## CONTENTS

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Included with the system are the following contents:

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

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## INSTALLATION

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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 **Error! Bookmark not defined.** for procedure details).

## 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 1. Standard Hot Air System (Model 160-A)**

**Table 1. 160-A, 185-A, and 210-A Control and Display functions**

Item	Function
1	Toggles cooling air on/off
2	Controls cooling air flow rate.
3	Controls the temperature of the thermal nozzle.
4	Toggles system power and air on and off.
5	Toggles heater power on and off.
6	Controls heater air flow rate.





Figure 2. Standard Hot Air System (Model 185-A)



Figure 3. Balloon Development System (Model 210-A)

Table 2. 210-A Only Control and Display functions

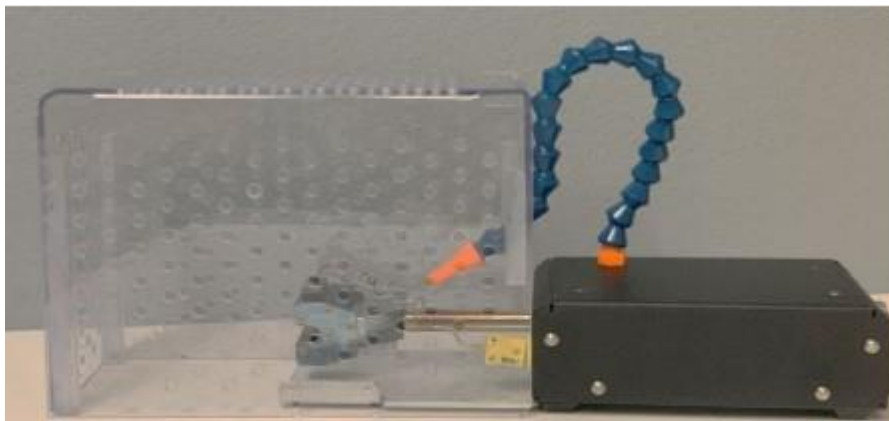
Item	Function
1	Display vacuum at the PRESS./VAC. Port.
2	Displays the pressure at the PRESS./VAC. Port.
3	Regulates the pressure at the PRESS/VAC. Port.
4	Access port for the pressure and vacuum function.
5	Selects pressure or vacuum at PRESS./VAC. port

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 4: Thermal Nozzles**



**Figure 5. Nozzle Cover (Optional)**

## SET UP AND CONFIGURATION

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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 the recommended guidelines.

- **Thermal Nozzle Diameter** - The nozzle diameter should be .187" - .25" larger than the material to be processed.
- **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.
- **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](http://www.machinesolutions.com) for more information on available accessories and/or to request a quote.

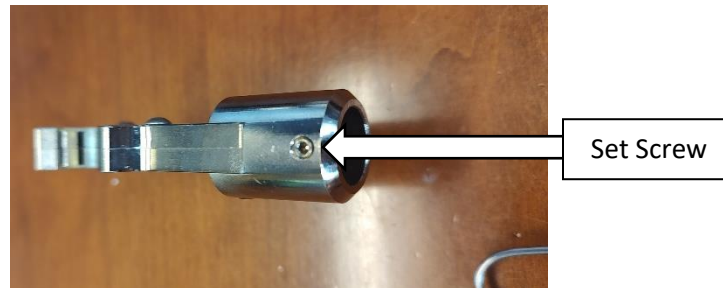
**Note:** To avoid damage to heater, MSI strongly recommends Flow be set at 35 scfh or greater while temperature is ramping up to set point. Flow can then be adjusted accordingly.

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## NOZZLE INSTALLATION

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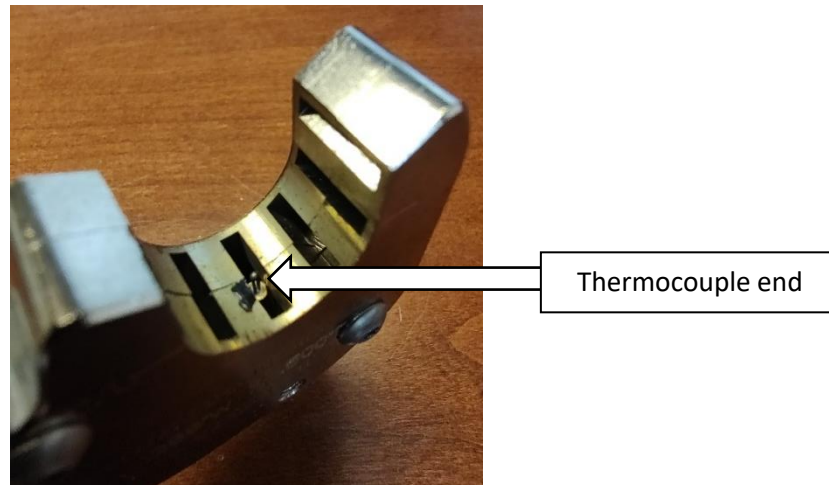
1. Slide the nozzle on to the heater tube while simultaneously installing the thermocouple connector.
2. Tighten the set screw in the nozzle end.



**Figure 6. 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 7. Thermocouple tip**

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



**Figure 8. Secure thermocouple wire placement**

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

## PARAMETER SETTINGS

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### 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.

## EUROTHERM TEMPERATURE CONTROLLER

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### *Tuning Temperature Controllers (Model 3216)*

**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.

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### *Switching from Fahrenheit to Celsius (Model 3216)*

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.

## SYSTEM OPERATION

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### ***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.

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### ***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.



## MAINTENANCE

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**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.



**Warning**

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### *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.

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### *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.

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

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### *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.

---

## ***Fuse Replacement***

**Note: Figures are reference only. They may vary depending on machine model.**

1. To replace a blown fuse, turn off machine power by unplugging the power cord from the machine.
2. Remove the insert.
  - a. Using a flat head screwdriver, push the fuse insert inward and turn counterclockwise to release.



**Figure 9. Removing Fuse Insert**

3. Fuse replacement.
  - a. Remove the old fuse and replace it with the new one.



**Figure 10. Fuse Replacement**

4. Insert replacement.
  - a. Using a flat head screwdriver, seat the insert by pushing inward and turning clockwise.



**Figure 11. Fuse Insert Replacement**

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## ***Temperature Controller***

Contact Beahm Designs for further diagnostics and instructions.

## DIAGNOSTICS AND TROUBLESHOOTING

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**Table 3. Diagnostics and Troubleshooting**

Issue	Possible Causes	Solution
Temperature not stable	<ul style="list-style-type: none"> <li>• Thermal Nozzle replaced</li> <li>• Thermocouple loose</li> </ul>	<ul style="list-style-type: none"> <li>• Auto-tune</li> <li>• Re-install thermocouple</li> </ul>
S.br	<ul style="list-style-type: none"> <li>• Break in thermocouple wire</li> <li>• Thermocouple failure</li> </ul>	<ul style="list-style-type: none"> <li>• Verify all connections from controller to remote TC jack</li> <li>• Replace thermocouple</li> </ul>
No heat at nozzle	<ul style="list-style-type: none"> <li>• Heater air flow too low</li> <li>• Defective heating element</li> <li>• Defective power control</li> </ul>	<ul style="list-style-type: none"> <li>• Increase air flow</li> <li>• Replace heating element</li> <li>• Contact Beahm Designs</li> </ul>
.Err code in display	<ul style="list-style-type: none"> <li>• Temperature controller software failure</li> </ul>	<ul style="list-style-type: none"> <li>• Replace temperature controller</li> </ul>
System will not power on	<ul style="list-style-type: none"> <li>• IEC power cord not fully connected</li> </ul>	<ul style="list-style-type: none"> <li>• Verify installation</li> </ul>

## SPECIFICATIONS

**Table 4. System Specifications**

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

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

### *Facilities Requirements*

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

## CRITICAL PARTS

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For replacement or spare parts, please contact us at [service@machinesolutions.com](mailto:service@machinesolutions.com), or call 928-556-3109.

**Table 5. Critical Parts List**

<b>Part Number</b>	<b>Description</b>	<b>Quantity</b>
1346288-001	Grade A Gauge	1 - (210-A Only)
1343250-001	3-way pneumatic valve	4 - 210-A 2 - 185A/160A
1150440-001	Temperature Controller	1 - 220VAC
1150440-003		1 - 120VAC
110254-001	Heater Quartz Tube	1

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## CUSTOMER SUPPORT AND SATISFACTION

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Machine Solutions Inc. is proud of the advanced engineering and quality construction of each piece of equipment that we build. It is our goal to provide equipment that exceeds the expectations of the customer. By implementing the highest standards and applying our experience to provide a quality product, we maintain an ongoing, positive working relationship with all our customers. Machine Solutions Inc. welcomes your comments and inquiries about our products and services.

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## WARRANTY AND LIMITATIONS

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### *General Warranty*

Machine Solutions Inc. (MSI) warrants its products to be free from defects in material and workmanship in normal every day use and service for a period of one year from the date of shipment from the factory in Flagstaff, Arizona. MSI's obligation under this warranty shall be limited to the repairing or replacing of the product or parts thereof which upon MSI's inspection reveals them to be defective. MSI reserves the right and option to refund the purchase price in lieu of repair or replacement upon evaluation of the returned original part. Modifications, misuse, attempted repairs by others, improper calibration or operation shall render this guarantee null and void. MSI MAKES NO OTHER WARRANTY REGARDING THIS PRODUCT, INCLUDING ANY EXPRESS OR IMPLIED WARRANTY. SPECIFICALLY, THERE IS NO WARRANTY OF MERCHANTABILITY OF THIS PRODUCT OR OF THE FITNESS OF THE PRODUCT FOR ANY PURPOSES. THE SUITABILITY OF THIS PRODUCT FOR ANY PURPOSE PARTICULAR TO THE CUSTOMER IS FOR THE CUSTOMER, IN ITS SOLE JUDGEMENT, TO DETERMINE. MACHINE SOLUTIONS, INC. ASSUMES NO RESPONSIBILITY FOR THE SELECTION OR USE OF THIS PRODUCT BY CUSTOMER. This product has not been tested or approved by the U.S. Food and Drug Administration or any other agency of the U.S. government. This product is not a consumer product as that term is defined in the Magnuson-Moss Warranty – Federal Trade Commission Improvement Act, 15 U.S.C. § 2301 et seq.

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In addition, you agree that the equipment will not be used to manufacture anything other than products in which you hold intellectual property rights free of infringement of others. You may not use the equipment to manufacture any product infringing on another's patented rights. By accepting and using the equipment, you agree to defend and indemnify Machine Solutions, Inc., its officers, directors, employees and agents, from and against any claims of infringement as a result of your use of the equipment.

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